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NESKE ALEXANDER

Managing sustainability-related complexity in supply chains: A capability-based managerial framework for organizational response

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Domestic scientific advisor:
PhD, Professor
Ilona Bordiyanu
Kazakh-American Free University
Ust-Kamenogorsk, Kazakhstan

Foreign scientific advisor:
Dr. rer. pol. Dr. h.c. mult., Professor
Hans-Christian Brauweiler
Westsächsische Hochschule Zwickau
Zwickau, Germany

Republic of Kazakhstan
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2 Social Code of the Republic of Kazakhstan, Code No. 224-VII of 20 April 2023. – URL: https://adilet.zan.kz/eng/docs/K2300000224 (accessed: 31.07.2026).

3 Decree of the President of the Republic of Kazakhstan No. 577 of 30 May 2013 "On approval of the Concept for transition of the Republic of Kazakhstan to a Green Economy until 2050". – Astana : Akorda, 2013.

4 Decree of the President of the Republic of Kazakhstan No. 121 of 2 February 2023 "On approval of the Strategy for achieving carbon neutrality of the Republic of Kazakhstan until 2060". – URL: https://adilet.zan.kz/rus/docs/U2300000121 (accessed: 31.07.2026).

5 Corporate Governance Code of the Republic of Kazakhstan, approved by Resolution No. 4 of the Presidium of the National Chamber of Entrepreneurs "Atameken" of 27 April 2021. – URL: https://online.zakon.kz/Document/?doc_id=36571188 (accessed: 31.07.2026).

DEFINITIONS

In this dissertation the following terms are used.

Sustainability-related complexity: the differentiated set of regulatory, stakeholder, data and auditability, interorganizational and temporal change requirements that an organization observes as relevant to sustainability in its supply chain and cannot process simultaneously with the resources it has (sub-chapter 1.1).

Selective stabilization: the organizational response to sustainability-related complexity, understood as the translation of selected requirements into decision premises, routines, roles, data systems, standards, supplier interfaces and review mechanisms (sub-chapter 1.1).

Packed Business Capability (PBC): a bundled organizational capability for managing sustainability-related complexity, located in one of the four domains Strategy, People, Process and Technology and composed of named sub-business capabilities. The taxonomy was reconstructed from Study I and applied to Study II (sub-chapters 2.1 and 2.2).

Organizational Response Model (ORM): the capability-based managerial framework developed in this dissertation, which explains the allocation of organizational effort between internal capability build-up and collaborative arrangements through two routing conditions, five moderators and six mechanism claims, and links the capability portfolio to three outcome metrics (sub-chapter 3.1).

Routing conditions: the two field conditions that govern the allocation decision of the ORM, namely perceptual convergence and prevalent cross-firm orchestration. Both are observable from outside the focal organization (sub-chapter 3.1).

Perceptual convergence: the degree to which the organizations of a field share an understanding of which sustainability issues are material and how they are to be evidenced (sub-chapter 3.1).

Prevalent cross-firm orchestration: the degree to which verification capacity, standards and collaborative arrangements are available in the field and can be joined by a single organization (sub-chapter 3.1).

Response types: the four configurations that follow from the routing conditions, namely Internal-first, Co-Developer, Selective Joiner and Collaborative-first, each with a proposed portfolio allocation and a transition rationale (sub-chapter 3.1).

Capability signaling: the mechanism by which sustainability communication precedes embedded practice as a transitional stage of capability development (sub-chapter 2.3).

Capability Maturity Score (CMS): the GRI-anchored measurement instrument of the ORM, consisting of 30 disclosure indicators scored on an ordinal scale, a composite value and a formal classification function that assigns a response type (sub-chapter 3.2).

LIST OF ABBREVIATIONS

AFSA	Astana Financial Services Authority
AI	Artificial Intelligence
AIFC	Astana International Financial Centre
ATC	Auditable tier coverage
BAT	Best Available Techniques
BCC	Bank CenterCredit JSC
CAPA	Corrective and Preventive Action
CBAM	Carbon Border Adjustment Mechanism
CC/S	Coordination cost per covered spend
CDP	Carbon Disclosure Project
CEO	Chief Executive Officer
CIMO	Context, Intervention, Mechanism, Outcome
CIO	Chief Information Officer
CMS	Capability Maturity Score
CO2	Carbon dioxide
COO	Chief Operating Officer
CPO	Chief Procurement Officer
CSR	Corporate Social Responsibility
DACH	Germany, Austria, Switzerland
DR	Decision rule
DfE	Design for Environment
EBRD	European Bank for Reconstruction and Development
EITI	Extractive Industries Transparency Initiative
ERG	Eurasian Resources Group S.à r.l.
ERP	Enterprise Resource Planning
ESG	Environmental, Social, Governance
EU	European Union
FTE	Full-time equivalent
GHG	Greenhouse gas
GRI	Global Reporting Initiative
GSCM	Green Supply Chain Management
HR	Human Resources
HSE	Health, safety and environment
IATA	International Air Transport Association
IEA	International Energy Agency
IFRS	International Financial Reporting Standards
ISO	International Organization for Standardization
IoT	Internet of Things
JSC	Joint Stock Company
KASE	Kazakhstan Stock Exchange
KMG	JSC National Company KazMunayGas
KPI	Key Performance Indicator

KPO	Karachaganak Petroleum Operating B.V.
LCA	Life Cycle Assessment
LLP	Limited Liability Partnership
MRV	Measurement, reporting and verification
MSI	Multi-stakeholder initiative
MoJ	Make-or-join
NAC	National Atomic Company (NAC Kazatomprom JSC)
NGO	Non-governmental organization
NRBV	Natural Resource Based View
OR	Prevalent cross-firm orchestration (routing condition)
ORM	Organizational Response Model
PBC	Packed Business Capabilities
PC	Perceptual convergence (routing condition)
PO	Purchase Order
R&D	Research and Development
RACI	Responsible, Accountable, Consulted, Informed
RBV	Resource Based View
RSPO	Roundtable on Sustainable Palm Oil
SKU	Stock Keeping Unit
SLA	Service Level Agreement
SDG	Sustainable Development Goal
SOP	Standard Operating Procedure
SCM	Supply chain management
SSCM	Sustainable Supply Chain Management
SME	Small and medium-sized enterprise
SST	Social Systems Theory
T2M	Time to mitigation
TBL	Triple Bottom Line
TCFD	Task Force on Climate-related Financial Disclosures
UDC	Universal Decimal Classification
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
WCED	World Commission on Environment and Development
WEEE	Waste Electrical and Electronic Equipment

INTRODUCTION

Relevance of the research topic. Addressing sustainability performance in Kazakhstan's supply chains is highly relevant because environmental and policy pressures concentrate in a few complex, emissions- and water-intensive industries. Oil and gas accounts for about 17 percent of GDP and roughly half of total exports. Non-ferrous metals and agribusiness are also strategic. These sectors create long multi-tier value chains with substantial environmental footprints [1]. Kazakhstan's Environmental Code targets the country's 50 largest industrial facilities, which are primarily in oil and gas, mining and metallurgy, chemicals, and power generation. These account for about 80 percent of environmental pollution, which points to material ESG gaps at the upstream end of many supply chains and to the need for best available techniques and integrated environmental permitting [2]. Water constraints add a further supply-chain risk. Total renewable water resources are estimated at about 108.5 km^3 per year, yet only about 41.9 percent is accessible, with 34 to 44 km^3 per year originating outside Kazakhstan's borders [3]. Agriculture alone withdraws about 15.4 to 24 km^3 per year, 78 percent of which is for irrigation, which amplifies exposure in agribusiness and water-intensive processing [3]. Externally, the EU Carbon Border Adjustment Mechanism (CBAM) increases competitiveness risks for emissions-intensive exports unless emissions measurement, reporting and verification are in place. Aluminum production represents nearly all CBAM-covered exports to the EU, with nearly 30 percent of Kazakhstan's aluminum exports going to the EU [4].

Kazakhstan's strategic and programmatic documents address these pressures. Strategy Kazakhstan 2050 makes green development a national priority [76]. The Concept for Transition of the Republic of Kazakhstan to a Green Economy of 2013 sets staged targets for resource efficiency and emissions [92]. It is listed as item 3 in the List of Regulatory documents. The Environmental Code of 2021, listed as item 1, establishes enforceable obligations for the largest emitters. The Strategy for Achieving Carbon Neutrality by 2060, listed as item 4, prioritizes decarbonization and modernization in energy and industry, including oil and gas and metallurgy. It also addresses resource-efficient agriculture [5]. Disclosure is becoming more formal through the ESG guidance of the Astana International Financial Centre (AIFC) and the ESG Data Platform of the Kazakhstan Stock Exchange (KASE). Internationally, the topic relates to the UN Sustainable Development Goals. These include SDG 12 on responsible consumption and production, SDG 13 on climate action, and SDG 17 on partnerships for the goals.

These policy and market pressures create a managerial contradiction. Companies must document, verify and coordinate sustainability responses across several supply-chain tiers. Requirements vary between counterparties, change with regulatory cycles, and require evidence. Organizations have limited resources and cannot process all requirements at once. Management must select which pressures to make visible, which responses to implement, and which collaborative arrangements to use. Existing sustainable supply chain management frameworks describe relevant practices. They offer

limited guidance on how organizations select these practices, establish them as routines, and make their responses auditable. This gap between external requirements and organizational capacity is the scientific problem addressed in the dissertation. It explains why a management model is needed.

Germany is included as the comparative context for three reasons. First, Germany is a high-impact downstream market for Kazakhstani exports in which supply-chain sustainability expectations have been formalized into enforceable due diligence under the Supply Chain Due Diligence Act [83] and into detailed reporting standards under the European Sustainability Reporting Standards [155]. Requirements formulated there cascade to upstream suppliers, including suppliers in Kazakhstan. Second, German organizations operate under high assurance density and high stakeholder pressure. The German cases provide evidence of capability construction under the sustainability expectations prevailing during the 2019 to 2020 interview period. Later regulatory developments inform the contextual discussion. Third, comparing a high-assurance environment with a transitional environment helps to separate the invariant elements of the organizational response mechanism from the elements that depend on institutional conditions. For Kazakhstan, the comparison yields a set of mechanisms whose sequencing can be adapted to domestic conditions. It does not yield a template for transfer. The institutional rationale of the two contexts is specified in sub-chapter 1.2.

Scientific problem of the research. The scientific problem consists in the absence of a mechanism-level explanation and of a governance-oriented model of how organizations in supply chains convert sustainability requirements that are heterogeneous in origin, unstable over time and dependent on verifiable evidence into an executable and auditable portfolio of capabilities, and of how institutional conditions such as enforcement, assurance density and data maturity change the feasible response pathway. The sustainable supply chain management literature explains drivers, practices and performance expectations, and the disclosure literature explains reporting quality and its determinants. The literature reviewed here offers limited integrated explanation of how organizations select, configure and stabilize response capabilities under sustainability-related complexity and connect these capabilities to observable outcomes. For Kazakhstan, where ESG expectations are rising faster than the institutional, data and assurance conditions for producing verification-grade evidence, this gap has direct practical consequences, because companies and regulators lack a model that tells them in which order and by which route capabilities should be built.

Author's position. The author proceeds from the position that sustainability-related complexity in supply chains is a selection problem, not a compliance problem. Organizations remain able to act under rising sustainability pressure when they construct internal complexity in the form of bundled capabilities across Strategy, People, Process and Technology that is sufficient to absorb the external complexity they select as relevant. Two conditions of the organizational field govern the choice between building this complexity internally and absorbing it through collaborative arrangements: the degree to which sustainability issues are framed through shared standards, and the degree to which cross-firm verification infrastructure exists. The model treats

these field conditions as constraints on managerial choice. Their influence relative to managerial preferences remains to be established empirically. Communication about sustainability can precede embedded practice and is interpreted in transitional institutional contexts such as Kazakhstan as a possible stage of capability development. On its own it does not establish decoupling. The author further holds that a management model for this problem must be judged by outcomes that can be audited, namely the speed of mitigation, the reach of verification-grade evidence across supply-chain tiers and the coordination cost of achieving that reach, and not by the number of sustainability practices an organization reports.

Degree of scientific development of the topic. The literature relevant to this dissertation can be grouped into four strands. The first strand comprises foreign research on sustainable supply chain management and organizational capabilities. It is rich in practices and thin on routing, that is, on how organizations decide between internal routines and collaborative instruments under specific boundary conditions. Classical works defined sustainable development, the triple bottom line and sustainable supply chain management and linked performance to stakeholder expectations. More recent work emphasizes capability building, sensing, seizing and reconfiguring, and portfolio views of practices that reduce risk and create value in supply networks [20; 21; 22]. Reviews of the field observe that sustainable supply chain management research predominantly borrows established theories such as the resource-based view, and stakeholder theory for developing new theory [27; 26; 179], and they call for models that capture how several factors interact [179].

The second strand comprises studies of the institutional environment and of sustainability disclosure. Stakeholder theory explains why particular sustainability issues become salient [17]. Institutional theory explains how regulatory, normative and reporting environments create convergence pressures, legitimacy expectations and the diffusion of response templates [18; 19]. The disclosure literature distinguishes symbolic from substantive reporting and shows that reporting depth depends on internal governance and incentives [154; 6]. Competing perspectives debate whether sustainability is primarily a legitimacy-seeking activity or a performance engine and warn against decoupling and greenwashing [143]. The limitation of this strand is that it seldom specifies the selection mechanisms that translate pressures into manageable capability portfolios with observable outcomes.

The third strand comprises the standards, reports and methodologies of international organizations that structure the field in practice. The GRI Standards define the disclosures against which sustainability reporting is assessed [157; 158; 159] and serve in this dissertation as the measurement anchor of the Capability Maturity Score. Assessments by the World Bank quantify the exposure of Kazakhstan's economy to CBAM [4]. PwC Kazakhstan's rating of ESG disclosure in Kazakhstan identifies the leading reporters across high-impact sectors and serves as the external sampling frame of Study II [82]. Reports of the European Bank for Reconstruction and Development and of the International Energy Agency document the energy transition context of Kazakhstan. These sources are indispensable for the information base.

The fourth strand comprises Kazakhstani and Central Asian research. Studies of sustainability reporting by listed companies and banks in Kazakhstan show that the depth and credibility of disclosure depend on governance attributes, ownership structure, firm size and auditor type, while the formal adoption of global reporting norms explains little [6; 210; 211]. Work on stakeholder expectations and culturally embedded CSR communication points to legitimacy pressures that can encourage symbolic reporting where measurement and control systems are weak [7; 8]. Recent national studies describe ESG implementation as uneven and constrained by cost, regulatory deficiencies, skills gaps and data availability [9; 10; 212], relate ESG strategy to financial resilience in the extractive sector [213] and document a gap between what firms disclose and what their employees perceive as embedded practice [214]. Studies of CSR and firm performance, of the circular business ecosystem and of reverse supply chains in mining extend this picture beyond reporting to management practice and supply chain design [41; 42; 43; 215]. Research on CSR in developing and transition economies shows that CSR priorities and disclosure logics are shaped by governance constraints and development imperatives of Western Europe [11; 12; 13]. This strand documents the state of practice in Kazakhstan, and it remains largely descriptive and does not reconstruct the organizational response mechanism or specify how institutional density and data maturity condition feasible pathways.

Taken together, the four strands explain drivers, practices, reporting quality and institutional context, but they do not explain how organizations select, configure and stabilize response capabilities when sustainability requirements multiply, shift and have to be evidenced, and they also do not connect this mechanism to auditable outcomes. It is this theoretical and methodological gap that determines the scientific position of this dissertation study.

Purpose of the research. The dissertation develops a capability-based Organizational Response Model to support the design, selection and governance of sustainability response portfolios in supply chains. It uses complementary evidence from German and Kazakhstani organizations to formulate links between response mechanisms and auditable outcomes and derive recommendations for Kazakhstan.

Research objectives. To achieve the purpose, the following objectives are set:

1. To clarify the content of the category "sustainability-related complexity" in supply chains and to substantiate Social Systems Theory as the sensitizing lens for interpreting organizational complexity reduction, complemented by stakeholder, institutional and capability-based perspectives (sub-chapter 1.1).

2. To systematize the institutional, regulatory and assurance conditions of Germany and Kazakhstan as boundary conditions for organizational sustainability responses (sub-chapter 1.2).

3. To substantiate a two-study abductive research design that combines an embedded multiple-case study with a qualitative content analysis and to specify its quality criteria (sub-chapter 1.3).

4. To reconstruct, on the basis of 23 interviews in 17 German organizations, the Packed Business Capabilities through which organizations manage sustainability-related complexity across Strategy, People, Process and Technology (sub-chapter 2.1).

5. To identify, on the basis of a content analysis of 20 reports of 11 large Kazakhstani companies, the publicly articulated capability profiles of Kazakhstani firms and their inductive extensions (sub-chapter 2.2).

6. To compare the German and Kazakhstani response patterns, to formulate the comparative propositions P1 to P8 and to develop the four institutional mechanisms M1 to M4 as proposed explanations for the cross-context contrasts (sub-chapter 2.3).

7. To develop the Organizational Response Model with its construct dictionary, moderators, routing conditions, response types and outcome metrics, and to propose its quantitative operationalization as a GRI-anchored Capability Maturity Score with a formal classification function and to apply both to the full sample of Study II (sub-chapters 3.1 and 3.2).

8. To derive prioritized recommendations for Kazakhstani companies and policymakers, including an implementation guide and a KPI dictionary, and to evaluate the model as a design-science artefact (sub-chapter 3.3).

Object of the research. The object of the research is organizations in the supply chains of Germany and Kazakhstan as systems responding to sustainability requirements.

Subject of the research. The subject of the research is the management mechanisms and capability portfolios that shape the organizational response to sustainability-related complexity, including decision points, moderators and boundary conditions that route the response between internal capability build-up and collaborative arrangements.

Research methodology. The theoretical basis of the dissertation is the Social Systems Theory of Luhmann. It is used as a sensitizing lens for the reduction of complexity through selection and stabilization [14; 15; 16], stakeholder theory [17], institutional theory [18; 19], the resource-based view as well as the dynamic capabilities perspective [20; 21; 22]. Agency reasoning is used for the governance of make-or-join decisions [61], the contingency perspective for context fit [63; 64], and design-science research for the development of prescriptive management knowledge [144; 145; 151]. The case study methodology of Yin and Eisenhardt [24; 108; 109] formed the methodological basis. It is enhanced by the logic of analytic generalization [111], qualitative content analysis [25] and the CIMO logic of design-oriented management research [147].

The dissertation applies general scientific methods, namely systemic analysis, institutional analysis, comparative analysis, logical and structural-functional analysis, and the method of scientific generalization. Study I used an abductive embedded multiple-case design. It comprised 23 semi-structured interviews in 17 German for-profit organizations across six supply-chain cases: textiles, food retail, food production, beverages, cosmetics, and cleansing products. The interviews took place between August 2019 and March 2020. Study II used deductive-inductive qualitative content analysis of 20 sustainability and annual reports. These reports covered 11 large Kazakhstani companies and were published between 2022 and 2025. The methods also included cross-case pattern matching and an intercoder reliability check using Krippendorff's alpha. Alpha was 0.818 on a stratified subsample at the level of the four PBC domains.

All 20 Study II reports were formally scored and classified against the 30 GRI disclosures of the Capability Maturity Score and the model's two routing conditions.

NVivo was used to code the Study I interview transcripts. Microsoft Excel supported the Study II coding matrix and the Capability Maturity Score calculations. Both studies used a documented case-study protocol and database.

The research draws on transcripts of 23 interviews with CEOs, sustainability managers, and purchasing managers of German organizations. It also uses 20 sustainability and annual reports from 11 Kazakhstani companies and the GRI Standards. The Kazakhstan sources include Strategy Kazakhstan 2050, the Concept for Transition to a Green Economy, the Environmental Code of 2021, and the Corporate Governance Code. They also include the Strategy for Achieving Carbon Neutrality by 2060 and the AIFC's ESG disclosure guidance. The relevant EU and German regulatory sources include the Supply Chain Due Diligence Act, the European Sustainability Reporting Standards, and CBAM. Further sources are reports and databases from the World Bank, EBRD, IEA, PwC Kazakhstan, and the KASE ESG Data Platform.

The research period covers 2019 to 2025. Study I reconstructs organizational response mechanisms before the most recent tightening of European reporting and due-diligence regulation. Study II examines public articulation and evidence orientation in the later ESG environment. The two studies therefore complement each other. Reading them as two parallel country studies would misstate the design. The justification of the chronological framework, including the argument for the stability of the reconstructed mechanisms across the regulatory change of 2021 to 2025, is given in sub-chapter 1.3.

Declaration on the use of artificial intelligence technologies. In accordance with paragraphs 5 and 5-2 of the Rules for Awarding Degrees, the author discloses the use of artificial intelligence tools in the preparation of this dissertation. One tool was used, namely ChatGPT (OpenAI, version GPT-6 Astra) [194], between 9 September and 5 October 2026. It was used for one purpose only, the revision of the manuscript, that is checking the language and the logical consistency of the arguments across the Introduction, Chapters 1 to 3 and the Conclusion. The tool pointed out unclear wording, gaps in the line of argument and inconsistencies between the text, the tables and the figures, and the respective sections where changes might be needed. The author assessed each of these notes, decided whether and how to change the passage concerned, and made the revisions himself to improve the readability and traceability of the dissertation. Every output was checked by the author against the primary source before it entered the dissertation.

Scientific novelty of the research. The scientific novelty of the dissertation consists in the following results obtained by the author personally:

1. The dissertation clarifies sustainability-related complexity in supply chains as a differentiated construct. It comprises regulatory, stakeholder, data and auditability, interorganizational, and temporal change complexity. The organizational response is conceptualized as selective stabilization into routines, roles, and evidence practices. This is developed in sub-chapters 1.1 and 3.1 and the construct dictionary.

2. The taxonomy of Packed Business Capabilities covers Strategy, People, Process, and Technology. It was developed from 23 interviews in 17 German organizations. Its applicability to publicly reported capabilities was explored through content analysis of 20 reports from 11 Kazakhstani companies. The analysis also identified context-specific capabilities, including strategic data infrastructures and logistics digitization standards. Sub-chapters 2.1 and 2.2 present these findings. See Table 49.

3. Eight comparative propositions, P1 to P8, describe differences between German and Kazakhstani organizations. They cover capability formalization, organization design, communication, the supply-chain operating model, risk integration, data and technology, and process and product innovation. Four institutional mechanisms, M1 to M4, are proposed as abductive explanations. These are enforcement and grievance channels, assurance and verification, legitimacy and decoupling, and capability cost and infrastructure. The analysis also identifies capability signaling as a transitional stage in which sustainability communication precedes embedded practice. Sub-chapter 2.3 develops these propositions and mechanisms.

4. The capability-based Organizational Response Model explains how organizations allocate effort between internal capability build-up and collaborative arrangements. It uses two routing conditions: perceptual convergence and prevalent cross-firm orchestration. These yield four response types: Internal-first, Co-Developer, Selective Joiner, and Collaborative-first. The model includes a normative transition logic, five moderators, and six mechanism claims with scope conditions. It links the capability portfolio to time-to-mitigation, auditable tier coverage, and coordination cost per covered spend. Sub-chapter 3.1 presents the model.

5. A GRI-anchored Capability Maturity Score with 30 indicators and a formal response type classification function have been developed and applied to the 20 reports from 11 Kazakhstani companies in Study II. The three outcome metrics have been operationally defined for future empirical testing. The dissertation also specifies 14 recommendations, an implementation guide and a KPI dictionary for Kazakhstani companies and policymakers (sub-chapters 3.2 and 3.3).

Key provisions submitted for defense.

1. Organizations manage sustainability-related complexity by bundling capabilities across Strategy, People, Process, and Technology. The resulting Packed Business Capabilities architecture is stable across heterogeneous cases. It was reconstructed from 17 German organizations in six supply-chain cases. It was also reproduced, with context-specific extensions, in the public reporting of 11 Kazakhstani companies. Subchapters 2.1 and 2.2 and Tables 18 and 19 substantiate this finding. See also Table 49.

2. Capability maturity is clustered, but the two corpora show different sequencing patterns. The German organizations in Study I build their responses on People and Process capabilities. These include organizational structure and staff, employee empowerment, process innovation, supply chain sustainability, and risk management. Strategic Management, Communication, Data Management and Reporting, and Technology Adoption are articulated as less developed. The Kazakhstani companies in Study II lead with policy articulation and communication. Data capture and basic con-

trols follow, while technology enablement arrives later and unevenly. Risk management is reported as an established capability, as described in P5. The two corpora differ in country, period, sector, and evidentiary modality. Study I uses interviews from 2019 to 2020. Study II uses reports published from 2022 to 2025. The sequencing patterns were reconstructed from these accounts and documents. The provision therefore claims patterns identified in the two corpora and does not claim a country effect isolated from period, sector and data source (substantiated by Table 18 in sub-chapter 2.1 and by the comparative propositions P1 to P8 in sub-chapter 2.3, Table 20 and Figure 3).

3. Four institutional mechanisms, enforcement and grievance channels, assurance and verification, legitimacy and decoupling, and capability cost and infrastructure, are proposed as abductive explanations of the observed cross-context contrasts, and sustainability communication in transitional contexts is interpreted as capability signaling that can precede and catalyze embedded practice. The mechanisms are theoretically and empirically informed explanations whose independent effects have not been separated from period, sector and evidentiary modality and remain to be assessed through matched comparative research (substantiated in sub-chapter 2.3, mechanisms M1 to M4, Figure 4).

4. The Organizational Response Model uses perceptual convergence and prevalent cross-firm orchestration to distinguish four response types and specify proposed portfolio configurations and transition paths. These conditions are modeled as constraints on organizational choice (sub-chapter 3.1).

5. The dissertation proposes that the organizational response becomes governable when the capability portfolio is linked to three mechanism-oriented outcome metrics, time-to-mitigation, auditable tier coverage and coordination cost per covered spend, and this linkage can be operationalized through a GRI-anchored Capability Maturity Score and a formal classification function that an analyst can apply to public sustainability reports under documented decision rules, as demonstrated by its application to all 20 reports of Study II with every score above 0 anchored to a cited page of the source report (substantiated in sub-chapters 3.1 and 3.2, Tables 32 to 38, Appendix Q). The proposition is developed from the empirical material and has not been validated. The three outcome metrics are specified but not measured in this dissertation.

6. Under the transitional assurance density of Kazakhstan, the companies of Study II correspond predominantly to the Co-Developer response type. Collaborative-first occurs only where third-party assurance coincides with membership in international schemes, namely at Air Astana JSC, Karachaganak Petroleum Operating B.V. (KPO), National Atomic Company Kazatomprom JSC, and, in its sustainability reports, JSC National Company KazMunayGas (KMG). Internal-first is confined to financial-sector documents without a materiality process, and no report in the corpus meets the condition for the Selective Joiner type, which requires low perceptual convergence together with high orchestration, a combination that does not occur here because the seven reports with high orchestration all show high convergence as well. The absence of platform evidence in the reports leaves open whether such a platform exists in the field. Since the Process domain is the weakest domain of the sample (document-level mean over the 20 reports 49.6 against 91.8 for Strategy) and the lowest-scoring

domain in 15 of the 20 reports, the disclosure gaps support prioritizing data integrity, supplier pre-qualification and exception governance, and local closure rights, while state-linked holdings and regulators can accelerate diffusion by raising verification capacity and field-level orchestration (substantiated in sub-chapters 3.2 and 3.3, Tables 38 and 40, and the Conclusion).

The correspondence between the points of scientific novelty and the provisions submitted for defense is as follows: novelty point 1 underlies provision 1, novelty point 2 is defended in provision 1, novelty point 3 is defended in provisions 2 and 3, novelty point 4 is defended in provisions 4 and 5, and novelty point 5 is defended in provisions 5 and 6. The comparative propositions P1 to P8 and the mechanisms M1 to M4 of Chapter 2, the mechanism claims MC1 to MC6 of sub-chapter 3.1 and the outcome-oriented design propositions FP1 to FP3 of sub-chapter 3.2 are not additional provisions for defense. P1 to P8 are empirical findings and M1 to M4 are abductive explanations of these findings, both aggregated in provisions 2 and 3, MC1 to MC6 specify the model rationale defended in provision 4, and FP1 to FP3 constitute the validation agenda for future research and are not submitted for defense. The complete hierarchy of these statements is presented in Table 31 at the end of sub-chapter 3.1. Among these results, the principal scientific result of the dissertation is the routing mechanism of novelty point 4. It converts the decision between internal capability build-up and collaborative arrangement, which the dynamic capabilities literature treats in general terms only [22], into a function of two conditions that can be observed from outside the firm. The four remaining results support it: novelty points 1 and 2 supply the constructs it operates on, novelty point 3 supplies the institutional explanation of the contrast it has to account for, and novelty point 5 makes it measurable and therefore testable. Table 30 in sub-chapter 3.1 positions this result against dynamic capabilities, the frameworks of sustainable supply chain management and organizational ambidexterity on six dimensions. It differs in the same respect from linear capability maturity models [242] and from typologies of strategic response to institutional pressure [243], as discussed after Table 30 in sub-chapter 3.1. The sequence of capability build-up depends on the state of the field, so two organizations at the same level of maturity can face different next moves.

Theoretical significance of the research. The theoretical significance of the dissertation lies, first, in the clarification of the category of sustainability-related complexity as a differentiated construct and of the organizational response as selective stabilization, which extends the conceptual apparatus of sustainable supply chain management beyond lists of practices. Second, the dissertation contributes to organizational capability theory a routing mechanism that explains when organizations generate requisite variety internally and when they absorb it through collaborative arrangements and thereby specifies the make-or-join decision, which the dynamic capabilities literature treats only in general terms, as a function of two observable field conditions. Third, the dissertation identifies capability signaling as a mechanism that connects the legitimacy logic of institutional theory with the maturation logic of capability theory and explains why communication can precede embedded practice without necessarily indicating decoupling. Fourth, the dissertation extends the application of Social Systems

Theory to a cross-national and cross-method research design as an interpretive lens. The contribution to Social Systems Theory is deliberately interpretive and delimiting: the dissertation does not test the theory and does not operationalize autopoiesis, and it does not claim to develop a new grand theory. Its theoretical contribution is a mid-range, capability-based explanation of organizational response under sustainability-related complexity.

Practical significance of the research. The results can be used by the groups. Companies in the extractive, energy, financial, construction and transport sectors of Kazakhstan can use the Packed Business Capabilities taxonomy and the Capability Maturity Score to diagnose their current response configuration, the routing conditions to decide between internal build-up and collaboration, and the 90-day and 12-month implementation guide with its KPI dictionary to govern the response. Ministries and authorized bodies of the Republic of Kazakhstan, the Astana International Financial Centre and the Kazakhstan Stock Exchange can use the four mechanisms and the policy levers of sub-chapter 3.3 to design instruments that raise verification capacity and field-level orchestration and thereby reduce coordination cost for companies. Consulting and audit firms can use the CMS and the outcome metrics as a structured diagnostic for sustainability governance and assurance readiness. Higher education institutions can use the model, the case material and the CMS in the training of specialists in management, supply chain management and sustainable development. The results correspond to the objectives of the Strategy for Achieving Carbon Neutrality by 2060, the Concept for Transition to a Green Economy and the Environmental Code of the Republic of Kazakhstan, and to SDG 12, SDG 13 and SDG 17.

Approbation of the research results. The main results of the dissertation were presented and discussed at the EurOMA Sustainable Operations and Supply Chain Forum, Nottingham, United Kingdom, February 2020 (paper "Managing sustainability complexity internally and via third-parties"), at the DAAD Alumni Week at Westsächsische Hochschule Zwickau, Germany, November 2020 (presentation "Nachhaltigkeitsmanagement digitalisieren"), and in research seminars and practitioner briefings in Germany and Kazakhstan. The Packed Business Capabilities taxonomy and the Organizational Response Model are being integrated into the teaching of Sustainable Supply Chain Management at SRH University, Germany, and as a cross-cutting sustainability case into modules at Westsächsische Hochschule Zwickau, Duale Hochschule Sachsen, and the Kazakh-American Free University. The diagnostic approach of the model was applied in 2026 in a sustainability disclosure project at a German medium-sized medical technology manufacturer. The engagement is covered by a confidentiality agreement. The company remains anonymous, and no act of implementation is submitted for it. Acts of implementation for the use of the results in university teaching at Westsächsische Hochschule Zwickau and at the Kazakh-American Free University are submitted to the dissertation council with the final version of the dissertation.

Publications. The main results of the dissertation are published in four scientific works, one of which is indexed in Scopus.

Publications in journals recommended by the Committee for Quality Assurance in the Sphere of Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan:

1. Neske, A., Brauweiler, C., Bordiyanu, I. A Systematic Literature Review on Theories Utilized Investigating Third Parties in Sustainable Supply Chain Management // Eurasian Journal of Economic and Business Studies. – 2023. – Vol. 67. – No. 1. – P. 5–26.

2. Neske, A., Bordiyanu, I., Brauweiler, C. Sustainability complexities in supply chains: a qualitative study utilizing social systems theory // Eurasian Journal of Economic and Business Studies. – 2024. – Vol. 68. – No. 1. – P. 58–76.

Chapter in a collective monograph:

3. Neske, A. A Social Systems Theory Approach to Managing Sustainability Complexity in Multi-Tier Supply Chains // Perspectives of Sustainability Management in Europe and Asia: Challenges, Socio-Economic Transformations and Innovations / eds. B. Zirkler, H.-C. Brauweiler, I. Bordiyanu, A. Yerimpasheva. – Berlin: Peter Lang, 2026. – P. 27–55. – ISBN 978-3-631-94563-6. – DOI: 10.3726/b23959. – Indexed in Scopus (EID: 2-s2.0-105048241800).

Proceedings of international scientific conferences:

4. Neske, A., Brauweiler, H.-C., Bordianu, I., Anashkina, N., Yerimpasheva, A. The Role of Third-parties in Sustainable Supply Chain Management: A Systematic Literature Review // Proceedings of the 1st International Scientific and Practical Conference on Transport: Logistics, Construction, Maintenance, Management (TLC2M 2022), Ekaterinburg, Ural State University of Railway Transport. – SciTePress, 2022. – P. 215–223. – ISBN 978-989-758-606-4. – DOI: 10.5220/0011581900003527.

Personal contribution of the author to the publications. In publications 1 and 2, the author developed the research design, conducted the systematic literature search and the interviews, performed the coding and analysis, and wrote the manuscripts. In publication 4, the author developed the review protocol, conducted the literature search and the analysis, and wrote the manuscript. The co-authors, among them the author's scientific advisors, contributed to the framing of the research questions, the discussion of the results and the revision of the manuscripts. Publication 3 is a single-authored chapter in a collective monograph edited by B. Zirkler, H.-C. Brauweiler, I. Bordiyanu and A. Yerimpasheva.

The key constructs of the Organizational Response Model, namely the two routing conditions, the taxonomy of Packed Business Capabilities, the response types and transition logic, the outcome metrics and the Capability Maturity Score, were developed by the author alone. The two routing conditions and the three outcome dimensions were first published in publication 3. The taxonomy of Packed Business Capabilities, the response types and transition logic and the Capability Maturity Score are presented for the first time in this dissertation.

Structure and volume of the dissertation. The dissertation consists of an introduction, three chapters comprising nine sub-chapters, a conclusion, a list of regulatory documents, definitions, a list of abbreviations, a list of references comprising 243 sources, and 17 appendices. The main text comprises 191 pages and contains 42 tables

and 7 figures. The appendices comprise 148 pages and contain 15 tables and one figure. Chapter 1 substantiates the theoretical foundations, the institutional boundary conditions of Germany and Kazakhstan and the research design. Chapter 2 presents the two empirical studies and their cross-context synthesis. Chapter 3 develops the Organizational Response Model, its quantitative operationalization and the recommendations. The conclusion summarizes the results, the limitations and the directions for future research.

The language and the logical consistency of this chapter were reviewed with ChatGPT [194]. All revisions were made by the author.

1 THEORETICAL FOUNDATIONS OF SUSTAINABILITY-RELATED COMPLEXITY IN SUPPLY CHAINS

This chapter establishes the conceptual scaffolding for the dissertation's empirical studies and subsequent model development by defining sustainability-related complexity in supply chains and specifying how it is rendered observable and manageable. Section 1.1 introduces working definitions of sustainability and sustainable supply chain management (SSCM) and develops the dissertation's mechanism for explaining how organizations convert sustainability pressure into manageable responses. Extended definitional material, broader SSCM theory overviews, and fuller practice catalogues are intentionally placed in the appendices so that the main chapter can remain tightly aligned with the dissertation's mechanism-oriented research question. Section 1.2 specifies the institutional boundary conditions for Germany and Kazakhstan and critically compares ESG disclosure frameworks and SSCM models. Section 1.3 sets out the methodological framework and research design. Together, these sections provide the vocabulary, mechanism rationale, and evidence orientation used throughout Chapters 2 and 3.

1.1 Selective conceptual foundations: Sustainable Supply Chain Management and Social Systems Theory-informed mechanism framing

Sustainability and sustainable supply chain management (SSCM) provide the substantive context. Its purpose is more specific: to establish only those conceptual foundations that are required to explain the dissertation's central mechanism problem, namely how organizations convert heterogeneous sustainability pressures into manageable, auditable, and governable response portfolios. Accordingly, the chapter uses a selective and problem-oriented review strategy. The appendices cover broader definitional debates, extended SSCM practice catalogues, and adjacent theories. The main chapter focuses on concepts operationalized in the empirical studies and consolidated into the Organizational Response Model [26; 14; 15; 16; 27].

Conceptual foundations of sustainability

Sustainability as a concept gained prominence with the work of the World Commission on Environment and Development, which defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [28]. This definition shows an inter-generational responsibility and has become the cornerstone of sustainability discourse. In a business context, the broad and sometimes vague notion of sustainability is often operationalized through the idea of the triple bottom line [29]. The triple bottom line framework posits that firms should simultaneously deliver value on three dimensions: economic, environmental, and social performance [29]. In other words, success is measured by profit and, in addition, by the company's environmental stewardship ("planet") and social responsibility ("people"). This multi-dimensional view moves beyond a purely financial evaluation of performance and requires balancing potentially competing objectives.

In academic literature, business sustainability has been defined in various ways. One common definition describes business sustainability as creating prosperity while preserving the social and ecological conditions on which future generations depend. This perspective places business activity within interconnected social, environmental, and economic systems [30]. It emphasizes resilience and the integration of the three sustainability dimensions into the organization. In supply chains, these expectations multiply across tiers and stakeholders. The result is the sustainability-related complexity that this dissertation examines as a problem of selecting and stabilizing feasible responses.

From green to sustainability in supply chain management

The concept of sustainability has increasingly been applied to supply chain management, giving rise to the field of sustainable supply chain management. A supply chain is the network of organizations that produces and delivers a product or service. It extends from raw material suppliers through manufacturing and distribution to the end customer. It often also includes end-of-life return flows. Managing sustainability in this context means addressing impacts and practices at each stage of this chain. Researchers have noted that focusing on supply chains is a logical step in advancing sustainability, because supply chains account for the full life-cycle impacts of production and consumption [31; 32]. By extending sustainability efforts beyond the focal firm to suppliers, logistics providers, distributors, and even product use and disposal, companies can significantly reduce overall environmental footprints and improve social outcomes.

As the sustainability field matured, the term Sustainable Supply Chain Management (SSCM) emerged to reflect a more holistic approach. While definitions vary, SSCM generally encompasses environmental initiatives, social and broader economic considerations across the supply chain. SSCM can thus be seen as an extension of GSCM that includes the full triple bottom line of sustainability. This means that in addition to green practices, SSCM ensures fair labor practices and safety in supply chain operations (social sustainability), and maintaining economic viability for all members of the chain (economic sustainability). For example, a sustainable supply chain program might simultaneously seek to reduce carbon emissions, improve worker welfare at factories and farms, and achieve cost savings through efficiency and waste reduction.

The literature confirms this evolution. Ahi and Searcy [33] compared GSCM and SSCM definitions. GSCM definitions were generally narrower, focusing on environmental issues, material flows, and coordination. SSCM definitions also included social and economic dimensions. Ahi and Searcy [33] conclude that SSCM is essentially a broader concept building upon GSCM. Seuring and Müller [36] found that environmental issues dominated research up to the mid-2000s. Social aspects were comparatively rare. Since then, supply-chain research and practice have increasingly included social topics such as labor rights and ethical sourcing. This reflects the wider triple bottom line agenda [31; 34].

Defining sustainable supply chain management

Because SSCM is a multidisciplinary concept, numerous definitions have been proposed in academic literature. Two widely cited definitions help illuminate the scope of SSCM:

Carter and Rogers [35] define sustainable supply chain management as "the strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key interorganizational business processes for improving the long-term economic performance of the individual company and its supply chains." [35]. The definition links sustainability to long-term economic performance. Integrating sustainability can therefore improve business viability and competitiveness over time, for example through efficiency gains, risk reduction, and brand value. In this view, sustainability initiatives often entail upfront costs or changes.

Seuring and Müller [36] offer another influential definition: *"the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental, and social, into account which are derived from customer and stakeholder requirements. In sustainable supply chains, environmental and social criteria need to be fulfilled by the members to remain within the supply chain, while it is expected that competitiveness is maintained through meeting customer needs and related economic criteria."* [36].

In order to synthesize the previous definitions, the author has developed his own definition, which is more of an integrative understanding: *Sustainable Supply Chain Management (SSCM) is the strategically grounded and governed coordination of material, information and financial flows, and of the collaborative relationships that enable them, across all tiers of a network. It purposefully integrates social, environmental and economic objectives derived from stakeholder expectations, mandates that every participant in the network meet explicit environmental and social performance thresholds as a condition of continued membership, and simultaneously pursues innovations that secure the long-term competitiveness, resilience and value-creating capacity of both the participant itself (e.g. the focal organization) and the wider network.* This definition is used as the working construct for the empirical coding and the capability-based response model developed in Chapters 2 and 3.

The dissertation uses a small set of working definitions based on this understanding of SSCM. They connect Chapter 1's conceptual foundations to the empirical studies and the Organizational Response Model. These definitions specify how the dissertation understands sustainability-related complexity, decision points, Packed Business Capabilities, and auditability. These concepts are introduced here because they structure the theory, empirical coding, model development, and operationalization that follow. The following table summarizes the working definitions used in the dissertation.

Table 1 – Working definitions used in the dissertation

Term	**Working definition**

Sustainability-related complexity	Sustainability-related complexity refers to the heterogeneous and interdependent sustainability-related demands that organizations face across multiple supply-chain tiers. In this dissertation, it is treated as a composite construct comprising regulatory complexity, stakeholder complexity, data and auditability complexity, interorganizational supply-chain complexity, and temporal/change complexity. These forms vary in volume, dynamism, ambiguity, and interdependence and are interpreted qualitatively [37; 14; 15; 16; 38].
Decision point	The organizational decision point at which external pressures are prioritized and translated into an actionable response path.
Packed Business Capabilities	Bundled capabilities across Strategy, People, Process, and Technology that make sustainability responses executable and manageable inside the organization.
Auditability	The availability of verification-grade evidence that allows internal governance and external assurance to validate performance claims.
Note – Compiled by the author based on [14; 15; 16; 37; 38].	

SCM research has drawn on multiple established lenses (e.g., stakeholder, institutional, and resource-based perspectives) [32; 39; 40]. These approaches are valuable for describing drivers and adoption patterns, but they provide limited guidance on how organizations *select* and *stabilize* response portfolios under rising sustainability-related complexity and heterogeneous institutional conditions. To address this explanatory gap, the analysis draws on Social Systems Theory to conceptualize sustainability pressure as a problem of selection under complexity.

While SSCM practice areas are well documented (see Appendix B – Extended SSCM theory and practice overview, section SSCM practice catalogue), this dissertation does not catalogue practices. Instead, it reconstructs how organizations convert sustainability pressure into *manageable capabilities* and how these mechanisms differ under distinct institutional conditions (Germany vs Kazakhstan).

Table 2 – Overview of Sustainable Supply Chain Management Principles and Practices

Practice area	**Summary**
Sustainable Sourcing & Supplier Management	Integrating sustainability criteria into procurement; "supplier management for risks and performance" via audits, scorecards, codes of conduct and long-term collaborative relationships.

Product Design & Innovation for Sustainability (DfE/LCA)	Eco-design to minimize life-cycle impacts; using LCA to identify hotspots; reconfiguring supply chain activities; product-service models that reduce physical throughput.
Operational Sustainability & Lean Practices	Reducing waste aligns environmental impact and cost; energy/water efficiency, EMS, and worker health & safety improvements across operations and key suppliers.
Closed-Loop Supply Chain & Reverse Logistics	Managing reverse flows for reuse, remanufacturing, recycling; take-back systems; recovering secondary raw materials; regulatory drivers (e.g., WEEE).
Collaboration & Transparency	Joint initiatives with suppliers/NGOs; traceability (e.g., blockchain), supplier databases and audits; disclosure incl. scope 3 emissions to manage risk and build resilience.
Performance Measurement & Continuous Improvement	KPIs across the triple bottom line; balanced scorecards; applying PDCA to supply chain sustainability and aligning incentives/information systems.
Note – Compiled by the author based on [26; 36].	

The table above summarizes the dominant SSCM practice areas described in prior research. These practices are treated as a repertoire of possible interventions. The contribution explains how organizations select, sequence, and govern them as "packed" capabilities under varying institutional and supply-chain conditions. This rationale becomes operational in Chapter 2 and is formalized in the Organizational Response Model in Chapter 3.

A fuller discussion of SSCM implementation challenges and future directions is provided in the Appendix B – Extended SSCM theory and practice overview. In the main chapter, the focus is restricted to the explanatory gap addressed here: how organizations select, stabilize, and evidence sustainability responses under rising complexity.

The SSCM literature provides definitions, typical practice domains, and known implementation challenges, yet it remains less explicit about how organizations select feasible responses, routinize them, and maintain auditable performance under rising complexity. The remainder of this section briefly synthesizes Kazakhstan-focused ESG/CSR and reporting research to motivate the dissertation's comparative design, and introduces Social Systems Theory as the dissertation's sensitizing mechanism lens for sustainability-related complexity in supply chains.

Kazakhstan-focused research on ESG, CSR, and sustainable management (implications for SSCM)

Although ESG and sustainability have become prominent in global supply-chain and management research, Kazakhstan-specific academic work is still comparatively concentrated in adjacent streams, most notably CSR and sustainability reporting. Empirical work in Kazakhstan's extractive industries shows that global norms alone are insufficient to ensure sustainability reporting. For example, evidence from Kazakhstan's oil, gas, and mining sector links sustainability reporting patterns to board and governance characteristics, implying that disclosure quality depends on governance architecture and sector conditions [6].

Determinant studies of GRI-based reporting by listed companies and of CSR disclosure by KASE-listed banks confirm this pattern: standalone reporting, firm size, profitability, auditor type, board gender diversity and foreign ownership explain disclosure depth, whereas board size and independence do not [210; 211]. More recent work relates national ESG transformation to the strengthening of non-financial reporting [212], ESG strategy to financial resilience in oil and gas [213], and shows for 25 Kazakhstani firms that external disclosure scores fall short of what employees perceive as embedded practice, above all in governance [214]. At the supply chain level, transit corridors and agro-industrial activity have been linked to sector-level ESG indicators [215]. A second stream, published in the journals recommended by the Committee for Quality Assurance in the Sphere of Science and Higher Education of the Republic of Kazakhstan, addresses the reporting architecture itself. Mukhiyayeva, Sembiyeva and Zhagyparova [217] compare global ESG frameworks with their application in Kazakhstan and identify the absence of a unified national reporting standard, limited expertise and infrastructure deficits as the binding constraints. Zarubina, Zarubin, Yesenkulova and Pritula [218] extend the question to small and medium-sized enterprises and conclude that non-financial reporting there requires statutory rules and fiscal incentives, because voluntary adoption alone has not produced it. Nizamdinova, Yang and Aktureeva [220] relate environmental management accounting to the environmental component of ESG scores and find that firms with structured accounting systems report lower emission intensity and disclose more transparently. Raimbekov, Syzdykbayeva, Rakhmetulina and Abylaykhanova [223] analyze the sustainability of food distribution chains in Kazakhstan and group the constraints into seven categories, among them technological, institutional and geographic factors. These studies describe the same field from the accounting and policy side that the present dissertation approaches from the capability side, and sub-chapter 3.2 compares the measured profile with further studies from this stream [219; 221; 222; 224].

Table 3 – Kazakhstan-focused ESG/CSR and sustainability management research

Author(s) / year	**Focus (Kazakhstan)**	**Method / data**	**Results**	**Relevance for dissertation**

Mahmood & Humphrey [7]	CSR expectations in local vs multinational firms	Empirical stakeholder-focused study	CSR drivers and expectations differ by firm type and local context	Supports "contextual boundary conditions" logic (who pressures whom, and why)
Mahmood & Orazalin [6]	Green governance & sustainability reporting in oil/gas/mining	Empirical evidence from extractives	Reporting quality depends on governance attributes and incentives	Direct anchor for the argument that auditability requires governance and capability mechanisms
Goby & Karimova [8]	CSR communication narratives	Qualitative/cultural framing	CSR talk can be culturally shaped; risk of symbolic communication	Supports decoupling/greenwashing sensitivity; connects to "communication vs control" capability tension
Baltabayeva et al. [9]	CSR principles and large business implementation	Empirical national-focused study	CSR adoption is uneven; institutional conditions are relevant	Justifies focusing on maturity differences and capability sequencing in Kazakhstan
Katenova & Qudrat-Ullah [41]	ESG as a governance/finance-relevant factor	Empirical analysis (listed firms)	ESG relates to corporate outcomes; not purely "ethics talk"	Reinforces that ESG can become strategy/finance-relevant when institutions push it
Jumasseitova & Alybayeva [10]	Barriers to ESG implementation & reporting	Expert-based / barrier mapping	Costs, regulation gaps, staffing/knowledge and data reliability constrain reporting	Directly maps to capability categories (Process/Tech/Data/Governance) and expected bottlenecks
Zhaksybayeva et al. [42]	Circular/sustainable business ecosystem	Qual interviews + netnography	Infrastructure and policy gaps constrain sustainable business practices	Broadens "sustainable management" beyond reporting; fits "feasibility constraints" argument

Li et al. [43]	Reverse supply chains in mining waste	Optimization modeling in Kazakhstan	Global models require adaptation to Kazakhstan's institutional/infrastructure reality	Gives a Kazakhstan SSCM anchor (transferability limits + localization)
Orazalin & Mahmood [210]	GRI-based sustainability reporting of listed companies	Content analysis of reports, 2013 to 2015, regression	Standalone reporting, language, profitability, size and auditor type drive disclosure	Anchors the GRI-based measurement logic of the CMS and the argument that auditability requires governance and capability mechanisms
Orazalin [211]	CSR disclosure of KASE-listed commercial banks	Annual reports 2010 to 2016, regression	Board gender diversity and foreign ownership raise disclosure, board size and independence do not	Governance-mediated incentives (mechanism family 1)
Kuur et al. [212]	ESG transformation factors of the national economy	Analysis of international ESG and sustainability ratings	Kazakhstan's position in global sustainability rankings deteriorates, non-financial reporting is the lever	Institutional density and data maturity as boundary conditions
Uralova et al. [213]	ESG and financial sustainability in oil and gas (KazMunayGas)	Financial data 2015 to 2024, regression	Reinvested earnings and long-term assets carry ESG-oriented resilience	Extractive-sector anchor for the Study II sample
Neafie et al. [214]	Disclosure versus employee perception of	ESGQ scores of 25 firms and	Internal perception exceeds external disclosure	Mirror image of capability signaling: disclosure

	ESG and SDG alignment	employee survey (52 responses)	scores, above all in governance and SDG dimensions	can underrepresent embedded practice
Akhmet et al. [215]	ESG effects of transport routes in the agro-industrial complex	National statistics 2013 to 2023, PCA and econometric model	Transit flows improve environmental and governance indicators, agricultural activity has mixed effects	Kazakhstan supply chain anchor with ESG indicators
Note – Compiled by the author based on [6; 7; 8; 9; 10; 41; 42; 43; 210; 211; 212; 213; 214; 215].				

Complementary Kazakhstan-focused studies extend this picture beyond reporting determinants. Work on CSR in Kazakhstani firms suggests that CSR adoption and outcomes vary across organizations and remain uneven, with patterns influenced by institutional conditions and firm-level capabilities. Recent studies document a changing CSR environment, and links between CSR practices and selected performance indicators in KASE-listed companies. These are findings that underline both the growing salience of CSR/ESG and the variability of implementation depth across firms [9; 41; 44]. In addition, research on CSR narratives in Kazakhstan indicates that "what counts" as responsible business conduct can be culturally patterned, which is relevant for how firms communicate sustainability and how stakeholders interpret disclosure [8].

A second Kazakhstan-relevant strand concerns the enabling infrastructure for ESG disclosure and comparability. In Kazakhstan, disclosure expectations are increasingly supported by market and regulatory initiatives such as the AIFC ESG Disclosure Guidance for regulated financial entities, and the stock-exchange infrastructure that centralizes ESG information and reporting resources. These initiatives increase the formalization of disclosure expectations, but they do not automatically resolve the operational challenges of producing verification-grade data [45; 46]. OECD analysis similarly frames Kazakhstan's changing ESG disclosure environment as part of a broader responsible business conduct agenda, emphasizing that governance capacity and institutional design shape the effectiveness of ESG-related expectations in practice [47].

Across these Kazakhstan-focused contributions, a consistent theme is that the main bottleneck lies in translating awareness of ESG language into organizational practice. The Kazakhstan-focused literature provides valuable context on disclosure drivers and CSR development. It offers less explanation of how organizations turn sustainability pressure into manageable, routine, and auditable supply-chain capabilities under institutional constraints. This gap is directly relevant to SSCM. Addressing this gap motivates the dissertation's mechanism focus on capability portfolios, sequencing, and auditability outcomes under differing institutional boundary conditions.

Social Systems Theory as a Lens for Sustainable Supply Chain Management

Building on the SSCM foundations established above, this subsection introduces Social Systems Theory (SST) as the mechanism used to explain how organizations reduce sustainability-related complexity into manageable responses. In recent years, SSCM has become increasingly important both in research and in practice, as companies are increasingly being held responsible for complying with social and environmental standards along their entire supply chain [48]. Despite this development, many challenges remain. In particular, the complexity of global supply chains makes the implementation of sustainability more difficult as many actors (suppliers, manufacturers, retailers, consumers) are involved, and it is necessary to consider a variety of sustainability dimensions (economic, ecological, social) at the same time [49; 50]. Research gaps exist primarily in understanding which specific sustainability-related complexity companies perceive in their supply chains and how they can deal with them [51; 52; 53].

Against this backdrop, Niklas Luhmann's social systems theory is gaining relevance as a theoretical lens. Luhmann's systems theory, originally based in sociology, focuses on how social systems manage complexity and adapt to their environment [54]. This perspective promises valuable insights for sustainable supply chain management: it makes it possible to view a supply chain as a system that is confronted with a complex environment (e.g. regulatory requirements, stakeholder expectations, ecological conditions) and requires mechanism to reduce complexity [14; 55]. Initial studies are already using Luhmann’s systems theory to analyze sustainability challenges in supply chains [53; 56].

This section introduces the SST concepts used in the empirical studies and the Organizational Response Model. It first explains sustainability pressure as selection under complexity, then specifies how organizations build internal versus collaborative complexity (requisite variety) and how these response pathways are conditioned by institutional contexts (Germany vs Kazakhstan). Supplementary discussion of broader benefits and managerial implications of an SST is provided in the APPENDIX E – EXTENDED SOCIAL SYSTEMS THEORY PRIMER (THEORETICAL DEPTH) on page 227.

Accordingly, conceptualizing sustainability-related complexity through the lens of social systems theory has two objectives: firstly, to advance the understanding of sustainable supply chain management practices within organizations, and secondly, to gain insight into the specific sustainability-related complexity that organizations perceive within their respective supply chains.

From this dissertation’s perspective, Social Systems Theory is employed to understand sustainability in supply chains for three reasons. Firstly, the concept of sustainability and the challenges it presents in supply chains represent a high level of environmental complexity, given that they encompass several different dimensions, including social, economic and ecological sustainability [49]. Secondly, in addition to sustainability, supply chain management considers the various actors involved in a supply chain and their interconnections [56; 57]. Thirdly, examining the environmental sustainability-related complexity (i.e. managing sustainability in supply chains) offers

an initial insight into the internal and collaborative complexities required for effective sustainability management [58; 49; 59].

Social Systems Theory (SST) provides a vocabulary for analyzing how organizations reduce sustainability-related complexity through selective perception and routinized decision-making. Its application here is bounded by the institutional context. The dissertation treats SST as a sensitizing mechanism that helps reconstruct *how* organizations translate diffuse sustainability expectations into internally executable routines. Institutional density shapes the environment that organizations construct and observe. Enforcement, reporting expectations, assurance infrastructure, and stakeholder scrutiny vary across countries and sectors. They influence which sustainability signals become salient and actionable. The same sustainability discourse can produce different organizational selections, evidence practices, and routines in Germany and Kazakhstan. This matters for the comparative design. Accordingly, the theoretical concepts introduced are applied under specified boundary conditions (see chapter 1.2 Contextual boundary conditions: Germany and Kazakhstan), and the comparative synthesis (see section Comparative synthesis: expected implications for capability building on page 50) clarifies how context is expected to moderate the feasibility and sequencing of response mechanisms.

The dissertation therefore adopts a plural structured theoretical framing. Social Systems Theory guides interpretation of selection, complexity reduction, and stabilization. Complementary theories explain stakeholder salience, institutional pressure, capability development, governance choices, assurance challenges, and context-fit. This distinction is important because the Organizational Response Model combines empirical grounding with insights from Social Systems Theory and complementary management theories. Social Systems Theory guides interpretation of the underlying mechanism. The model is a capability-based managerial framework developed from empirical studies and supported by complementary management theories. The following table summarizes the role of Social Systems Theory and the complementary theoretical perspectives used in the dissertation.

Table 4 – Role of Social Systems Theory (SST) and complementary theories in the dissertation

Theory	**References**	**Explanation**	**Shortcomings for the present analysis**	**Role in the analysis**
Social Systems Theory (organization as decision system)	Luhmann [14; 15; 16]	Selection under complexity; stabilization into decision premises/routines; system-environment processing; internal vs col-	Does not prescribe a specific "tool list" of practices; requires operationalization into constructs and indicators	Supporting / sensitizing lens for selection and routinization; complemented by stakeholder,

		laborative variety; context differences via institutional density		institutional, and capability-based perspectives in the empirical analysis and model development
Stakeholder theory	Freeman [17]	Issue salience; stakeholder pressure; engagement/legitimacy strategies	How pressures become stabilized into auditable routines/capability portfolios across tiers	Supporting (moderators; salience; stakeholder channels)
Institutional theory (neo-institutional)	Meyer & Rowan [18]; DiMaggio & Powell [19]	Diffusion of templates; legitimacy pressures; standardization; decoupling risks	Within-firm conversion of pressures into executable capability portfolios and evidence systems (often underspecified)	Supporting (institutional density; convergence/orchestration context)
RBV / NRBV	Barney [20]; Hart [21]	Sustainability as capability/resource advantage; value creation from environmental capabilities	Selection under competing signals; routinization into decision premises; evidence/auditability mechanism vocabulary	Supporting (capability framing; competitive logic)
Dynamic capabilities	Teece, Pisano & Shuen [22]; Eisenhardt & Martin [60]	Sensing, seizing, reconfiguring; adaptive capability building under turbulence	Explicit decision-structure stabilization and auditability under institutional-density variation	Supporting (adaptation logic; capability maturation language)

Agency theory	Jensen & Meckling [61]	Incentives, monitoring, information asymmetry, principal-agent conflicts	Complexity-processing and routinization mechanism for multi-tier sustainability portfolios	Supporting (assurance, monitoring, incentive alignment where relevant)
Contingency perspectives	Burns & Stalker [62]; Lawrence & Lorsch [63]; Donaldson [64]	Context-fit rationale; why "what works" differs by environment and task uncertainty	Concrete micro-mechanisms of selection/routinization (often treated as black box)	Supporting (boundary conditions; context-fit framing)
Note – Compiled by the author based on [14; 15; 16; 17; 18; 19; 20; 21; 22; 60; 61; 62; 63; 64].				

Luhmann's social systems theory as theoretical framework

Niklas Luhmann's theory of social systems [14] offers an approach to understanding complex social constellations such as organizations or societies. The central element of the theory is the concept of complexity. Luhmann defines complexity as the number and interconnection of the elements that make up a system or its environment [14; 15]. A core assumption is that a system is always less complex than its environment, meaning that a single organization can never process all events, influencing factors and requirements of the outside world simultaneously. Instead, the system has to make a selection: from the abundance of environmental complexity, it selectively perceives those aspects that it considers relevant for its own survival or its goals, and ignores other aspects [65]. This selective perception and processing reduces the effective complexity with which the system has to operate, and enables goal-orientated action.

What "selection" looks like in practice depends on how clearly sustainability expectations are institutionalized and enforced. In high-enforcement contexts, sustainability signals tend to take the form of standardized demands. Examples include due diligence requirements, audit expectations, and mandated disclosures. This reduces interpretive ambiguity and increases pressure to formalize routines, roles, and control systems. In lower-density or transitioning contexts, sustainability signals may be fragmented or unevenly enforced. They may also be mediated through export customers and financiers. This can increase ambiguity about compliance and the urgency of particular issues. In SST terms, this affects, on the one hand, which forms of sustainability-related complexity are perceived as relevant and, on the other hand, how they can be stabilized into decision premises and repeatable routines. For this dissertation, the implication is that selection should be expected to vary across Germany and Kazakhstan both in intensity, and also in the type of organizational stabilization it enables.

The concept of complexity has been applied in organizational design studies [66], industrial collaboration [67], supply chain management [68] and sustainable supply chains [69].

An extended discussion of the NK "rugged landscape" heuristic is provided in Appendix E – Extended Social Systems Theory primer (theoretical depth). The main text retains only the SST selection approach required to derive the dissertation's response mechanism constructs.

Social systems, e.g. companies as organizational systems, are also characterized by operational closure and environmental dependency. This means that an organization can only communicate and act with the means that are available within the system (e.g. internal decision-making processes, resources). Luhmann describes organizations as independent systems of meaning that communicate through decisions and differentiate themselves from their environment [23]. Each system constructs its environment according to its own criteria. For example, two organizations can perceive the same external reality differently, depending on their internal structures, experience and goals. This results in divergent perspectives: For example, a supplier and a buyer in a supply chain (two separate systems) might have different views on which sustainability issues are a priority.

Another central concept in systems theory is contingency: systems have latitude in how they react to environmental complexity. Here, Luhmann draws on the concept of 'requisite variety' [70]. In order to cope with external complexity, a system must have a corresponding internal variety of possible reactions. In other words: The more complex the environmental challenges, the more variation or internal complexity the system requires in order to respond appropriately. Two basic strategies are available [55]:

Increase internal complexity: The system expands its internal structures, processes and competences to provide more variety. For example, a company can set up specialized departments or expert teams for sustainability, implement extensive data information systems or introduce additional decision-making levels. This increases the ability to process different problems internally [71; 72; 55].

Utilizing cooperative or collaborative complexity: The system draws on the complexity resources of other systems by forming co-operations or networks. For example, a company can involve external partners, form alliances, or rely on industry-wide initiatives to overcome challenges. In this way, the required variety is outsourced or distributed, so that several systems each contribute their capabilities [55]. In this context, Luhmann also speaks of structural coupling when systems connect via common structures (contracts, standards, communication channels) in order to interact with each other without giving up their independence.

The term 'internal complexity' is used to describe the internal structures and processes of an organization, as defined by Daft and Lengel [71] and Damanpour [72]. In contrast, the term 'collaborative complexity' refers to structures and processes between organizations, as proposed by Schneider et al. [55].

Which path a system chooses to increase complexity internally or collaboratively depends on many factors (e.g. resources, power relations, trust). Both approaches are

often combined: organizations combine internal and collective complexity by expanding their own capabilities on the one hand and seeking overlap with the environment on the other, where other actors share similar problems [55]. The system must find a balance so that the internal variety ultimately corresponds to the complexity flowing in from outside [70]. If the environment has become more turbulent (more problems, new requirements), the system must react to this, either through internal learning/restructuring or through more intensive cooperation with the environment.

One dynamic aspect of systems theory is that both the system itself and its environment are constantly changing. A system must therefore constantly review and adapt its patterns of perception and reaction. Luhmann speaks of the process of self-observation: organizations observe their environment (e.g. market trends, stakeholder feedback) and at the same time themselves (own goals, performance) in order to identify new relevant complexity and, if necessary, make new decisions. This adaptive cycle is essential for the survival of the system. Schneider, Wickert and Marti [55] conceptualize this response approach as reducing complexity by creating complexity, meaning that organizations develop internal and collaborative response capacity in order to make selected parts of environmental complexity manageable.

Operationalizing complexity reduction through complexity creation in management research

In management research, the idea of complexity reduction through complexity creation should not be understood as a paradoxical slogan, but as a mechanism of organizational response. Organizations do not reduce environmental complexity by eliminating it. Rather, they reduce the part of environmental complexity that becomes decision-relevant by creating additional internal and collaborative structures that allow the organization to observe, classify, prioritize, and process external demands. In this sense, complexity reduction means the creation of selective actionability referred to as selective stabilization. Sustainability-related complexity remains present in the environment. However, it becomes more manageable for the organization when it is translated into decision premises, routines, roles, data systems, standards, supplier interfaces, and review procedures.

Schneider, Wickert and Marti [55] make this mechanism particularly useful for management research because they distinguish between internal complexity and collaborative complexity. Internal complexity refers to additional structures and processes created inside the organization, for example sustainability departments, cross-functional committees, risk assessment routines, data systems, audit procedures, escalation rules, and managerial review cycles. Collaborative complexity refers to response capacity created between organizations, for example supplier development programs, industry standards, certification schemes, multi-stakeholder initiatives, shared platforms, contractual requirements, and external assurance arrangements. Both forms increase the organization's available response variety. They are therefore not the opposite of complexity reduction, but the means through which the organization becomes able to reduce unstructured environmental complexity into manageable response options.

However, the argument is treated critically here. Creating more internal or collaborative structures does not automatically improve sustainability management. Additional roles, indicators, audits, standards, and partnerships may also increase bureaucracy, coordination cost, reporting overload, symbolic compliance, or decoupling between public communication and operational control. Complexity creation becomes functional only when it improves the organization's ability to select relevant sustainability issues, allocate responsibility, produce verification-grade evidence, coordinate across supply-chain interfaces, and adapt responses over time. If these conditions are not met, additional structures may reproduce complexity.

This critical interpretation is important for the dissertation's operationalization of Social Systems Theory. The dissertation does not measure Social Systems Theory directly and does not attempt to operationalize the full Luhmannian vocabulary. Instead, it translates the management-relevant part of the theory into observable response constructs. Environmental complexity is operationalized as sustainability-related regulatory, stakeholder, data and auditability, interorganizational, and temporal change complexity. Internal complexity is operationalized through Packed Business Capabilities across Strategy, People, Process, and Technology. Collaborative complexity is operationalized through standards, supplier development, certification, external assurance, industry initiatives, and shared reporting or verification infrastructures. Complexity reduction is operationalized as the organization's ability to produce actionable and auditable responses, reflected in time-to-mitigation, auditable tier coverage, and coordination cost.

The implication for the Organizational Response Model is that internal and collaborative complexity are not treated as abstract theoretical categories. They are translated into managerial routing choices. Where sustainability demands are firm-specific, weakly standardized, or insufficiently supported by external infrastructures, internal capability building becomes more important. Where sustainability demands are shared across firms and supported by standards, assurance systems, or industry platforms, collaborative complexity can reduce the burden on the focal organization. The ORM therefore uses Schneider, Wickert and Marti's distinction as a sensitizing mechanism, and extends it into a capability-based managerial framework that specifies how organizations decide between internal build-up, collaborative response, or a combined pathway.

Core SST constructs used

This dissertation does not attempt to operationalize the full vocabulary of Luhmann's Social Systems Theory. Instead, it uses a limited set of SST constructs that are directly relevant to the dissertation's analytical purpose, namely explaining how organizations reduce sustainability-related complexity into manageable and auditable responses [14; 15; 16]. In this sense, SST is used in a bounded and operational way: not as a complete theory of organizational autopoiesis, but as a conceptual vocabulary for selective perception, system-environment differentiation, and the stabilization of decision-relevant expectations into organizational routines [23].

In this dissertation, system refers primarily to the focal organization as a decision-producing organization. Environment refers to the regulatory, stakeholder, market, sectoral, and supply-chain conditions that the focal organization observes as relevant to sustainability. Communication refers to the decision-relevant articulations through which sustainability issues are interpreted, justified, documented, and translated into organizational action. Selection refers to the prioritization of some sustainability signals over others. Stabilization refers to the translation of selected issues into recurring routines, roles, controls, and evidence practices. Structural coupling means relatively stable links through audits, standards, reporting frameworks, contracts, and collaborative initiatives. These allow organizations to coordinate with external actors while remaining distinct systems [14; 15; 16; 23]. These constructs are used here because they are analytically serviceable for the dissertation's empirical purpose.

These constructs are used throughout the dissertation as interpretive anchors. They guide the reconstruction of how organizations transform external sustainability pressures into decision points, Packed Business Capabilities, and auditability-oriented governance arrangements. Accordingly, SST informs the interpretation of organizational response processes, while the empirical coding and model development remain capability-based and governance-oriented.

A further distinction is important for the comparative design. In Study I, interview material is used to reconstruct how organizations describe embedded routines, choices, and response mechanisms. In Study II, public sustainability reports are treated as forms of organizational self-description. Sustainability reports provide evidence of public articulation, evidence orientation, and external-facing stabilization. They cannot fully substitute for internal organizational communication [14; 15; 23].

For analytical clarity, sustainability-related complexity is differentiated into five overlapping forms. Regulatory complexity refers to the multiplicity, variability, and enforceability of legal and quasi-legal sustainability requirements. Stakeholder complexity refers to the plurality of actors, expectations, and legitimacy pressures that organizations must interpret and prioritize. Data and auditability complexity refers to the difficulty of producing comparable, verifiable, and cross-tier evidence for sustainability claims. Interorganizational supply-chain complexity refers to the number, heterogeneity, and interdependence of suppliers, customers, intermediaries, and collaborative interfaces through which sustainability responses must be coordinated. Temporal/change complexity refers to the fact that sustainability priorities, standards, and risks evolve over time and may outpace existing routines. This working typology draws on supply chain complexity literature that distinguishes structural/static, dynamic, and decision-making aspects of complexity while adapting them to the dissertation's sustainability-governance focus [37; 14; 15; 16; 38].

A further boundary of the dissertation's use of Social Systems Theory should be made explicit. In Luhmann's theory, organizations can be understood as self-referential systems that reproduce themselves through decision communication under conditions of operational closure [14; 15; 16]. The present dissertation does not attempt to operationalize autopoiesis in this strict sense. It neither traces the full reproduction of organizational communication over time nor reconstructs organizations as self-producing

communication systems in a sophisticated way. Instead, it uses a limited SST vocabulary to illuminate how organizations reduce sustainability-related complexity through selection, stabilization, and routinization. Autopoiesis therefore remains part of the broader theoretical background of SST.

Application to sustainable supply chain management

In this dissertation, sustainable supply chains are not treated as single, unified systems that constitute the primary unit of analysis. Supply chains are understood as relational contexts comprising multiple organizations. These organizations observe one another and interact through standards, contracts, data exchanges, audits, and collaborative arrangements. They also form part of one another's relevant environment [14; 15; 16; 23]. The analytical focus therefore remains on the focal organization as the decision-producing system. From this perspective, supply-chain sustainability management involves three questions. How do organizations observe pressures in their wider value-chain environment? Which issues do they select as relevant? How do they translate these issues into internal and collaborative responses?

First, in current supply chains, companies are faced with a flood of requirements, be it ecological criteria (climate protection, resource consumption, reduction of pollutants), social expectations (working conditions, human rights, diversity) or economic constraints (costs, quality, time). Luhmann's approach helps to understand that no company can take all of these environmental complexities fully into account at the same time. Instead, priorities are set. In a qualitative study of various industries, Neske et al. [53] found that companies identify very different sustainability-related complexity in their supply chains, for example, textile companies focused on social labour standards and supplier transparency, while food and agricultural companies tended to focus on environmental challenges such as climatic impacts on raw materials and biodiversity [53]. These differences reflect the selective perception of the systems, meaning that each company filters the sustainability issues according to its own structure, industry, culture and the expectations of its stakeholders.

A further contextual layer concerns *what counts as acceptable evidence* when organizations claim they are addressing sustainability expectations. Policies, commitments, reports, and supplier codes can initially reduce complexity. This sustainability communication selects and stabilizes meanings that can be shared with stakeholders. However, the degree to which such communication must be backed by verification-grade data differs across institutional environments. Stronger assurance infrastructure and scrutiny increase pressure for audit-ready evidence. This includes traceable supplier coverage, documented corrective actions, and measurable indicators. Where reporting and assurance are still developing, organizations may rely on public articulation and framework alignment as visible signals. Measurement and control infrastructures may lag behind. For the dissertation, this implies that transparency practices should not automatically be treated as equivalent to auditability. Instead, the analysis distinguishes communicative alignment from the development of internal data governance and control routines that enable verifiable sustainability performance. Here, auditability refers to the extent to which sustainability claims are supported by specific, verifiable indicators, evidence trails, and documented governance routines.

In academic literature, many studies on complex systems employ simulation techniques. An exception is Matos and Hall [69], who employ a qualitative data-driven approach to identify elements and interactions.

Selective perception can also lead to blind spots. Yang et al. [56] showed that some companies long regarded supplier instability (frequent supplier changes or cancellations) primarily as a cost and quality problem and underestimated its impact on their CSR (corporate social responsibility) performance. A systems-theoretical view of the entire company life cycle showed that unstable supplier relationships in growth and maturity phases can have a significant negative impact on sustainability performance (e.g. compliance with social standards), while the effect is weaker in later phases [56]. The systemic perspective can thus reveal temporal dynamics and indirect effects that analyses focused on costs and efficiency have overlooked.

Second, from a systems theory perspective, a company that wants to implement sustainability in its supply chain must first define the complexity relevant to itself and then ensure sufficient internal variety in order to master it. Many companies have adapted their internal structures accordingly in recent years: For example, by creating sustainability departments or officers, developing detailed codes of conduct and audit processes for suppliers, introducing IT systems for tracking materials, or training employees in sustainable procurement. All of these steps increase the internal complexity of the company by having more information, more expertise and more differentiated processes available to deal with sustainability issues. Hall, Matos and Silvestre [50] report that companies that proactively invest in sustainable supply chains often have to set up a more complex internal coordination structure in order to manage the multitude of indicators and actors. For example, coordination between the purchasing, quality, CSR and legal departments is required when a new supplier code of conduct is implemented. This increased coordination is what Hall et al. [50] describe as a complexity challenge.

A system-theoretical interpretation here would be that the company increases its own complexity in order to be able to resonate better with the complex environment (supply chain with sustainability requirements). However, this is associated with costs and effort. Too much internal complexity can in turn lead to inefficiency (a phenomenon known in organizational theory as the risk of bureaucracy). The trick is therefore to build up just enough internal diversity to ensure sustainability, and not to get lost in internal structures.

Third, no company operates in isolation. Sustainability issues in particular often transcend the boundaries of a single system. This is why companies are increasingly looking for cooperative approaches to tackle external complexity in supply chains. In the terminology of Schneider, Wickert and Marti [55], this means that they use collaborative complexity. Companies incorporate the diversity of other organizations. In practice, this manifests itself in industry initiatives and multi-stakeholder alliances, for example companies working together with competitors, non-governmental organizations, local communities and governments to develop common standards and solutions.

A prime example is the Roundtable on Sustainable Palm Oil (RSPO) [73]. In view of the highly complex issues surrounding palm oil supply chains (e.g. rainforest

deforestation, biodiversity loss, human rights issues), numerous companies in the food and consumer goods industry have sat down with NGOs and producers to establish binding sustainability standards and certifications for palm oil. This network represents a new level of the system in which information and responsibilities are shared. No single company would have the resources to tackle the environmental and social challenges along the entire global palm oil supply chain alone. However, the structural linkage in the RSPO distributes the competences and shifts the environmental complexity onto several shoulders, so to speak. The same applies to the textile industry: tragic accidents such as the collapse of the Rana Plaza factory in Bangladesh in 2013, international fashion companies and local stakeholders concluded the Accord on Fire and Building Safety in order to jointly implement binding safety standards for factories [74]. From a systems theory perspective, such agreements form temporary superordinate systems that provide collective variety adapted to the highly complex problem situation.

Co-operation does not automatically solve all complexity, but it does change the way complexity is dealt with. Instead of each company independently trying to control working conditions at the supplier, for example, resources can be pooled and conflicts negotiated collectively. However, this requires communication and trust between those involved. Systems theory emphasizes the role of joint communication: through constant coordination, reports and meetings, the network creates a joint communication system, which in turn follows its own rules. Studies show that communication in such multi-stakeholder initiatives is often characterized by strategic ambiguity in order to reconcile different interests [75]. For a company, participation in collaborations therefore also means that it has to learn to act inter-organizationally, which is another form of complexity that the company has to deal with.

Fourth, systems theory thinking also sensitises us to the fact that every company retains its own rationale despite all cooperation. Sustainability programs in supply chains often fail because, for example, suppliers do not understand the requirements of their customers or do not regard them as legitimate; in other words, the cultural or normative differences between the systems are too great. Reinecke and Ansari [59] discuss such cases as ‘wicked problems’, in which different stakeholders have different perceptions of the problem and frames for solutions. Using the example of conflict minerals, they show how targeted framing processes can succeed in creating a shared understanding of responsibility in the field so that companies take responsibility for remote social problems [59]. Applied to supply chains, this means that for cooperation to work, a common definition of the relevant sustainability-related complexity must first be found. For example, a supplier in a developing country may have a different view of ‘fair wages’ than a Western brand manufacturer. Only through communication and negotiation can such differences be bridged. If this is successful, a shared perspective is created (a field frame according to Reinecke & Ansari), which in turn is the basis for effective joint action.

To summarise, the application of Luhmann's systems theory to SSCM provides an analytical toolbox for understanding 1) Which sustainability issues does a company perceive as systemically relevant and which not? (selection mechanism), 2) How does

a company harmonise its internal complexity with external requirements? (internal structures, processes, competences), 3) Where does it seek cooperation to overcome external complexity and how does it organise this cooperation? (networks, initiatives, communication between systems), 4) Where are potential differences in perception or misunderstandings between actors? (different system logics), and 5) How do dynamics (growth, crises, changes in the environment) influence the sustainability performance of the supply chain? (adaptation processes).

Recent academic work has shown that this perspective can lead to practically relevant recommendations. For example, Neske et al. [53] emphasize that companies must first develop a clear picture of their specific sustainability-related complexity before taking appropriate management measures. This reflection is, in a sense, the first step in complexity reduction. Yang et al. [56] provide evidence-based indications that complexity-reducing practices (e.g. standardization of supplier switching processes or building long-term supplier relationships) can significantly mitigate the negative effects of environmental complexity on sustainability performance. This emphasizes that the systems theory perspective is both descriptive and prescriptive: it helps to strengthen resilience and adaptability in supply chains by showing where variety is lacking or cooperation is needed.

The broader conceptual advantages and practical implications of an SST lens are documented in the APPENDIX E – EXTENDED SOCIAL SYSTEMS THEORY PRIMER (THEORETICAL DEPTH) on page 227. In the main chapter, the focus is only on the SST constructs that are subsequently operationalized in the coding scheme (Chapter 2) and translated into the Organizational Response Model (Chapter 3).

Sustainable Supply Chain Management (SSCM) faces an inherent complexity problem due to the multitude of actors, levels, and issues involved. Niklas Luhmann's Social Systems Theory offers a valuable theoretical framework for analyzing and addressing this complexity. By focusing on system-environment relationships, selection processes, and adaptation mechanisms, it enables a deeper understanding of how and why companies engage with or neglect certain sustainability aspects.

Applying this theory to SSCM shows that supply chains can be understood as social systems governed by communication and decision-making. Supply Chains are successful when they manage to reflect relevant external complexity through suitable internal structures and external collaborations. Recent qualitative case studies [53] and quantitative analyses [56] show how Luhmann's concepts can explain concrete phenomena. Examples include different understandings of sustainability across industries and the effects of supplier instability on CSR performance.

The dissertation examines SST's premise through organizational capability building. Organizations need enough internal and collaborative variety to handle environmental sustainability-related complexity. Their response consists of building and stabilizing a capability portfolio across Strategy, People, Process, and Technology. These Packed Business Capabilities turn selected pressures into routines, measurement, and auditability where required. This makes the systems-theoretic rationale observable in the empirical material. The analysis examines decision premises, roles, re-

sources, and data and control infrastructures. It also examines when organizations develop capabilities internally or collaborate with external actors. Institutional conditions affect which pathways are feasible. Section 1.2 therefore defines Germany and Kazakhstan as contextual boundary conditions. It specifies which sustainability signals attract attention and which capability pathways can become auditable routines. These conditions guide the later comparison.

At the theoretical level, Social Systems Theory provides a sensitizing vocabulary for how organizations reduce sustainability-related complexity through selection and stabilization [14; 15; 16]. At the explanatory level, stakeholder and institutional perspectives clarify why particular pressures become salient and how regulatory, normative, and assurance contexts shape their transmission and interpretation [17; 18; 19; 162]. The dissertation develops a capability-based, governance-oriented Organizational Response Model. It specifies how sustainability pressures lead to decision points, Packed Business Capabilities, and auditable outcomes. It also specifies moderators and boundary-condition routing [20; 21; 22]. The dissertation therefore does not treat these theoretical perspectives as competing claims to exclusivity. Rather, it uses them in a complementary way, with SST informing the interpretation of complexity reduction and the ORM providing the managerial specification of response mechanisms and outcomes.

The title of the dissertation uses the term sustainability-related complexity to specify that the research does not address organizational complexity in general. Rather, it focuses on the forms of complexity that arise when organizations are confronted with heterogeneous sustainability requirements across supply-chain contexts. In this dissertation, sustainability-related complexity comprises regulatory complexity, stakeholder complexity, data and auditability complexity, interorganizational supply-chain complexity, and temporal change complexity. The term managerial framework indicates the applied orientation of the study. The dissertation reconstructs organizational responses conceptually and translates them into a capability-based Organizational Response Model, a Capability Maturity Score, and mechanism-oriented outcome metrics that support organizational response and auditability.

1.2 Contextual boundary conditions: Germany and Kazakhstan

Kazakhstan has made sustainability a national priority through a series of strategies, policies, and institutional reforms over the past decade [77]. As the largest economy in Central Asia and a resource-rich nation, Kazakhstan has to promote economic growth while addressing significant environmental and social issues [80; 81]. The government has adopted long-term strategic documents and regulatory frameworks aimed at integrating principles of sustainable development and Environmental, Social, and Governance (ESG) considerations into its national development model. Kazakhstan-specific evidence corresponds to the implementation barriers discussed in the broader ESG literature. Expert-based findings identify high implementation costs, regulatory deficiencies, knowledge and staffing gaps, and limited data availability and reliability

as key constraints on ESG reporting in Kazakhstan, with practical difficulties in measuring social and governance dimensions. These constraints affect the auditability and comparability of corporate ESG disclosures and help explain why the formal adoption of ESG language may outpace measurement systems [10]. Practitioner reporting on ESG disclosure among leading firms in Kazakhstan shows growing activity but uneven depth and standardization [82].

Section 1.2 specifies Kazakhstan as a set of contextual boundary conditions that shape how sustainability expectations become feasible (or infeasible) to translate into auditable organizational responses in supply chains. The main chapter retains the policy timeline, disclosure architecture, sector relevance, and capability constraints. These support the comparative rationale and the Organizational Response Model.

Table 5 – Policy Timeline (Kazakhstan)

Year	Policy / Instrument	Description
2012	Strategy "Kazakhstan 2050"	Long-term vision to join the top 30 developed countries; green development trajectory; foundation for subsequent policies.
2013	Concept for Transition to a Green Economy	Roadmap to 2050 with staged transition; targets incl. 50% of power from alternative/renewable sources and −50% energy intensity vs. 2008 by 2050; water supply milestones (2020/2040).
2020	Carbon neutrality pledge	Announcement of a national carbon-neutrality target for 2060, integrated into strengthened climate planning.
2021	Environmental Code (new)	Stricter standards; transition to integrated environmental permits linked to best available techniques (BAT), with an originally scheduled 2025 start for designated major installations and phased implementation for existing facilities; "polluter pays" to drive modernization.
2021	Corporate Governance Code	Standards for transparency, board accountability, shareholder rights.
2023	Social Code	Consolidates policies on social protection, labor, and social development.
2023	Strategy on Achieving Carbon Neutrality by 2060 (Decree No. 121)	Operationalizes the 2060 pledge across sectors.
2024	AIFC ESG Debentures Framework & ESG Disclosure Guidance (AFSA)	Standards for green/sustainable bonds and guidance for ESG disclosures within AIFC.

Note – Compiled by the author based on the List of Regulatory documents (items 1 to 5) and [45; 76; 95; 96].

Kazakhstan's national commitments provide a policy context for the dissertation. Presidential Decree No. 121 of 2 February 2023 approved the Strategy for Achieving Carbon Neutrality by 2060. It appears as item 4 in the List of Regulatory documents. The strategy covers energy, industry, agriculture and forestry, waste management, climate finance, carbon regulation, and international cooperation [5]. Implementation raises requirements for technology, data, supplier governance, and emissions evidence. The dissertation examines how firms translate these requirements into supply-chain decisions and routines.

Why context is relevant for sustainability responses

The implementation of these practices can vary significantly by context. In a global supply chain, social compliance may require on-the-ground audits in developing countries and oversight of complex subcontracting networks. In a domestic supply chain with closer oversight, the focus may instead be on environmental efficiency. Likewise, industry-specific challenges exist: a food supply chain might emphasize sustainable agriculture and cold-chain energy use, while an electronics supply chain might focus on hazardous substance control and e-waste recycling. Despite these differences, the fundamental principles of SSCM, such as integration of triple bottom line goals, inter-organizational collaboration, stakeholder engagement, and continuous improvement, are broadly applicable.

The relevance of context is that sustainability expectations do not enter organizations as stable, universally defined requirements. They become actionable only through locally available institutions, enforcement capacities, stakeholder scrutiny, and infrastructures for producing "acceptable" evidence. In Social Systems Theory terms, institutional environments shape which sustainability signals gain relevance, how uncertainty is reduced, and which response options can be selected and stabilized as routine. For this dissertation, Germany and Kazakhstan represent distinct boundary conditions along key dimensions such as due-diligence enforceability, reporting and assurance maturity, and the availability of auditable ESG data. These differences affect the intensity of pressure and the feasibility of embedding sustainability into manageable routines. Accordingly, the analysis treats context as a moderator of capability building: organizations must assemble and sequence Packed Business Capabilities across Strategy, People, Process, and Technology in ways that fit their institutional setting. The following subsections therefore specify the German and Kazakh boundary conditions and then synthesize their implications for expected response mechanisms.

Germany: downstream due diligence and enforcement context

In the following, Germany is selected as the dissertation's additional context because it represents a high-impact *downstream* market where supply-chain sustainability expectations are formalized into enforceable corporate due-diligence practices that can cascade to upstream suppliers. Germany's Supply Chain Due Diligence Act, the Lieferkettensorgfaltspflichtengesetz or LkSG, requires in-scope companies to implement structured supply-chain due diligence. This includes risk management, preventive

and remedial measures, complaints channels, and reporting. It covers the company's own operations and contractual partners. Under defined conditions, it also covers indirect suppliers [83]. Because "auditability" ultimately depends on consistent measurement rules, documentation, and verification routines, the analysis draws on MRV (measurement, reporting, and verification) logic to clarify what constitutes robust sustainability evidence. MRV is widely treated as foundational for credible climate-related reporting and for demonstrating progress against mitigation targets, which is directly relevant when evaluating the reliability of corporate ESG disclosures [84; 85]. The Federal Office for Economic Affairs and Export Control provides regulatory oversight and implementation guidance. This includes requirements for a functioning complaints procedure. Internal and external stakeholders must be able to report supply-chain human-rights or environmental risks and violations [86]. Germany also has close economic links with Kazakhstan. Kazakhstan is Germany's most important trading partner in Central Asia. Bilateral trade reached approximately €9.5 billion in 2024, and around 400 German companies are present in Kazakhstan [87]. Trade links also concentrate in sustainability-relevant product categories: recent data show petroleum oils and petroleum gases among Kazakhstan's top exports to Germany. This makes Germany a substantively grounded "demand-side" case for analyzing how buyer-country governance pressures translate into ESG integration practices for Kazakhstan-based supply chains given Germany's focal position in the European Union and Western markets [88].

Kazakhstan: developing regulatory and disclosure architecture

Kazakhstan's commitment to sustainability is articulated in high-level national policies and its participation in global initiatives. The country has aligned itself with international sustainable development agendas by adopting the United Nations Sustainable Development Goals (SDGs) in 2015 and ratifying the Paris Agreement on climate change in 2016 [89; 90]. A cornerstone of Kazakhstan's vision is the *Strategy "Kazakhstan 2050": A New Political Course of the Established State*, announced in 2012, which sets out an ambitious goal for Kazakhstan to become one of the world's top 30 developed countries by 2050 [91]. This Strategy 2050 provides clear guidelines for building a sustainable and efficient economic model, emphasizing a transition to a green development path [92]. In alignment with this vision, Kazakhstan's government approved the *Concept for Transition to a Green Economy* in 2013, a policy framework designed to overhaul the economy towards sustainable practices and technologies [93; 94].

The *Concept for Transition to a Green Economy* (hereafter "Green Economy Concept") outlines a phased approach for Kazakhstan to achieve long-term sustainability goals by 2050. It defines a green economy as one with high living standards and careful, rational use of natural resources for present and future generations, in line with international environmental obligations. The Green Economy Concept is closely linked to Strategy 2050, seeing green economic transformation as instrumental to Kazakhstan's sustainable development and prosperity. The green economy transition is expected to help Kazakhstan join the top 30 economies. It is intended to support GDP growth, create over 500,000 jobs, and improve living standards nationwide. To realize

these benefits, the concept calls for annual investments of about 1% of GDP into green technologies and infrastructure [93; 91].

Beyond these overarching strategies, Kazakhstan has demonstrated policy commitment by setting concrete targets and joining global climate efforts. In 2020, President Kassym-Jomart Tokayev announced Kazakhstan's pledge to achieve carbon neutrality by 2060, integrating this objective into the nation's strengthened climate plan under the Paris Agreement [95; 96]. This pledge has been accompanied by plans to formulate a long-term low-carbon development strategy and to enhance climate change adaptation measures, including making adaptation a legal requirement in planning under the new environmental code. Collectively, these high-level commitments create a policy environment where sustainable development is a declared priority. The Kazakhstan focus adopted here aligns directly with the national Strategy on Achieving Carbon Neutrality by 2060, adopted by presidential decree, which frames decarbonization and modernization of carbon-intensive industry as a strategic priority [97]. For supply chains, this implies that environmental performance increasingly becomes embedded in investment screening, permitting logic, and industrial modernization programs, raising the need for manageable and auditable organizational response portfolios. The following sections investigate the major national strategies and regulatory frameworks that operationalize these commitments, and how they shape the ESG environment in Kazakhstan [95; 96]. These policy commitments function as institutional "signals" that raise expectations for verifiable sustainability performance and increase the need to translate strategic intent into measurable routines and auditable evidence (see section Kazakhstan: developing regulatory and disclosure architecture on page 44).

Institutional and regulatory frameworks for sustainability in Kazakhstan

Strategy Kazakhstan 2050 as the vision for sustainable development

Unveiled in 2012, *Strategy Kazakhstan 2050* is a long-term development vision that encompasses economic, social, and environmental dimensions [76; 93]. While primarily a socio-economic strategy, it explicitly recognizes sustainability as a key principle. The Strategy 2050 guidelines call for building a resilient and efficient economic model based on a green development trajectory [92]. This includes diversifying the economy away from over-reliance on extractive industries, modernizing infrastructure, and improving energy efficiency and resource productivity. The strategy's emphasis on entering the ranks of the top developed countries implicitly requires adopting international best practices in governance and sustainability. In practice, Strategy 2050 has provided a high-level mandate for subsequent environmental and sustainable development policies, ensuring they are integrated into Kazakhstan's broader national agenda. For example, the Green Economy Concept of 2013 was developed as a direct response to the sustainable development guidelines set out by Strategy 2050. By aligning environmental goals with economic aspirations, Strategy 2050 set the foundation for policies that seek win-win outcomes, such as reducing pollution while increasing quality of life and economic competitiveness [98; 91].

For the dissertation, Strategy 2050 is treated as a **high-level mandate** that legitimizes sustainability as a national development priority; the analytical focus is how such mandates translate (or fail to translate) into **auditable organizational routines and supplier governance** under real implementation constraints.

Concept for transition to a green economy (2013)

One of the most significant policy frameworks in Kazakhstan's sustainability agenda is the Concept for Transition of the Republic of Kazakhstan to a Green Economy, approved by Presidential Decree No. 577 of 30 May 2013 (List of Regulatory documents, item 3, English version [93]). This strategy document lays out the rationale, goals, and implementation plan for transforming Kazakhstan's economy to become more sustainable by 2050. The Green Economy Concept operationalizes Kazakhstan's sustainability agenda through staged targets (energy, water, agriculture, waste, and efficiency) and is therefore a central reference point for sectoral expectations placed on firms and supply chains. For this dissertation, its relevance lies less in the full target catalogue and more in the **governance implication**: firms must develop capabilities for measurement, reporting, technology upgrading, and supplier coordination to deliver "data-backed proof" of progress.

Ecological code

In addition to broad strategies, Kazakhstan has been developing specific frameworks and regulations that correspond to the pillars of ESG. Early on, Kazakhstan established an *Ecological Code* in 2007 as the main environmental law, and more recently this was comprehensively updated. A new Environmental Code (List of Regulatory documents, item 1) came into force on July 1, 2021, replacing the 2007 code. This new Environmental Code is a critical piece of the sustainability regulatory framework, as it introduces stricter standards and procedures to enforce pollution control and encourage green technology. For example, the code mandates that the 50 largest industrial polluters (which account for about 80% of emissions nationally) must adopt the Best Available Techniques (BAT) for emissions reduction by 2025, or else face sharply increased pollution fees. This "polluter pays" principle is intended to push companies toward modernization of production facilities and adoption of cleaner technologies. The code was developed in line with OECD and EU principles, aiming to balance environmental and economic interests. Officials have emphasized that under the new code, companies should prevent environmental harm proactively [99]. By tightening environmental enforcement and linking it to modern technology adoption, the Environmental Code of 2021 strengthens the institutional framework that holds companies accountable for their environmental impact.

Corporate governance code

On the governance and social side of ESG, Kazakhstan introduced a national Corporate Governance Code in 2021 (List of Regulatory documents, item 5) and a new Social Code in 2023 (List of Regulatory documents, item 2) [100]. The Corporate Governance Code (2021) provides standards for transparency, board accountability, and shareholder rights in companies, reflecting an effort to improve corporate governance practices in line with international standards. The Social Code (2023) is aimed at consolidating and updating policies related to social protection, labor, and broader social

development, signaling the country's attention to the "S" in ESG: issues like employee welfare, community development, and social equity. While these codes are relatively recent, they demonstrate a trend of institutionalizing ESG principles through formal legislation or guidelines [89].

As of 2024, Kazakhstan does not yet mandate integrated ESG reporting for all companies. At the same time, the disclosure environment is tightening unevenly, creating an ESG "gap" between leading firms and the broader market. The ARDFM has issued ESG disclosure guidance primarily for banks, which other financial organizations may also use. Separately, AFSA's 2024 guidance introduced voluntary ESG disclosure for banks, fund managers, and insurers within the AIFC [45]. This uneven but accelerating disclosure architecture increases the practical need to understand how organizations build auditable data and governance capabilities under shifting standards. Many companies, especially large ones and those seeking international investment, have begun issuing voluntary sustainability or ESG reports, driven by investor demand and global best practices. The government has also taken steps to encourage more systematic ESG disclosures. In the Astana International Financial Centre (AIFC), a special financial zone in Astana, the regulator has introduced ESG-specific rules to encourage sustainable finance. The Astana Financial Services Authority (AFSA) enacted an ESG Debentures Framework in October 2024 to set standards for issuing green and sustainable bonds, aligning such instruments with global definitions and making it easier for investors to identify green investments. The related AFSA ESG Disclosure Guidance begins with a voluntary phase to integrate ESG factors into reporting and decision-making [89; 45]. In parallel, market infrastructure for ESG transparency is developing through the Kazakhstan Stock Exchange (KASE). KASE has established an ESG Data Platform that centralizes access to information on ESG bond offerings, non-financial/ESG reports of listed companies, and more importantly both guidelines, and methodological recommendations related to ESG disclosure. This platform functions as an intermediary that can reduce search and coordination costs for investors and standard-setters while increasing the visibility of reporting heterogeneity across firms. Such infrastructures are of relevance here because they shape which sustainability claims become externally inspectable and therefore which internal data, process, and control capabilities become "must-have". These AIFC initiatives, while applicable mainly to firms within that financial center, reflect Kazakhstan's broader move towards ESG integration and could serve as pilots for wider national adoption. Indeed, policy discussion in Kazakhstan suggests a gradual path toward mandatory ESG reporting in coming years, especially for large and publicly listed companies (with some targets around 2025-2030 for phased implementation, according to consultancy reports).

A gap that cuts across the key industry sectors discussed below is the limited maturity of auditable ESG data infrastructure at supply chain level. Under CBAM-type regimes, exporters have to demonstrate product-specific emissions intensity. Otherwise, they risk being assessed with conservative default values, which can penalize firms even where actual performance is better [4]. Sustainability claims therefore have to be supported by data, which requires consistent measurement, reporting, and verifi-

cation processes, supplier engagement, and documentation across multiple tiers. Kazakhstan's carbon neutrality pathway calls for sectoral transformation and carbon regulation instruments, so firms have to establish monitoring and reporting capabilities within industrial and agricultural value chains [5]. An organizational risk management approach that integrates ESG metrics, compliance evidence, and supplier governance is therefore a practical response to an emerging regime of verifiable sustainability performance that spans domestic permits, international market access, and climate resilience requirements [5; 4].

Kazakhstan's institutional and regulatory framework for sustainability thus has several layers: a high-level Strategy 2050 sets the developmental vision, the Green Economy Concept provides a detailed sustainability roadmap, and a suite of laws and codes (environmental, social, governance) create binding requirements and guidance. This framework is still developing, and it establishes the policy basis on which industries in Kazakhstan must operate with regard to sustainability and ESG considerations. Regulatory modernization (e.g., strengthened environmental rules and technology requirements) increases the salience of compliance- and measurement-oriented routines, making Process and Technology capabilities (controls, baselines, monitoring, documentation) central to auditable responses. Additionally, expanding disclosure expectations increase the risk of decoupling between communication and practice unless reporting is coupled to data governance and internal controls. Therefore, Technology and Process capabilities become prerequisites for credible, auditable ESG claims.

Key industry sectors and their sustainability relevance

Kazakhstan's economy is characterized by a strong reliance on natural resource sectors and heavy industries, which makes the sustainability agenda particularly pertinent. The key sectors like energy (especially oil, gas, and coal), mining and minerals, agriculture, and manufacturing/industrial production each play a significant role in the economy and face distinct sustainability challenges and opportunities.

Table 6 – Sector relevance in Kazakhstan

Sector	**Sustainability relevance**
Energy (Oil, Gas, Power)	Foundation of the economy and largest contributor to emissions and air pollution; policy focus on diversifying the energy mix with renewables/alternative sources and halving energy intensity of GDP by 2050.
Mining & Mineral Resources	Heavy environmental/social implications and large legacy waste; stricter Environmental Code enforcement (BAT), reclamation and community issues; EITI for transparency.
Agriculture & Land Use	Land degradation; projected water deficit of 13-14 bn m^3 by 2030; staged water-security goals (population by 2020, agriculture by 2040); emphasis on sustainable/high-productivity agriculture.

Manufacturing / Industrial	Modernization to reduce pollution/energy use; push for cleaner technologies and waste management; link to green construction and energy-efficient standards.
Note – Compiled by the author based on the List of Regulatory documents (item 1) and [93; 99].	

The table above identifies the sectors most relevant for sustainability and supply-chain governance in Kazakhstan and therefore informs the dissertation's contextual boundary conditions and sampling approach.

Challenges for companies in addressing sustainability in Kazakhstan

Despite the array of policies and frameworks in place, companies operating in Kazakhstan face several challenges when trying to implement sustainability and ESG practices. These challenges can be broadly categorized into policy and regulatory gaps, enforcement and compliance issues, financial and economic constraints, and limitations in institutional capacity and awareness.

Concretely, firms face (1) translation gaps between national ambition and operational guidance, (2) enforcement uncertainty and developing standards, (3) financing and technology-upgrade constraints, and (4) capability gaps in data, reporting routines, and trained personnel. These conditions directly shape the feasibility and sequencing of "packed" sustainability capabilities across Strategy, People, Process, and Technology.

While Kazakhstan's policy environment for sustainability has advanced, companies on the ground face multiple challenges: from bridging the gap between ambitious plans and actionable guidance, to securing the funds and knowledge needed to upgrade their operations. Overcoming these challenges will require continued government support (in terms of clear policies, incentives, and enforcement), increased access to sustainable finance, and a growing awareness in the business community that sustainability is becoming integral to competitiveness and risk management.

Kazakhstan's path toward sustainability is marked by ambitious national visions and gradually strengthening institutional frameworks. The *Strategy Kazakhstan 2050* and the *Concept for Transition to a Green Economy* have charted a path that integrates environmental stewardship with economic and social development goals. These have been reinforced by concrete regulatory measures from the updated Environmental Code to governance and social codes that collectively form the country's ESG environment. Key industry sectors like energy, mining, agriculture, and manufacturing are both the focal points of these policies and the testing ground for their implementation. Companies operating in Kazakhstan today must respond to these changing expectations, addressing challenges such as policy implementation gaps, enforcement pressures, financial constraints, and the need to build internal capacity for sustainability. The extent to which they succeed is strongly influenced by the institutional environment: when institutions provide clear rules, incentives, and support, businesses are more likely to innovate and align with sustainability objectives.

Kazakhstan's sustainability agenda thus combines ambitious national targets with heterogeneous implementation capacity, a changing disclosure architecture, and

sector-specific constraints in carbon- and resource-intensive value chains. For the dissertation, these features are treated as contextual boundary conditions that shape which sustainability response mechanisms become salient and which sequences of Packed Business Capabilities (Strategy, People, Process, Technology) are feasible. The following section synthesizes these factors in a comparative frame against the German context and derives expected implications for auditability and organizational response portfolios that are subsequently examined in the empirical chapters.

Comparative synthesis: expected implications for capability building

The preceding subsections show that sustainability expectations are translated into actionable organizational requirements under markedly different institutional boundary conditions in Germany and Kazakhstan. To make these differences analytically explicit, Table 7 on page 50 contrasts contextual dimensions and specifies their expected implications for how firms select, sequence, and stabilize sustainability response mechanisms. The table is used as a comparative frame for interpreting empirical evidence and for specifying contextual moderators and feasibility constraints in the Organizational Response Model.

Table 7 – Contextual boundary conditions shaping sustainability response mechanisms (Germany vs Kazakhstan)

Dimension	**Germany (downstream, high-enforcement context)**	**Kazakhstan (upstream, transition context)**	**Expected implications for mechanisms and Packed Business Capabilities**
Regulatory enforceability & due diligence	Due diligence expectations are more formalized and enforceability is comparatively higher. Compliance pressure can pass from buyers to suppliers.	Regulation is being modernized, but enforcement and implementation capacity can vary. Export markets and national policy may bring stronger requirements.	Germany: Compliance pressure favors routine controls and formal risk management. Relevant domains are Process and Technology.
Oversight, guidance & complaint channels	Dedicated oversight, implementation guidance and complaint channels help firms interpret requirements.	Oversight may be more fragmented. Guidance comes from policy initiatives, sector regulation, capital markets and voluntary frameworks.	Germany: Clearer compliance criteria support standardized processes and documentation. The relevant domain is Process.

ESG reporting & disclosure requirements	Reporting expectations and stakeholder scrutiny are more established. Reporting is often linked to risk management, supplier governance and auditability.	Disclosure requirements are developing. Reporting varies by firm size, sector and capital market orientation. Communication may precede internal measurement.	Germany: Reporting is expected to be more closely linked to systems and evidence. Relevant domains are Technology and Process.
Assurance, auditability & MRV infrastructure	Auditors, assurance practices and verification routines are more available. Demand for claims supported by evidence is comparatively stronger.	ESG data infrastructure may be less mature. Firms may need to build measurement, reporting and verification capabilities internally with external support.	Germany: Verification needs favor auditable data flows, supplier audits and control systems. Relevant domains are Technology and Process.
Stakeholder activism & public scrutiny	Stronger consumer, NGO and media scrutiny can increase reputational risk and speed up responses.	Stakeholder pressure varies by sector and international exposure. Export customers and financiers may transmit external pressure.	Germany: Reputational signals can increase the speed and range of responses. Relevant domains are Strategy and People.
Supply-chain position & leverage	Downstream buyers and brands can influence suppliers through requirements, audits and contracts. Responsibility often extends across tiers.	Upstream producers may face demands from downstream buyers and external regimes. Bargaining power and dependency can limit feasible responses.	Germany: Codes of conduct, audits and remediation plans can become established across tiers. The relevant domain is Process.
Sector structure & material ESG exposure	Germany has a diverse sector mix with different materiality profiles. Compliance frameworks can set	Industries that use substantial resources and produce high emissions may face high ESG exposure. Demands can focus on environmental	Germany: Standardized due diligence can support broad governance routines. The relevant domain is Process.

	common minimum expectations.	performance, labor and community impacts.	
Data maturity & systems readiness	Integrated management systems and digital tools are more common. They support auditable evidence across functions and suppliers.	Systems readiness varies. Firms may use manual or fragmented data while moving toward integrated ESG management.	Germany: Data integration and controls support stable routines and continuous improvement. Relevant domains are Technology and Process.
Note – Compiled by the author.			

Table 7 defines scope conditions for the theoretical mechanisms. Its expectations are examined in the empirical chapters. Study I does not confirm the expected strength of data, technology, and continuous improvement. Data Management and Reporting, Technology Adoption, and Continuous Improvement were rated Low in all six German cases, as Table 18 shows.

The comparative frame places each study within its institutional setting. Study I examines German interview accounts from a downstream context shaped by customer and stakeholder expectations. The interviews preceded the Supply Chain Due Diligence Act, which took effect in 2023. Study II examines Kazakhstani reports produced under changing disclosure and infrastructure conditions. These differences inform the ORM's moderators and feasibility constraints. Interpretation also considers the different periods and evidence sources. The comparison supports contextual explanations of capability configuration. It does not isolate a country effect.

Critical synthesis of ESG disclosure frameworks and SSCM models

This dissertation draws on two partly overlapping and analytically distinct bodies of work. On the one hand, ESG disclosure and reporting frameworks that specify what organizations should disclose to enable comparability and accountability. On the other hand, SSCM models that conceptualize how sustainability can be embedded in supply-chain design and governance. The synthesis clarifies the external evidence expectations that shape what "auditability" entails in practice. This subsection compares dominant frameworks along four dimensions. These are their purpose, distinguishing disclosure comparability from operationalization, and their unit of analysis. The comparison also examines their translation of expectations into supply-chain routines and their assumptions about auditability, assurance, and verification-grade data.

ESG disclosure frameworks: what they standardize and what they presuppose

Many practical ESG frameworks define disclosure requirements. GRI uses Universal, Sector, and Topic Standards to help organizations understand and report impacts on the economy, environment, and people [157]. It specifies disclosures and how to identify material topics. It does not itself define the routines and controls needed to produce verification-grade data across complex supply chains.

The TCFD Recommendations, while focused specifically on climate-related disclosures, have been influential in standardizing disclosure around four pillars: governance, strategy, risk management, and metrics and targets. This architecture makes climate risks more legible to capital markets and helps structure corporate disclosure, yet it generally assumes that organizations can identify, measure, and manage relevant data across operations and value chains, which is often a non-trivial capability challenge.

The ISSB's IFRS Sustainability Disclosure Standards, IFRS S1 and IFRS S2, address sustainability-related financial disclosure for capital markets. They are designed to work together and use the same four areas as TCFD: governance, strategy, risk management, and metrics and targets. They improve comparability and investor relevance while increasing demand for traceable and consistent data. Disclosure frameworks specify what must be reported and assured. They leave open how firms build the routines, measurement systems, and supply-chain governance needed for reliable disclosure.

Critical implication: ESG disclosure frameworks are necessary for comparability and accountability, but they often function as "output specifications" that presuppose organizational and supply-chain capabilities (data infrastructure, internal control, and assurance readiness). This presupposition becomes especially consequential in cross-country settings where enforcement, market institutions, and assurance infrastructures differ.

SSCM conceptual models: integration rationale and typical under-specification of response mechanisms

In contrast, SSCM literature primarily explains how sustainability can be incorporated into supply-chain decision-making and governance. Seuring and Müller's literature review and conceptual framework remain foundational in organizing SSCM around triggers for SSCM and strategies such as supplier management for risks and performance and supply-chain management for sustainable products. This stream helps clarify where sustainability enters supply-chain management and why supplier-facing governance becomes central.

Carter and Rogers [35] propose a SSCM framework that goes beyond the triple bottom line by emphasizing supporting facets that enable SSCM in practice. This perspective highlights that sustainability outcomes depend on stated goals, and on enabling conditions (e.g., managerial systems, governance, and risk management-related facets) that allow sustainability to be implemented and maintained.

Pagell and Wu, using case studies of exemplar firms, contribute a more practice-near theoretical model by examining what leading firms do differently when building sustainable supply chains, emphasizing integrated attention to environmental and social outcomes alongside economic performance.

Finally, definitional work shows why SSCM is often difficult to operationalize consistently. Ahi and Searcy [33] identify substantial variation in definitions of GSCM and SSCM in the literature, implying that empirical work can vary widely in what is considered "in scope" and how sustainability is operationalized.

Critical implication: SSCM models excel at conceptualizing integration points and governance levers in supply chains, but they often under-specify (a) how firms

choose feasible response paths under constraints, (b) how capability building is sequenced and stabilized over time, and (c) how auditability and verification demands shape which sustainability routines become "non-negotiable" in practice, particularly in contexts with heterogeneous enforcement, market transparency, and assurance capacity.

The comparison identifies the functional gap that justifies developing the ORM as a capability-based managerial framework for organizational response.

Table 8 – Comparison of dominant ESG disclosure frameworks and SSCM models (critical synthesis)

Framework / model	**Primary purpose**	**Unit of analysis**	**Supply-chain operationalization**	**Auditability / verification orientation**	**Limitation for the research question**
GRI Standards	Impact reporting and stakeholder-oriented transparency	Organization (with value-chain impacts)	Medium. Value chain impacts are covered, but operational routines are not specified.	Medium. Focuses on disclosure. Assurance is possible, but the standards are not an operational assurance model.	Specifies disclosure more clearly than the routines and evidence systems needed to produce it.
TCFD Recommendations	Climate-related financial disclosure structure	Organization / financial materiality	Medium. Supply chain climate risks are covered, but implementation routines are not prescribed.	Medium/High. Metrics and targets require measurement capability.	Standardizes disclosure but assumes MRV capacity and internal controls.
IFRS S1/S2 (ISSB)	Sustainability-related financial disclosures	Reporting entity aligned with financial statements	Medium. Value chain risks and opportunities are relevant, but implementation is not detailed.	High. Structured disclosures increase demand for traceable data.	Emphasizes comparability but gives less detail on capability building and sequencing

	for capital markets				under constraints.
Seuring and Müller (SSCM framework)	Conceptual framework for SSCM strategies and triggers	Supply chain	High. Includes supplier management and product and supply chain strategies.	Low/Medium. Auditability remains largely implicit.	Positions SSCM strategies but gives less detail on response selection and auditability mechanisms.
Carter and Rogers (SSCM framework)	SSCM theory building with enabling facets beyond TBL	Supply chain / firm	High. Connects sustainability with management and enabling factors.	Medium. Enablers imply governance and controls. Assurance receives less emphasis.	Gives less detail on sequencing, feasibility constraints and verification demands.
Pagell and Wu (case-based theory)	Practice-near model of what exemplar SSCM firms do differently	Supply chain	High. Covers integration across the chain and social and environmental outcomes.	Medium. Focuses on practices. Auditability is not formalized.	Provides practice insights but does not explicitly specify mechanisms across national contexts.
Ahi and Searcy (definitions)	Clarifies SSCM vs GSCM definitional variation	Field-level conceptual	Indirect. Focuses on definitions.	Indirect.	Clarifies construct ambiguity but does not explain operational response mechanisms.
Note – Compiled by the author based on [32; 33; 35; 36; 157; 158; 159].					

Functional gap between existing SSCM governance frameworks and the ORM

The comparison in the table above shows that existing ESG disclosure frameworks and SSCM models provide important building blocks for sustainability management in supply chains. Disclosure frameworks such as GRI, CSRD-related reporting logic, and ESG guidance systems strengthen transparency, comparability, and external accountability. SSCM governance frameworks, including supplier sustainability and sustainable supplier development approaches, clarify the relevance of supplier assessment, supplier collaboration, certification, standards, monitoring, and engagement mechanisms. These contributions are important because they specify what organizations can use to govern sustainability issues across supply-chain interfaces.

The remaining gap concerns how organizations select, sequence, and combine these tools under sustainability-related complexity. Existing frameworks describe reporting requirements, governance procedures, and supplier practices. They give less guidance on moving from heterogeneous pressures to a decision point, capability portfolio, response type, and auditable outcomes. An integrated response logic is needed to connect complexity interpretation, capability configuration, governance routing, and measurable auditability.

Supplier sustainability risk-management frameworks explain assessment, engagement, and collaboration beyond narrow compliance. Their main focus is supplier management and buyer-supplier governance. The ORM also examines the focal organization's capabilities. It asks how Strategy, People, Process, and Technology must be configured to make supplier-facing mechanisms executable, auditable, and adaptable. The ORM integrates these procedures into a broader managerial response architecture.

The ORM explains how firms turn sustainability-related complexity into manageable response portfolios and assess them using auditable, decision-relevant metrics. Firms need guidance on when to build capabilities internally and when to collaborate. They also need to embed mechanisms in organizational routines and review their outcomes. This is the model's functional contribution.

Table 9 – Functional gap between existing SSCM governance frameworks and the ORM

Comparison dimension	**Existing SSCM governance frameworks**	**Organizational Response Model**
Primary focus	Supplier assessment, supplier collaboration, certification, standards, monitoring, and supplier development	Organizational response to sustainability-related complexity through decision points, capability portfolios, routing conditions, and outcome metrics
Main unit of explanation	Buyer-supplier relationship or supply-chain governance mechanism	Focal organization as decision-making and capability-configuring system

Treatment of complexity	Often implicit, mainly reflected through risks, supplier requirements, compliance demands, or governance challenges	Explicitly specified as regulatory, stakeholder, data and auditability, interorganizational, and temporal change complexity
Mechanism selection	Usually described through available governance mechanisms or supplier-management practices	Structured through decision points, internal and collaborative response pathways, moderators, and boundary conditions
Capability logic	Often focused on supplier-facing governance practices	Organized as Packed Business Capabilities across Strategy, People, Process, and Technology
Outcome rationale	Frequently linked to sustainability performance, compliance, supplier improvement, or governance effectiveness	Linked to time-to-mitigation, auditable tier coverage, and coordination cost per covered spend
Context sensitivity	Often assumes relatively established governance or supplier-management conditions	Explicitly incorporates institutional density, assurance infrastructure, perceptual convergence, and cross-firm orchestration
Functional contribution	Explains important governance mechanisms for SSCM	Explains how organizations configure and route response portfolios to make sustainability responses executable, auditable, and adaptable
Note – Compiled by the author.		

This functional gap provides the basis for the model-development rationale in Chapter 3, where the ORM is specified as an integrated response architecture.

Synthesis: a mechanism gap at the intersection of disclosure demands and supply-chain operationalization

The dissertation examines how external expectations lead organizations to select feasible and priority issues. It then examines how capability portfolios across Strategy, People, Process, and Technology shape reliable and auditable supply-chain sustainability outcomes. In doing so, the study complements disclosure-focused "what to report" standards with a mechanism-oriented explanation of "how sustainability performance becomes manageable and auditable" under cross-country differences in enforcement and assurance infrastructures.

1.3 Methodological Framework and Research Design

This dissertation examines how organizations translate sustainability pressures into executable responses under varying institutional and supply-chain conditions. Its purpose is to develop an SST-informed Organizational Response Model and provide an initial design-oriented evaluation of the model.

Methodological positioning: qualitative case-study rationale and design-science logic

The dissertation combines qualitative case-study rationale and design-science logic. The qualitative case-study rationale is used for empirical reconstruction. It supports the analysis of how organizations perceive sustainability-related complexity, select response paths, stabilize routines, and configure Packed Business Capabilities under specific institutional and supply-chain conditions. This logic is appropriate because the research question is mechanism-oriented and asks how organizational responses are formed in context.

Design-science logic provides the artifact-development rationale through which the empirical regularities are translated into a managerial framework. Here, the artifact is the Organizational Response Model, including its decision point, capability domains, moderators, boundary conditions, response types, mechanism-oriented outcome metrics, and Capability Maturity Score. The purpose of the design-science part is therefore to structure the movement from empirical explanation to practically usable management knowledge.

Qualitative analysis reconstructs response patterns from the interviews and reports. Design-science reasoning translates these patterns into the ORM. The resulting procedures support diagnosis and response selection. The dissertation evaluates the model analytically and applies the CMS to Study II. This provides an initial evaluation of the artifact. Statistical validation and testing of organizational outcomes remain tasks for future research.

The ORM summarizes and explains response patterns across both studies. It also translates them into a capability-based framework for organizational decisions. The method therefore has two steps: qualitative reconstruction through case studies and content analysis, followed by artefact development and initial design-science evaluation.

The dissertation adopts a qualitative, abductive logic and combines two complementary empirical studies. Study I is an abductive multiple-case study based on interviews with German organizations, with evidence used from 17 organizations operating in German and DACH supply-chain contexts. Study II is a qualitative content analysis of sustainability and annual reporting from 11 leading Kazakh companies, covering 20 reports published between 2022 and 2025 for the reporting years 2021 to 2024.

This section sets out the dissertation-wide methodological rationale. The Study I and Study II subsections below specify sampling, data collection, coding and quality procedures. Appendices F and G provide the extended methodological detail.

Research period and temporal logic of the empirical design

The research period is 2019 to 2025. It covers empirical data collection, analysis of the interview material and design-oriented development of the ORM. The design comprises two temporally distinct but analytically connected observation windows.

Study I uses German interviews collected between August 2019 and March 2020. They preceded recent European ESG regulatory changes, including CSRD's first application to the 2024 financial year and CSDDD's entry into force in 2024. The study

therefore reconstructs responses before the post-2024 regulatory environment. It examines how organizations described issue selection, internal capability building, supplier routines, collaboration, and evidence practices before this intensification.

Study II covers sustainability and annual reports of Kazakh companies published between 2022 and 2025. It therefore reflects a later ESG environment in which sustainability disclosure, auditability, and governance expectations became more visible in Kazakhstan and in international supply-chain relations. Study II provides public-articulation evidence on how Kazakh companies describe sustainability-related capabilities.

The different periods are part of the design. Study I reconstructs mechanisms. Study II refines and corroborates them in another context. The studies do not observe identical regulatory conditions or estimate country effects statistically. They support a framework for executable, auditable responses under different institutional and evidence conditions.

Three arguments support the proposed stability of Study I's mechanisms across later regulatory changes. First, the mechanisms concern organizational selection and stabilization rather than individual laws. Issue selection, capability building, internal and collaborative choices, and evidence production were already visible in 2019 and 2020 under voluntary and customer-driven requirements. The Supply Chain Due Diligence Act [83], European Sustainability Reporting Standards [155], and CBAM [4] increased enforcement and assurance density around these mechanisms.

Second, the ORM explicitly includes policy and assurance density as a moderator. M1 and M2 in sub-chapter 2.3 explain how enforcement and assurance affect capability design. Regulatory tightening therefore changes a condition already represented in the model.

Third, Study II's 2022 to 2025 reports reflect rising disclosure expectations. They describe the same capability domains with different sequencing patterns. Sub-chapter 2.3 proposes institutional mechanisms to explain these differences. P1 to P8 are interpreted as context-and-period contrasts. German evidence does not directly describe the post-2024 European environment in detail. The Conclusion acknowledges this limitation, and the research agenda proposes longitudinal studies.

Research paradigm, epistemic stance, and rationale

Systems-theoretic perspective with a management-mechanism focus

The dissertation is grounded in Social Systems Theory (SST) by Niklas Luhmann, using SST to conceptualize organizations as systems that respond to environmental complexity through internal differentiation (structures and processes).

Social Systems Theory provides sensitizing concepts for interpreting complexity reduction, prioritization and stabilization into organizational routines [14; 15; 16]. The empirical coding is organized around the Packed Business Capabilities of Strategy, People, Process and Technology. This architecture supports reconstruction of executable organizational responses, while SST guides interpretation.

The contribution is managerial and operational. It reconstructs capability portfolios, decision points, and governance routines. Moderators and boundary conditions connect them with time-to-mitigation, auditable tier coverage, and coordination cost.

Abductive reasoning as dissertation-wide method rationale

The dissertation adopts an abductive approach to address its central how question. Analysis moves iteratively between theory and empirical material to develop constructs and refine explanations.

Empirical abduction first operates within the interview-based Study I. Sensitizing concepts from SST and prior sustainability and supply chain research guide early coding. The analysis remains open to emergent categories that better capture observed capabilities.

Second, the PBC architecture developed from interviews is applied deductively in the Kazakh report analysis, while allowing inductive additions and refinements. Subsequently, a formal derivation protocol is used to lift stabilized constructs and conditions into the ORM (analytic generalization).

The dissertation renders complexity empirically through qualitative reconstruction of which forms of complexity organizations describe as salient, how they prioritize them, and which response capabilities they mobilize. Accordingly, the empirical chapters analyze perceived and publicly articulated complexity patterns. This design is consistent with the dissertation's abductive and capability-based aim, which is explaining organizational response configurations [37; 38].

The comparative, abductive design reconstructs response configurations, capability patterns and governance arrangements from interviews and public documents. It does not provide a longitudinal analysis of organizational change. Temporal interpretation is limited to reported review cycles, sequencing patterns and shifts in emphasis visible in the material.

Design-science orientation for prescriptive management knowledge

In Chapter 3, the dissertation positions the ORM as a design-science management artifact aimed at prescriptive management knowledge whose field testing remains for future research. It uses CIMO approach (Context-Intervention/Mechanism-Outcome) adapted from realist evaluation reasoning and aligns with management design proposition traditions.

Methodologically, this clarifies that the dissertation claims analytic generalization from replicated patterns across heterogeneous cases and makes no claim to statistical generalization. The warrant for this claim lies in replication: patterns that recur across heterogeneous cases and data modalities, and mechanisms corroborated across both studies.

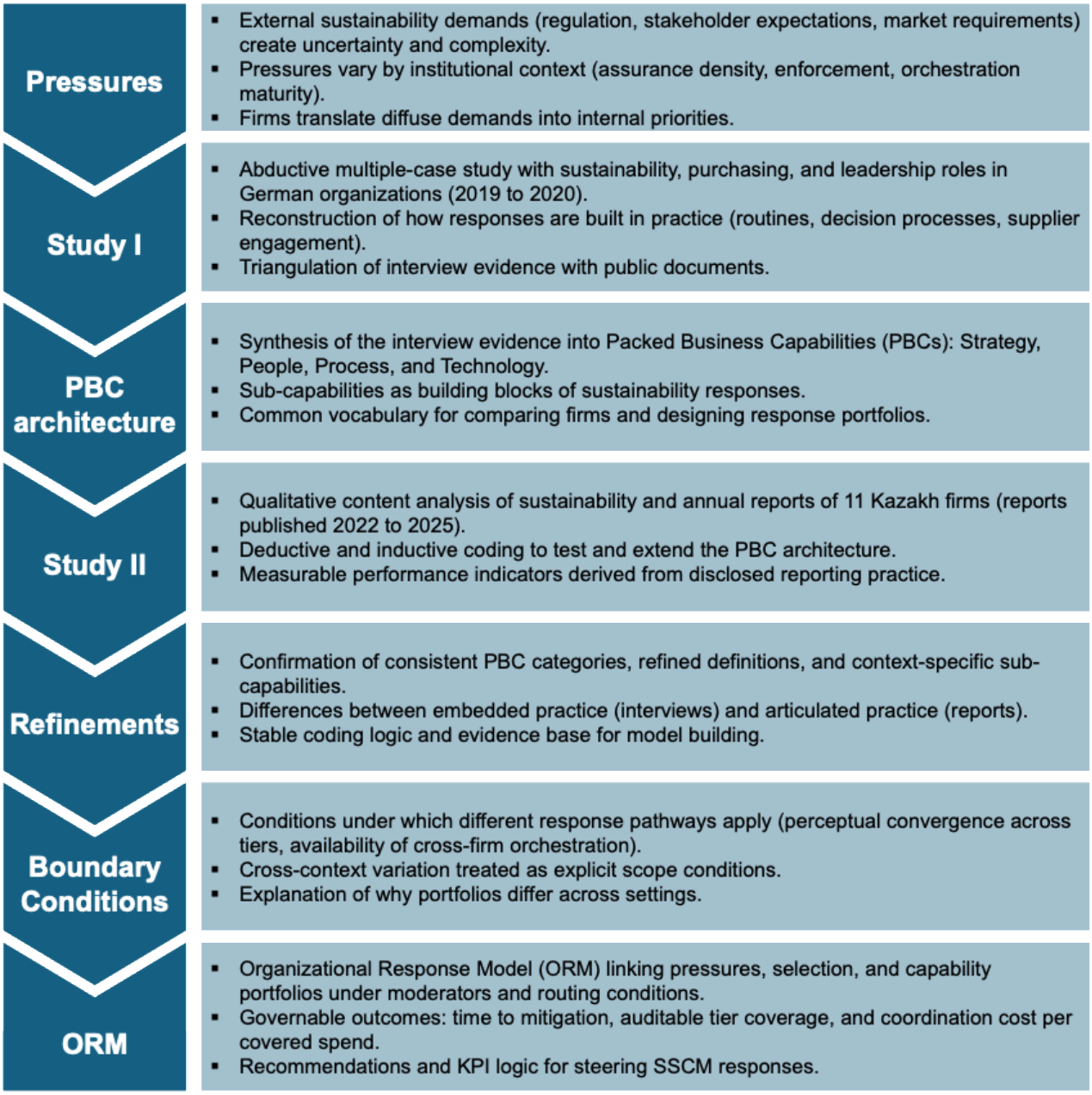


Figure 1 – Research design overview

Note – Compiled by the author.

Epistemological positioning and the nature of qualitative evidence

The dissertation adopts an interpretive-constructivist epistemological stance that is consistent with and reinforced by its Social Systems Theory grounding [105; 106; 14; 15; 16; 107]. Making this stance explicit is methodologically important because it determines what kind of inference the empirical material can support, and it pre-empts a category mistake that would weaken the dissertation if it were left implicit.

Interviews and sustainability reports show how organizations describe their responses to sustainability requirements. Interviewees explain which issues matter, who

is responsible, and how routines develop. Reports present the capabilities that companies choose to disclose. These sources support the reconstruction of organizational interpretations and reported arrangements. They cannot, on their own, verify every described practice. The analysis therefore distinguishes reported capabilities from verified implementation.

The research question asks, "How do organizations design business capabilities to manage sustainability-related complexity in supply chains?" It concerns how firms select, frame, organize, and articulate responses. Within SST, self-description is part of the practice of self-organizing communicative systems [14; 15; 16; 23]. Interview and reporting accounts therefore provide evidence of the phenomenon being studied. Treating them only as factual claims for audit would overlook how organizations construct their responses [105; 106].

This stance has three implications. First, analysis seeks recurring capability constructions across different organizations, evidence sources, and institutional contexts. Recurrence supports analytic robustness. It does not require every account to reproduce operational practice exactly [108; 109; 24].

Second, triangulation compares interview transcripts, reports, websites, codes of conduct, and press articles. It examines the robustness of capability constructions rather than verifying every claim. Agreement strengthens the construction. Divergence can reveal tension between strategic statements and operational implementation.

Third, the reconstructed architecture does not claim to mirror every organization's practice. It describes how organizations produce, communicate, and stabilize responses across contexts. The ORM consolidates this architecture into a governance model. FP1 to FP3 in sub-chapter 3.2 define future tests of its outcome effects. The Conclusion discusses transferability and the inferences supported by sensemaking and self-description. Sub-chapter 3.2 adds outcome-based metrics for further evaluation.

Overall research design: two-study, complementary evidence strategy

Two complementary temporal windows and modalities

The studies use different periods and evidence sources to support analytic generalization. Study I uses German interviews from August 2019 to March 2020. Accounts of embedded routines support inductive PBC development. Study II uses Kazakh reports published between 2022 and 2025. It examines public capability claims, measurement orientation, and auditability. Together, the studies inform outcome definitions and mechanism-oriented metrics.

Research question, sub-questions, and comparative guiding questions

Both studies are guided by the dissertation-wide research question: How do organizations design business capabilities to manage sustainability-related complexity in supply chains? Because the research interest is mechanism-oriented and exploratory, this question is split into three analytically focused sub-questions.

- SQ1 (Capability reconstruction): Which Packed Business Capabilities do organizations construct in response to sustainability-related complexity, and how are these capabilities configured across the Strategy, People, Process, and Technology domains? This is addressed primarily through Study I (sub-chapter 2.1), with confirmatory and refining evidence from Study II (sub-chapter 2.2).

- SQ2 (Contextual variation): How are these capability configurations shaped by institutional context, in particular by differences in regulatory density, assurance infrastructure, and supply-chain position between high-assurance environments (Germany/DACH) and transitional environments (Kazakhstan)? This is addressed through the comparative analysis in sub-chapter 2.3.
- SQ3 (Model derivation): How can the empirical regularities observed across both contexts be translated into a governance-oriented Organizational Response Model that links capability configurations to auditable outcomes under specified moderators and boundary conditions? This is addressed through Chapter 3, including the quantitative operationalization in sub-chapter 3.2.

Formulating the dissertation's research interest as a central "how" question with three analytically focused sub-questions follows from the abductive and capability-based design discussed above. Pre-specified hypotheses assume stable variable relationships derived from a settled theoretical model. This study instead reconstructs mechanisms that remain under-specified in the literature. It uses them to develop a governance-oriented model [108; 109; 24].

To operationalize the comparative dimension of SQ2, four guiding questions structure the cross-context analysis between Western and Kazakh evidence: First, how capabilities are built and used across the two contexts. Second, the extent to which Kazakh report evidence confirms or challenges interview-based findings. Third, what explanations account for observed differences. Fourth, what new theoretical insights emerge from the comparison. These four guiding questions are operational lenses that render SQ2 empirically tractable in sub-chapter 2.3.

Unit of analysis and phenomenon boundaries

Across the dissertation, the focal phenomenon is organizational responses to sustainability pressures in value chains under varying institutional, regulatory, and assurance environments (Germany/DACH vs. Kazakhstan). The primary substantive unit of analysis is the focal organization. This means that the dissertation’s claims concern how organizations perceive, prioritize, routinize, and govern sustainability responses.

Supply chains and value chains provide the empirical setting in which such pressures arise. They are treated as the focal organization’s relevant environment and as arenas of structural coupling with suppliers, customers, regulators, standard-setting bodies, and other external actors [14; 15; 16; 23].

In Study I, each case is defined by a focal organization, supplemented where necessary by one or two focal purchasing categories selected because they make sustainability pressures especially visible and empirically traceable. These purchasing categories help bound the case, and they do not replace the organization as the primary unit of analysis [24].

In Study II, the reporting organization again remains the substantive level of inference. However, because the data consist of public documents, the unit of coding is a meaningful text passage, typically a paragraph or section dealing with one theme, consistently applied across reports [25]. Thus, Study II distinguishes between the coding unit and the unit about which interpretive claims are made.

The dissertation compares organizational response patterns across contexts, not isolated text segments, and not whole supply chains as if they were single actors.

Table 10 – Methodological and research-design overview

Method element	**Purpose**	**Data and unit of analysis**	**Sample and period**	**Analysis and tools**	**Quality measures**	**Outputs**
Dissertation design	Reconstruct organizational responses to sustainability pressure. Develop and initially evaluate the ORM with moderators, boundary conditions and proposed outcomes.	Interview and public report studies. Abductive reasoning with SST as a sensitizing lens.	Study I interviews in 2019 to 2020. Study II reports published in 2022 to 2025.	Iterative movement between theory and data. Analytic generalization through a derivation protocol.	Complementary evidence across studies. Explicit scope limits and analytic generalization.	PBC portfolio, moderators, boundary conditions and outcome/KPI definitions.
Study I Abductive multiple-case study	Examine how firms make sustainability-related complexity manageable through PBCs and moderators.	Semi-structured interviews and public sources. Organization and focal purchasing categories. Reports, websites and codes of conduct support triangulation.	17 for-profit organizations. 23 of 26 interviews, August 2019 to March 2020.	Within-case and cross-case analysis. Deductive and inductive coding in NVivo.	Case protocol and database, documented selection criteria, transcript checks by interviewees and multiple sources.	PBC architecture across Strategy, People, Process and Technology. Case patterns inform moderators and mechanism claims.
Study II Qualitative	Examine reported PBCs and their evidence orientation in Kazakhstan. Identify	Public sustainability and annual reports in English. Organization is the analysis	11 companies and 20 reports published in 2022 to 2025.	Deductive and inductive analysis following Mayring and Hsieh and Shannon.	Coding protocol, pilot on two external reports, intra-	Evidence on reported PBCs and contextual refinements. Input to

content analysis	contextual refinements relevant to auditability.	unit. Meaningful text passages are the coding unit.	Mostly fiscal years 2021 to 2024. Reports pooled by company for case patterns.	Excel codebook and cross-case synthesis.	coder checks, peer review and memos documenting judgments.	the proposed outcome logic and governance application.
Integration into the ORM	Translate the findings into a conditional model of mechanisms, moderators, boundary conditions and proposed outcomes.	PBC vocabulary from both studies, comparative moderators and operational definitions of boundaries and outcomes.	Both studies inform the model. Outcome definitions are designed for later audit and governance use.	Four steps: stabilize PBCs, identify context factors, define outcomes and add boundary conditions. Analytic generalization.	Traceability through coding and quality records. Explicit moderators and scope conditions.	ORM explanation and operationalization. T2M, ATC and CC/S definitions, with execution-health indicators.
Note – Compiled by the author.						

Study I: Abductive multiple-case study (interview evidence, DACH)

Study I uses an abductive, embedded multiple-case design to examine organizational responses to sustainability-related complexity [24; 53]. Between August 2019 and March 2020, 26 interviews were conducted with 20 organizations. The analysis includes 23 interviews from 17 organizations grouped into six cases. Within-case analysis reconstructs response patterns, while cross-case analysis identifies recurring capabilities and contrasts.

The semi-structured interview guide draws on SSCM research [114; 115; 116]. Appendix F documents sampling, data collection and analysis. Appendix C provides the case and interview overview. Table 48 summarizes the measures addressing reliability, construct validity, internal validity and external validity following Yin [24].

Study I organizations are anonymized because interview confidentiality was assured. Potentially identifying details in quotations are replaced by generalized descriptions in square brackets. Study II organizations are named because that study uses publicly available reports.

Study II: Qualitative content analysis (Kazakh sustainability and annual reports)

Study II uses qualitative content analysis with deductive PBC categories and inductive extensions [25; 102]. It examines 20 sustainability and annual reports from 11 Kazakh companies, published between 2022 and 2025. Selection draws on PwC Kazakhstan's Top 50 ESG Disclosure Companies ranking, using English editions where available. Appendix G documents the method, Appendix H the coding scheme and Appendix P the case analyses.

Quality procedures included pilot testing, intra-coder checks, peer debriefing and reflexive memos. Independent coding of 29 passages from five companies yielded Krippendorff's alpha of 0.818 and 86.2 percent agreement at PBC-domain level (Table 51). This check does not cover the 600 CMS indicator scores or 120 routing sub-scores in sub-chapter 3.2, which the author assigned as a single coder.

Rigorousness and integrity across the dissertation

Rigor through complementary triangulation

Study I triangulates interviews with public documents under a protocol/database and uses transcript validation. Study II stabilizes a transparent coding matrix via protocolized unitizing, pilot testing, intra-coder checks, and peer review of a sample. Together, they secure construct stability and traceability, which are prerequisites for analytic generalization into the ORM.

Ethical considerations and research integrity

Study I interviews were conducted anonymously (German language), recorded and transcribed, and transcripts were shared with participants for verification. No interviewee requested changes. Study II uses publicly available official sustainability/annual reports and therefore does not rely on confidential internal data. Integrity measures are applied through transparent coding protocols, reflexive memos, and peer debriefing to reduce interpretive drift.

The following table shows how each core concept is operationalized. It also identifies its use in the empirical studies and the Organizational Response Model (ORM).

This establishes Chapter 1's dissertation-specific theoretical and methodological foundation. Concepts that are not used in later chapters are provided in appendices.

Table 11 – Theory-to-analysis traceability

Chapter 1 construct / claim	**Where used in Study I (Germany)**	**Where used in Study II (Kazakhstan reports)**	**Where used in Chapter 3 ORM**
Sustainability-related complexity as a selection problem (SST)	Interview coding: how firms prioritize issues/risks; mechanism reconstruction	Coding: which issues are selected/ignored; narrative vs evidence emphasis	Mechanism layer: "selection & stabilization"
Complexity reduction via routines, decision rights, and governance review schedule	Case themes: governance routines; supplier controls; escalation rules	Codes: policies, governance structures, management systems	"Stabilization" pathway; routinization rationale
Requisite variety (internal variety) via capability build-up	Evidence of internal capability build vs partnerships	Evidence of reliance on external frameworks/consultants vs internal systems	Moderator: internal vs collaborative complexity
Internal complexity vs collaborative complexity	Case comparison: internal systemization vs ecosystem partnerships	Codes: collaboration, third-party assurance, stakeholder engagement	Two response routes; capability portfolio design
Cross-firm orchestration (joinable standards, audits, verifiers, platforms)	Mechanisms: stakeholder/buyer coupling; compliance channels	Mechanisms: reporting as coupling; export/buyer pressure traces	Boundary condition logic; coupling intensity as moderator
Transparency ≠ auditability (evidence regimes)	Evidence trail: audits, corrective actions, supplier verification	Codes: indicators, baselines, evidence claims vs narrative	Outcome layer: auditability + evidence requirements

Packed Business Capabilities (Strategy/People/Process/Technology)	Case coding buckets and cross-case comparison	Deductive codebook structure (PBCs)	ORM capability layer + sequencing logic
Capability sequencing (context relevance)	Germany: formalization/scaling patterns	Kazakhstan: measurement/systemization path patterns	Sequencing rules; feasibility constraints
Germany-Kazakhstan boundary conditions	Interpret German findings as downstream and customer-driven (before 2023)	Interpret Kazakh findings as transition/upstream	Moderators/scope conditions
"Response portfolio" concept (not single action)	Mechanism bundles in cases	Capability bundles in disclosures	Portfolio rationale in ORM
Verification capacity + audit-ready evidence as the auditability foundation	Evidence expectations; audit readiness	Evidence orientation in disclosure	Measurable/auditable outcomes mapping
Note – Compiled by the author.			

The language and the logical consistency of this chapter were reviewed with ChatGPT [194]. All revisions were made by the author.

2 EMPIRICAL STUDIES OF ORGANIZATIONAL RESPONSES TO SUSTAINABILITY-RELATED COMPLEXITY

The term German supply-chain contexts is used because Study I is empirically grounded in organizations operating in Germany and related DACH supply-chain settings. The term Kazakh companies is used for Study II because the analysis focuses on public sustainability and annual reports of companies operating in Kazakhstan. This wording avoids an overgeneralized regional comparison and clarifies that the empirical studies provide complementary evidence for the Organizational Response Model.

Study I is based on German interview data from 2019 to 2020 and is used to reconstruct response mechanisms before the most recent intensification of European sustainability regulation. Study II is based on Kazakh corporate reports published between 2022 and 2025 and is used to analyze public articulation, evidence orientation, and capability configurations in a later ESG environment. The chapter therefore does not present the two studies as synchronous country cases. Instead, it uses them as complementary empirical inputs for the development and contextual refinement of the ORM.

2.1 Organizational responses in German supply-chain contexts: Interview-based Study I

Growing environmental concerns and increasing regulatory and societal pressures have made managing sustainability a strategic priority for organizations. However, integrating sustainability into core operations introduces significant complexity, particularly in supply chains that are globally dispersed and operationally diverse. While existing literature acknowledges the strategic relevance of sustainability in supply chain management, it remains unclear how organizations internally build and draw on business capabilities to address such complexities. The limited research in this area calls for an exploratory approach to understand how organizations respond to and manage sustainability-related challenges [54].

In the empirical analysis, sustainability-related complexity is differentiated into the forms that become salient in each case. Instead, the cases are read for which forms of complexity become salient, namely regulatory, stakeholder, data and auditability, interorganizational, and temporal/change complexity, and how these salience patterns are translated into Packed Business Capabilities and governance responses.

To ensure contextual relevance and analytical rigor, 17 German for-profit organizations were examined across diverse industries such as textiles, food, beverages, and cosmetics, all sectors characterized by high sustainability relevance and supply chain complexity. The construction and mobilization of capabilities within organizational contexts was supported by 23 in-depth interviews and their triangulated data sources.

The study identifies Packed Business Capabilities in strategic management, organizational structure, employee empowerment, supply chain sustainability, and technology adoption. It examines their maturity and how they depend on one another. It also explores how these capabilities are configured in different sectors. The analysis considers patterns across cases and differences within individual cases. This provides

a grounded framework for understanding how organizations build capabilities for internal sustainability management.

The following sections present patterns articulated by interviewees and validated through public sources. They follow the interpretive-constructivist approach outlined in Section 1.3. They do not present independently verified operational facts. References to organizations building, developing, integrating, or applying capabilities are analytical reconstructions of interviewees' accounts. They describe responses to sustainability-related complexity and patterns recurring across heterogeneous cases. Where statements draw on triangulated evidence (sustainability reports, codes of conduct, corporate websites, press articles), the evidentiary basis is named explicitly. To preserve readability, this interpretive caution is set globally. The boundaries of inference from articulation to operational practice are made explicit in the limitations discussion in the Conclusion.

Within-case-analysis on how organizations design business capabilities to manage sustainability-related complexity

The following sections report on the within-case analysis. Consistent with the embedded multiple-case design specified in Section 1.3, each of the six cases represents a supply-chain context, and the organizations within each case are analyzed as embedded units. Besides providing a case description, internal complexities are elaborated as well. In this dissertation’s understanding, these internal complexities are the business capabilities. However, only the business capabilities found in the cases are reported. The business capabilities that were not found are elaborated in the discussion and cross-case analysis section. Due to the length of information only a short summary of the cases is presented here. Details can be found in the respective appendices, which are linked in the following elaborations.

Case production/retail textiles, see APPENDIX J – CASE PRODUCTION/ RETAIL TEXTILES page 255

Case description

The textile industry faces persistent sustainability-related complexity, highlighted by incidents such as the collapse of Rana Plaza and sustained public attention. Sustainability goals now span all stakeholders across an extended and fragmented supply chain. The research covers organizations of different sizes and positions in the chain, including small, medium and large businesses as well as multinational corporations. Some operate with direct customer contact. Others act in business-to-business settings as producers and retailers. Due to their customer-facing operations and size, some are internationally recognized for premium products, while smaller organizations are well known in the German textile market. The case is based on nine interviews across five organizations [53].

Packed business capability & business capabilities elaboration

At the strategy domain, organizations build the business capability of "Strategy Capability" with generally low maturity. For "Retail" firms, sustainability may be less strategically central because their primary role is selling products. By contrast, "Production" firms face direct operational responsibilities and market expectations that make sustainability more strategically salient. Motivation and size also matter, as in

family-owned "Production/retail textiles" companies. One General Manager noted that strategic choices are made in strategy meetings and should be done properly.

At the People domain, organizations develop several capabilities. First, they build "Organizational Structure & Staff" with pronounced development. "Retail textile" often relies on a dedicated Sustainability Department, while "Production/retail textile" uses a more decentralized Sustainability Function. Larger firms tend to require more central control, whereas smaller firms embed sustainability in company history and philosophy. As a Director Global Sustainability explained, gradual systematization led to the creation of a separate organizational unit that has grown to almost 30 people, which did not exist a decade ago. Second, they address "Employee Empowerment" at low maturity, with training described as a first step so employees can contribute effectively. A Team Leader Corporate Responsibility highlighted ongoing social standards and fiber trainings to bring people to the same level. Third, they develop "Communication", often at relatively low maturity. High integration of functions increases informal exchanges and reduces the emphasis on formal communication. A Head of Sustainability described staff meetings and internal media as recurring channels to communicate sustainability topics.

At the Process domain, organizations build "supply chain sustainability" by developing suppliers and strengthening relationships. They use relationship-building and "controlling" via supplier management systems for disclosure, onboarding and development, including scrutiny of facilities in Asian countries against sustainability requirements. They also build "Risk Management" by integrating supplier and internal management systems with guidelines and partner risk analyses. In addition, they advance "Process Innovation & Adaptation" through sourcing process adjustments and stronger cross-functional integration. Networking across Purchasing, customer management and Sales expands dialogue and supports dynamic responses.

At the Technology domain, organizations focus on "Data Management and Reporting" and "Technology Adoption". "Data Management and Reporting" often shows low maturity due to limited technology adoption, but reporting becomes more pronounced, including status reports on social audits and chemicals management and new systems for KPIs in corporate responsibility. "Technology Adoption" involves tool and ERP adjustments to capture more information, change purchasing documentation, and monitor supply chains and production steps, prompting significant changes in product development and purchasing and increasing transparency across processes.

Table 12 – Heatmap for the distribution of business capabilities

Construct (Packed Business Capability)	**Sub-Construct (Business Capability)**	**Production/retail textiles**
Strategy	Strategic Management	Low
People	Organizational Structure & Staff	High
	Employee Empowerment	Low

	Communication	Low
Process	Process Innovation & Adaptation	Mid
	Supply Chain Sustainability	High
	Risk Management	Mid
	Product Innovation & Adaptation	Low
	Social Responsibility	Low
	Continuous Improvement	Low
	Innovation for Sustainability	Low
Technology	Data Management and Reporting	Low
	Technology Adoption	Low
Note – The cells summarize the coded interview passages of the case. Each passage coded to a business capability was classified by two criteria, the number of organizations of the case in which the capability appears and the specificity of the account. Low means that the capability is mentioned in no or one organization of the case, or only as an intention without a described routine. Mid means that it is mentioned in several organizations of the case with at least one described routine, role or instrument. High means that it is mentioned across most organizations of the case with described routines and concrete examples. The category is a qualitative rubric applied by the author to the coded material, not a frequency threshold. The color shading follows the category: dark green for High, lighter shades for Mid and Low. This rubric applies to the following heatmaps and tables of Study I, too.		

Case retail food/ non-food, see APPENDIX K – CASE RETAIL FOOD/ NON-FOOD page 259

Case description

The retail food and non-food sectors are among the largest industries in Germany and depend on substantial imports alongside German-grown products. This case keeps that mix. Two organizations are among the large national retailers, offering fruits, wheat products, textiles, and household items. The others are a small coffee retailer and further food and non-food retailers. The industry's direct connection to end customers heightens sustainability awareness and complexity, with customers increasingly assessing retailers on their activities and buying sustainable products. To capture variation across size and positioning, six interviews with five organizations were conducted, providing strong contrast for analysis.

Packed business capability & business capabilities elaboration

At the strategy domain, larger firms have developed sub-business capabilities to steer sustainability and set targets. In contrast, the 'Trade Coffee' sub-case is too small to formalize specific strategic capabilities, as sustainability is intrinsically anchored in

its business model. Still, strategic steering is present and target-driven, with management involvement and specialist departments acting as sparring partners.

At the People domain, the development of "Organizational Structure & Staff" varies by scale and portfolio. ‘Retail Food’ companies distribute responsibilities across different functions to remain flexible. Leading functions differ by country context, ranging from quality assurance to purchasing. Advisory structures support direction-setting and external resonance, for example through boards that include NGOs and scientific expertise. Interviewees report that employee empowerment is highly relevant: organizations expand departmental capacities and roll out broad training, such as sustainability ambassador programs that reach hundreds of employees, while embedding sustainability thinking into everyday tasks, including purchasing of office supplies. Communication is comparatively underdeveloped as an explicit capability, yet intensive exchanges occur through integrated working relationships. Outreach flows both ways between sustainability and business departments.

At the Process domain, capabilities in supply chain sustainability are less pronounced, reflecting retailers’ intermediary role and limited direct contact with production sites. Tools such as a Requirement Profile support work with products and commodities, but changes often require phased transitions with existing suppliers. Risk management is heavily utilized through supplier and internal systems with policies. An exception appears in coffee companies with strong local presence, which handle issues directly. Process adaptation is significant, especially in sourcing, supported by cross-functional integration. Topics often originate from market and customer requirements and then work backwards through the organization. Sustainability teams initiate and coordinate with departments, develop solution proposals, and seek management approval, while centralized staff units are embedded across product development and procurement, with capacities in line functions expanded over time.

At the Technology domain, "Data Management and Reporting" is at a low maturity, mirrored by limited Technology Adaptation. Reporting exists, for example monthly updates on sustainable assortments, and broader technology adjustments remain modest. This constrains the ability to manage and report data, even as the need for better information on products, suppliers and progress grows.

Table 13 – Heatmap for the distribution of business capabilities

Construct (Packed Business Capability)	**Sub-Construct (Business Capability)**	**Retail food/non-food**
Strategy	Strategic Management	Low
People	Organizational Structure & Staff	High
	Employee Empowerment	High
	Communication	Low
Process	Process Innovation & Adaptation	High

	Supply Chain Sustainability	Mid
	Risk Management	Mid
	Product Innovation & Adaptation	Low
	Social Responsibility	Low
	Continuous Improvement	Low
	Innovation for Sustainability	Low
Technology	Data Management and Reporting	Low
	Technology Adoption	Low
Note – Compiled by the author based on the interviews of Study I. Categories Low, Mid and High as in the note to Table 12.		

Case production food, see APPENDIX L – CASE PRODUCTION FOOD page 263

Case description

Compared to retail food and non-food, there are relatively few German-owned food producers by revenue. At the same time, the German market includes internationally operating and selling organizations that are relevant both domestically and abroad. This case mirrors that structure and the associated sustainability-related complexity. Three interviews with two organizations were conducted. One is a chocolate producer. The other, while less prominent, belongs to a small group of ingredient providers. The focus is on publicly known organizations and their supply chain position.

Packed business capability & business capabilities elaboration

At the strategy domain, organizations build Sub-Business Capabilities to strengthen their Strategy Capability, based on the view that sustainability and raw material security are essential for the business and its survival. One manager described defining strategically relevant raw materials and pursuing backward integration to gain more power in the supply chain by shortening distances to growers. Together with partners on the ground, including a bilateral development agency and a natural-cosmetics manufacturer, they seek to valorize ecosystems by assigning economic value to Nontimber Forest Products so that farmers recognize that keeping trees standing can be more profitable than cutting them down. The aim is long-term availability of key inputs.

At the People domain, communication is relatively underdeveloped as a distinct business capability. It is present within the integration of functions, where close working relationships increase exchange and reduce the need for formal coordination. This can lower the prominence of communication as a separate capability.

At the Process domain, "Production Food" and "Production Ingredients" display different configurations of Supply Chain Sustainability. Sub-business capabilities are dispersed, and specific practices are not uniformly implemented. "Production Food"

benefits from owning plantations, creating a more self-contained supply chain that facilitates internal sustainability measures. "Production Ingredients" can source substitutes globally and engage in "multi-sourcing", which requires broader approaches to supply chain security and sustainability. One organization reported purchasing several thousand tons of cocoa from cooperatives in a Central American sourcing region, involving several thousand farmers, with a substantial share to be supplied from its own sourcing project once it reaches full capacity. The remainder comes from another region via direct procurement with cooperatives. Direct procurement currently accounts for about half and is planned to cover nearly all volumes, with minor exceptions such as shipping. Organizations emphasize a sustainability agenda, policies and processes managed in an integrated management system, focusing on the supply chain and supplier management. Tools and processes are used to evaluate, measure and analyze supplier sustainability performance and to initiate follow-up measures when needed.

Risk Management is highly used as a sub-business capability. It operates through supplier and internal management systems with guidelines to mitigate risks. Examples include checklists for suppliers to report on raw material status, clear guidelines for main raw materials and corresponding procurement papers that cover a range from raw materials to technical aids.

Overall, the case shows strategic prioritization of critical inputs and backward integration, functional integration that substitutes for a standalone communication capability, differentiated supply chain designs between "Production Food" and "Production Ingredients", and structured risk management to support resilience and sustainability performance.

Table 14 – Heatmap for the distribution of business capabilities

Construct (Packed Business Capability)	**Sub-Construct (Business Capability)**	**Production food**
Strategy	Strategic Management	Mid
People	Organizational Structure & Staff	Mid
	Employee Empowerment	Low
	Communication	Low
Process	Process Innovation & Adaptation	Mid
	Supply Chain Sustainability	Mid
	Risk Management	Mid
	Product Innovation & Adaptation	Low
	Social Responsibility	Low
	Continuous Improvement	Low

	Innovation for Sustainability	Low
Technology	Data Management and Reporting	Low
	Technology Adoption	Low
Note – Compiled by the author based on the interviews of Study I. Categories Low, Mid and High as in the note to Table 12.		

Case production beverages, see APPENDIX M – CASE PRODUCTION BEVERAGES page 266

Case description

The beverage industry is a major sector in Germany, with a diverse, high-volume beer market and several prominent non-alcoholic beverage companies. Ingredients are often sourced internationally or pre-produced at origin, putting sustainability-related complexity both abroad and in Germany on the public agenda. Subsequent processing is energy-intensive, for example in cooling and heating, and logistics poses additional sustainability challenges. Three interviews were conducted with representatives of three prominent German organizations.

Packed business capability & business capabilities elaboration

At the Strategy domain of the packed business capability, the "Strategy Capability" shows a lower degree of development, yet a strategic focus is evident, particularly on securing sustainable raw materials and aligning production processes. As one manager noted, premium organic positioning can be sustained when activities are authentic and long-standing, with early top management decisions that built direct farmer connections and gradually developed personnel structures to support them.

At the People domain, organizations typically rely on a central Sustainability Department to manage sustainability-related complexity. In "Production/Retail Beverages" the topic is relatively new, starting with a central focus to establish foundations: “we have created a position, there is a sustainability team, which is relatively large… We have 16 people in the company who have been trained and educated externally as sustainability managers.” Engagement with colleagues occurs as needed and through plant-level presentations to build awareness. Employee empowerment is relevant, but in "Production/Retail Beverages" it is less visible due to the novelty and centralization of the topic: “what I can't do is say, ‘I-, how does sustainability work in purchasing? … that is precisely why we have trained and educated colleagues there who do not now have one hundred per cent of their working time available on the subject of sustainability.” Communication appears relatively underdeveloped as a distinct capability, but is present through integrated work between sustainability, brand and communications and external associations; in surveys, in-person briefings improved response rates.

At the Process domain, in building "Supply Chain Sustainability" organizations emphasize supplier development and strong relationships, including supplier management systems with development and onboarding. The "Production/Retail Beverages" case shows fewer sub-business capabilities than "Production Beverages", reflecting maturity differences. Long-standing organic approaches support direct farmer contact

and fair, ecological procurement, which predate formal management systems. Supplier development takes priority over substitution: “how can we develop you… I think it's more about developing the supply chain.” Risk Management relies on supplier-facing and internal systems with guidelines. Sustainability is part of feasibility analyses and weighed alongside financial and quality considerations.

Process adaptation is significant, especially in sourcing, with cross-functional teams aligned around reporting and operational integration. Teams assign KPI responsibilities under selected GRI standards and examine cases of sustainability integration into daily work. This reflects the Sustainability Department's leading role in process change.

At the Technology domain, "Data Management and Reporting" is at a low level of development, mirrored by limited "Technology Adoption". Responsibilities for CSR strategy and audits are established, and system enablement lags: “The challenge is to implement this in the ERP system… we are not that far advanced… there is still a lot of paper… folders and Excel tables,” which constrains full traceability and reporting.

Table 15 – Heatmap for the distribution of business capabilities

Construct (Packed Business Capability)	**Sub-Construct (Business Capability)**	**Production beverages**
Strategy	Strategic Management	Low
People	Organizational Structure & Staff	Mid
	Employee Empowerment	Mid
	Communication	Low
Process	Process Innovation & Adaptation	High
	Supply Chain Sustainability	High
	Risk Management	Mid
	Product Innovation & Adaptation	Low
	Social Responsibility	Low
	Continuous Improvement	Low
	Innovation for Sustainability	Low
Technology	Data Management and Reporting	Low
	Technology Adoption	Low
Note – Compiled by the author based on the interviews of Study I. Categories Low, Mid and High as in the note to Table 12.		

Case production/ retail cosmetics, see APPENDIX N – CASE PRODUCTION/ RETAIL COSMETICS page 271

Case description

In recent years, the cosmetics industry has intensified its focus on responsible ingredient sourcing. Customers increasingly examine how ingredients affect the skin. They also examine the environmental impact of microplastics and other pollutants. Given the market's fragmentation and vast product portfolios, this case concentrates on large organizations. The study drew on access to one of the leading international natural-cosmetics and personal care companies, widely recognized for its sustainability commitment and emphasis on natural ingredients that benefit consumers and protect the environment.

Packed business capability & business capabilities elaboration

At the People domain, "Organizational Structure & Staff" required only minor adjustments because the business had historically addressed sustainability challenges. The existing setup already aligned well with complexity. Collaboration with other departments is routine, including shared data work and market-specific responsibilities across countries. As one buyer noted, "Okay, can we perhaps include other data?" reflecting cross-department data provision and comparison. Local teams adapt to regulatory and market needs, with larger hubs taking responsibility for smaller markets. "Employee Empowerment" focuses on awareness so employees can proactively engage with sustainability topics. External experts and peer learning have built knowledge, summarized as "we accumulated knowledge." Communication remains a lean, distinct capability because functions are strongly integrated. Multiple channels nevertheless reach different audiences, for example "there are newsletters, there are Slack channels, anyone who is interested in the topic can sign up."

At the Process domain, the business capability "Supply Chain Sustainability" is expressed through a diverse set of sub-business capabilities, including supplier engagement, sustainable sourcing, lifecycle assessment and advanced logistics. Long-term relationships and regular on-site visits support project-based collaboration and closer oversight. This is especially evident in regions such as Indonesia, Africa, and South America. "Risk Management" is widely used through supplier management and internal systems. Clear guidelines support the identification, prioritization, and management of environmental and social risks. A buyer described the evaluative approach: "How often, how much, in what concentration, which of these are critical?" Follow-up actions include working with suppliers and replacing raw materials where transparency is lacking. "Process Innovation & Adaptation" required only targeted refinements because sustainability had already shaped core processes over time. A concrete example is the onboarding control for animal testing, which requires every new supplier to complete a company-level declaration confirming its non-involvement in animal testing. Annually updated questionnaires and external audits support this control. A similar approach is being introduced for pesticides.

"Product Innovation & Adaptation" shows significant change in only one case, underlining the difficulty of replacing entrenched inputs without compromising performance or simply substituting one monoculture with another. Alternatives to palm-based inputs, such as olive-based materials, illustrate both intent and constraint.

"Data Management and Reporting" remains low in maturity in the Technology domain. "Technology Adaptation" is also limited. Few changes to tools and systems constrain reporting and make it difficult to scale traceability and KPI management across the portfolio.

Table 16 – Heatmap for the distribution of business capabilities

Construct (Packed Business Capability)	**Sub-Construct (Business Capability)**	**Production/retail cosmetics**
Strategy	Strategic Management	Low
People	Organizational Structure & Staff	Low
	Employee Empowerment	High
	Communication	Low
Process	Process Innovation & Adaptation	Mid
	Supply Chain Sustainability	High
	Risk Management	Mid
	Product Innovation & Adaptation	Low
	Social Responsibility	Low
	Continuous Improvement	Low
	Innovation for Sustainability	Low
Technology	Data Management and Reporting	Low
	Technology Adoption	Low
Note – Compiled by the author based on the interviews of Study I. Categories Low, Mid and High as in the note to Table 12.		

Case production cleansing, see APPENDIX O – CASE PRODUCTION CLEANSING page 276

Case description

The cleansing industry is a key focus area similar to cosmetics, with significant environmental impacts and potential user health risks arising from certain ingredients. Public attention has increased accordingly. This case draws on an interview with a German producer of environmentally friendly cleaning products.

Packed business capability & business capabilities elaboration

At the Strategy domain, organizations did not place a strong emphasis on developing the "Strategy Capability". The focus appears less on upstream supply chain integration and more on internal processes and downstream activities. Strategic efforts are therefore aligned primarily with internal and downstream sustainability goals. The interview material provides no illustrative quotation for this capability.

At the People domain, "Organizational Structure & Staff" required only minimal adjustments because the business had historically addressed sustainability challenges and the existing setup aligned with requirements. As the Head of Sustainability and Organizations Management noted: "Our department essentially has two different branches that are nevertheless very closely linked. Firstly, everything that has to do with sustainability management, except sustainability communication, is done by corporate communications. All certifications in the field of environmental and energy management are handled by us, [for all our sites]. And the other branch, organizational management, is primarily concerned with organizational development in relation to process and project management. Process management is logical in some ways, because these ISO standards always rely on this process-oriented approach, so it is obvious that we also take the lead in this area in the company." Organizations also built "Employee Empowerment", emphasizing training and management support. "So through various measures and methods, we do a mandatory training course, an online training course for employees once a year on environmental and energy, sustainability topics, which everyone has to complete with control questions at the end. […] We regularly offer events on the topic of sustainability with different focuses. […] So we are very active in this area and we regularly have articles in the staff magazine about it, about information monitors. So yes, countless." "Communication" was present but somewhat underdeveloped as a distinct capability, which can be explained by close functional integration and low coordination costs. No quote was available for this capability.

At the Process domain, "Risk Management" is developed but shows lower maturity, consistent with downstream-oriented models and specific requirements. The integrated management system anchors work with quality, environment and energy standards. "Well, ultimately, we have an integrated management system that we work with. So we have the quality arm, of course, with which we work very closely, and the environment and energy. And we have all kinds of standards and norms and certificates here at the site, these are ISO, i.e. 14001, 9001, 50001 for energy, EMAS, we are proud of that, we have had it for [many] years now. Which is extremely helpful, especially in dealing with ecological challenges. Which is also just like the ISO standards, which means that we are of course constantly changing. […] When we carry out process optimization, we look at every process and see whether the guiding value is sustainability or one of the guiding values is sustainability. This means that the employees are forced to deal with the topic and see what risks the process they are currently working on has for the environment, for example, or for social components. They have to evaluate this." "Process Innovation & Adaptation" required only minor refinements, since core processes were already aligned with sustainability needs. "Not specifically now, of

course we have grown over time because the subject areas have simply expanded. But ultimately we also try to position the departments in such a way that they actually take a lot of things into account themselves, because we work, we have a sustainability team that consists of representatives from all departments in the company and they meet regularly and discuss certain topics, so that is also the goal, that ultimately the sustainability department does not do sustainability, but that the departments themselves understand how it works. And we just support them and give them content-related input. […] So we don't go directly to China and let them do our work or buy the raw materials there, but we mainly have dealers and they are all based in Europe. Our direct dealers are based in Europe, but of course they do get some of their raw materials from other countries, even outside the EU, depending on the raw material."

At the Technology domain, "Data Management and Reporting" shows low development, mirrored by limited "Technology Adaptation". No fitting quote was available for these capabilities.

Table 17 – Heatmap for the distribution of business capabilities

Construct (Packed Business Capability)	**Sub-Construct (Business Capability)**	**Production cleansing**
Strategy	Strategic Management	Low
People	Organizational Structure & Staff	Mid
	Employee Empowerment	High
	Communication	Low
Process	Process Innovation & Adaptation	High
	Supply Chain Sustainability	Low
	Risk Management	Mid
	Product Innovation & Adaptation	Low
	Social Responsibility	Low
	Continuous Improvement	Low
	Innovation for Sustainability	Low
Technology	Data Management and Reporting	Low
	Technology Adoption	Low
Note – Compiled by the author based on the interviews of Study I. Categories Low, Mid and High as in the note to Table 12.		

Discussion & cross-case analysis on reducing environmental complexity by building internal complexity through business capabilities

Social systems inherit a high degree of internal complexity if they represent their environments. This capacity increases their capability to represent environmental complexities and respond to changes in their environments [119]. However, current literature has not yet outlined how organizations internally represent the changes in their environments (i.e. what is understood here as sustainability-related complexity). Authors like Blau [120], Child and Mansfield [121], Hsu et al. [122], Daft and Lengel [71], Tushman and Nadler [123] focused on overarching concepts like structures and processes but not on which business capabilities organizations enable in order to overcome sustainability-related complexity within their supply chains.

From this research the evidence indicates that organizations represent sustainability-related complexity internally by increasing their internal complexity, that is, by building up business capabilities. In the cases organizations create an amount of requisite variety to respond to external sustainability-related complexity. This requisite variety was built up by creating business capabilities. This dissertation distinguishes these business capabilities in strategy, people, process, and technology. The following table provides a heatmap for the distribution of the business capabilities. The categories Low, Mid and High follow the rubric stated in the note to Table 12 and are consolidated across the six cases by the same rule.

Table 18 – Consolidated heatmap for the distribution of business capabilities.

Construct (Packed Business Capability)	**Sub-Construct (Business Capability)**	**Production/retail textiles**	**Production beverages**	**Retail food/non-food**	**Production/retail cosmetics**	**Production food**	**Production cleansing**
Strategy	Strategic Management	Low	Low	Low	Low	Mid	Low
People	Organizational Structure & Staff	High	Mid	High	Low	Mid	Mid
	Employee Empowerment	Low	Mid	High	High	Low	High
	Communication	Low	Low	Low	Low	Low	Low

Process	Process Innovation & Adaptation	Mid	High	High	Mid	Mid	High
	Supply Chain Sustainability	High	High	Mid	High	Mid	Low
	Risk Management	Mid	Mid	Mid	Mid	Mid	Mid
	Product Innovation & Adaptation	Low	Low	Low	Low	Low	Low
	Social Responsibility	Low	Low	Low	Low	Low	Low
	Continuous Improvement	Low	Low	Low	Low	Low	Low
	Innovation for Sustainability	Low	Low	Low	Low	Low	Low
Technology	Data Management and Reporting	Low	Low	Low	Low	Low	Low
	Technology Adoption	Low	Low	Low	Low	Low	Low
Note – Compiled by the author based on Tables 12 to 17.							

From a cross-case perspective, the analysis shows high engagement and a build-up of business capabilities across the case studies: 1) production / retail textiles, 2) production beverages, and 3) retail food / non-food. Managing sustainability internally is a critical focus for these organizations due to regulatory compliance, market demand, and operational efficiency. These reasons support the ethical and responsible conduct of the organizations, and contribute to their resilience and competitiveness in the long

term. In the case of production and retail of cosmetics, food, and cleansing, by contrast, there appears to be less engagement in terms of business capabilities. An explanation for that could be that high costs, regulatory and market challenges, and cultural and organizational barriers are obstacles for them. Alternatively, these interviewed organizations may in fact be further developed in their internal sustainability management and did not highlight these business capabilities precisely because of their already high level of integration. Several factors influence the effectiveness of these strategies in managing sustainability-related complexity. For instance, organizational size and resource availability significantly impact the ability to invest in advanced business capabilities such as Technology Adoption or Data Management and Reporting. Additionally, Supply Chain Sustainability is rated High in textiles, beverages, and cosmetics, Mid in retail food / non-food and production food, and Low in cleansing (Table 18). Product Innovation & Adaptation and Innovation for Sustainability, by contrast, are rated Low in all six cases, including cosmetics and cleansing, where customer-driven sustainability is more prominent.

When looking at the business capabilities in detail, the analysis shows a very fragmented picture. On the one hand, there are highly developed, well-established business capabilities; on the other hand, the development of several business capabilities lags behind. Across the interview responses, the capabilities articulated as most highly developed are Organizational Structure & Staff, Employee Empowerment, Process Innovation & Adaptation, Supply Chain Sustainability, Risk Management, and External Collaboration and Advocacy. External Collaboration and Advocacy emerged inductively beyond the deductive coding frame and is therefore reported narratively. The capabilities articulated as less developed are Strategic Management, Communication, Product Innovation & Adaptation, Data Management and Reporting, and Technology Adoption. From this dissertation's point of view there are various explanations for this. First, the interview responses suggest that prioritizing people and process capabilities provides a foundation for sustainable growth, risk mitigation, and organizational dynamics. Second, this sequencing implies that subsequent emphasis on strategy and technology builds on an established base. Third, the accounts indicate that focusing on people and processes first supports the implementation of strategic initiatives and technological integrations. The analysis shows that the interviewed organizations focus on people and process first. These findings align with Carter and Rogers [35]. Their work highlights the role of people-oriented capabilities, including training and empowerment, in achieving sustainability goals. The emphasis on process innovation also aligns with Klassen and Vachon [124]. They identified supply-chain innovation as central to addressing sustainability challenges. However, unlike prior studies that emphasize strategic alignment [32], this research shows that organizations prioritize foundational capabilities before advancing to strategic and technological maturity. This divergence suggests that the sequence of capability development may vary depending on industry context and organizational maturity.

From a People perspective, the reported arrangements can be interpreted through functional specialization and organizational differentiation. Functional specialization assigns tasks such as risk management to dedicated roles. Horizontal differentiation

creates units or divisions, while vertical differentiation adds levels of authority [120; 122]. These arrangements structure how organizations process sustainability requirements. Whether additional differentiation improves response capacity depends on coordination and decision rights.

From a process perspective the findings support indications from prior research as well. To be viable over time, organizations continuously balance their structures and processes, because failing to match structures and processes will lead to not being capable of managing changes in their environments [125]. For example, increasing their internal complexity, the organizations increase the density of communication by integrating more and a broader range of employees. This allows them to integrate more information points and assess actual challenges they must deal with. For example, increasing density of communication includes introducing and increasing the frequency of meetings in parallel to intensifying relations between divisions or units within the organization [71]. These findings carry important implications for practitioners. Organizations developing sustainable supply-chain strategies should first strengthen internal complexity through Organizational Structure, Employee Empowerment, and Risk Management. These capabilities serve as a foundation for addressing external complexities, including regulatory pressures and stakeholder expectations. Second, the application of social systems theory provides a valuable perspective for balancing internal and external complexities. Managers can view sustainability challenges as an interaction between environmental demands and organizational responses. This helps them identify and address capability gaps proactively. Finally, organizations with limited resources might consider collaborative approaches, such as partnering with external stakeholders or applying shared technology platforms, to compensate for underdeveloped capabilities.

Summarizing this discussion, the interviewed organizations increase their capacity (requisite variety) to adapt and react to changes in their environment (sustainability-related complexity) by creating internal complexity as business capabilities. Building on these insights, the following figure illustrates the relationship between internal and external complexities and the role of business capabilities in achieving requisite variety. This model highlights how organizations progressively integrate foundational capabilities (e.g., people and process) before advancing to strategic and technological capabilities.

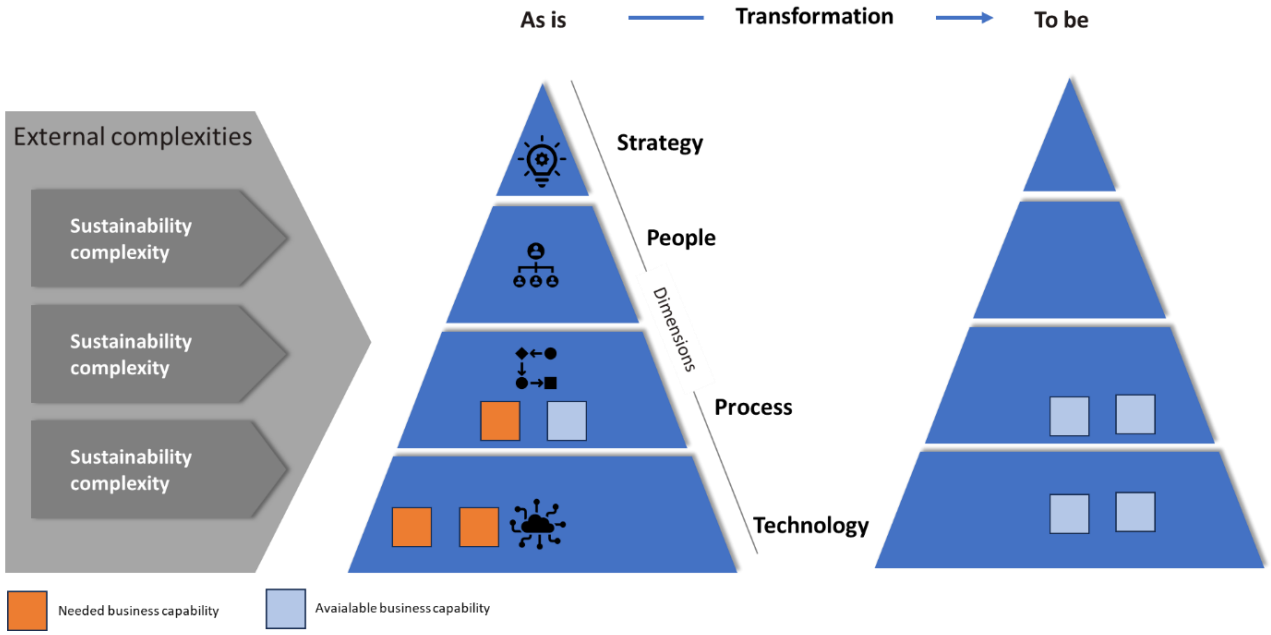


Figure 2 – Relationship between internal and external complexities and the role of business capabilities in achieving requisite variety

Note – Compiled by the author based on Study I.

Due to the abductive multiple case study approach, this dissertation recognized that not all business capabilities could be identified. In the following, the reasons for that are elaborated.

First, these capabilities, such as Environmental Management, Social Responsibility, and Ethical Governance, may not be categorized by organizations as distinct capabilities. Instead, they might be embedded within broader organizational processes, making them harder to distinguish during interviews or document analysis. This lack of identification indicates the need for more detailed frameworks and metrics to capture less tangible capabilities. For example, Environmental Management may not be reported because it is integrated into broader operational practices. Longitudinal case studies or participatory action research could examine these embedded capabilities. They would provide more detail on how organizations develop sustainability practices. Additionally, industry-specific studies could shed light on unique challenges and innovations, offering a comparative way to assess the generalizability of these findings.

Second, varying industry focus or maturity levels of sustainability efforts could impact the visibility of these capabilities. For example, some organizations may prioritize compliance-driven practices, addressing only minimal requirements, which could downplay more advanced capabilities like Innovation for Sustainability or Supply Chain Sustainability. This difference in sustainability maturity may lead organizations to overlook capabilities that are either underdeveloped or changing.

Third, organizational culture matters considerably. Interviewees report that organizations with a traditional focus on financial performance might see sustainability as a secondary concern. This culture may hinder explicit development of Continuous Improvement, Employee Empowerment, or Technology Adoption for sustainability. These capabilities are not directly linked to immediate financial goals.

Fourth, data-related challenges could arise. Process Innovation, Data Management, and Reporting might not be fully systematized or standardized across organizations, leading to their exclusion in interviews or reports. Finally, supply chain complexities and varied external pressures might also make certain capabilities harder to isolate. For example, Product Innovation and Adaptation, or Crisis Response, could be reactive, making it difficult to frame them as formal capabilities.

By adopting an abductive, multiple-case study design, the study identified and analyzed internal processes across 17 for-profit organizations in Germany. The findings indicate that sustainability management operates as a dynamic capability composed of interconnected constructs spanning strategy, structure, processes, people, and technology.

Across industries, organizations demonstrate varying degrees of maturity in developing specific business capabilities. Larger firms describe more formalized risk management and initial strategic sustainability alignment. This reflects their access to resources and formal structures. However, Strategic Management is rated Low in five of six cases, and Risk Management is rated Mid in all six. See Table 18. In contrast, smaller organizations often rely on implicit strategies and decentralized approaches. Capabilities such as employee empowerment and supply chain sustainability are widely implemented, and their depth and execution vary according to organizational size, industry, and historical commitment to sustainability.

The analysis further shows that capability development is deeply contextual and iterative. Several organizations describe sustainability as an ongoing process and use cross-functional integration and supplier management systems to adapt their practices, while continuous improvement routines and technological tools remain weakly articulated (Table 18). The use of business capabilities such as "Process Innovation & Adaptation" or "Risk Management" illustrates how internal complexity is managed through structured yet flexible systems.

Furthermore, the findings suggest that managing sustainability-related complexity requires a blend of formal governance (e.g., structures and audits) and informal enablers (e.g., culture, employee initiative). While some capabilities, such as risk management, are universally critical, others, such as technology adoption, remain underdeveloped and present opportunities for further investment.

By conceptualizing sustainability management as a form of internal capability-building, this chapter offers a practical and theoretical framework for organizations aiming to navigate sustainability-related complexity. It also provides a foundation for future research on capability evolution and sustainability performance across varying organizational contexts.

2.2 Publicly reported sustainability responses of Kazakh companies: Content-analysis Study II

Sustainable business practices have become a strategic imperative. This is particularly true for transitional economies like Kazakhstan, which are characterized by structural challenges, resource-based industries, and shifting regulatory contexts. This

section investigates how organizations in Kazakhstan publicly articulate and evidence their responses to sustainability-related complexity and how these responses are expressed through disclosed business capabilities. Because the empirical material consists of sustainability and annual reports, but does not claim direct access to internal decision-making or embedded organizational routines. Instead, it analyzes how firms present priorities, governance arrangements, measurement practices, and capability claims in public-facing communications [14; 15; 16; 25; 102].

The aim is to provide an empirical, document-based perspective on the research question: How do organizations in Kazakhstan publicly articulate business capabilities for managing sustainability-related complexity? Building on Social Systems Theory, the chapter treats sustainability reports as organizational self-descriptions and communicative artefacts through which firms present selected sustainability priorities, governance arrangements, and claims of evidence. The analytical emphasis is on articulation, and specificity.

The research design employs qualitative content analysis with a deductive-inductive coding framework applied to sustainability reports from 11 strategically selected companies. These firms represent a range of industries, ownership structures, and ESG maturity levels, enabling a rich comparative analysis. The coding scheme is structured around four Packed Business Capabilities (PBCs): Strategy, People, Process, and Technology. Within each PBC, sub-business capabilities were evaluated to uncover how sustainability is operationalized, embedded, and communicated.

This study makes both theoretical and methodological contributions. Theoretically, it extends the understanding of capability-building under sustainability pressures in emerging markets. Methodologically, it shows the value of sustainability reports as a legitimate data source for qualitative management research. By integrating system theory and empirical evidence, this section offers a framework for examining how firms in Kazakhstan deal with the increasing demands of sustainability governance.

Study II applies qualitative content analysis to sustainability and annual reports to reconstruct how Kazakhstani firms articulate, structure, and evidence Packed Business Capabilities (Strategy, People, Process, Technology) in response to sustainability-related complexity [25; 102]. The reports are treated as purposeful organizational communications that publicly encode priorities, governance arrangements, and claims of performance, enabling systematic cross-company comparison while keeping attention on the auditability of disclosed information, i.e., the presence of specific, verifiable indicators, evidence trails, and documented governance routines [126]. In line with Social Systems Theory, the analysis uses reports as empirically accessible traces of how organizations observe themselves and respond communicatively to external sustainability expectations [127]. Importantly, the reports are analyzed as claims and self-descriptions. The coding therefore emphasizes the presence, specificity, and evidence-orientation of capability statements. Appendix G, Methodology: Kazakh Firms Responses to Sustainability-related complexity, provides procedural detail on page 270. It covers sample construction, the codebook, coding steps, and quality checks.

Specifically, cases were selected to maximize variation in sector exposure, ownership structures, and reporting maturity, enabling both similarity- and contrast-oriented comparisons consistent with replication rationale. The resulting sample supports cross-case pattern identification.

Established qualitative content analysis approaches, Study II uses a hybrid deductive-inductive coding strategy [101; 102; 25]. The coding scheme is organized around the Packed Business Capabilities architecture developed in Study I and documented in an Excel-based codebook with definitions and examples. Social Systems Theory guides the interpretation of organizational self-description and complexity reduction, while Packed Business Capabilities structure the empirical coding. The coding remained open to emergent categories to refine or extend the scheme as new patterns appeared in the reports [102]. Coding consistency was supported through structured codebook refinement and documented decision rules (see APPENDIX G – METHODOLOGY (KAZAKH FIRMS RESPONSES TO SUSTAINABILITY-RELATED COMPLEXITY) on page 240).

The following sections apply the interpretive-constructivist epistemological stance set out in Section 1.3. They analyze how Kazakh firms describe their sustainability-related capabilities in sustainability and annual reports. The analysis concerns the organizations' self-descriptions. It does not directly establish how they operate in practice [102; 14; 15; 16; 25]. Statements that firms develop, build, integrate, or report a capability describe patterns found across the reports. They do not confirm the underlying operational practices. This distinction applies throughout the analysis. The Conclusion discusses the limits of drawing conclusions about operational practice from reported accounts.

Discussion & cross-case analysis on cross-case patterns and institutional embeddings

Content analysis combined a structured, rule-based coding scheme with openness to new concepts [25; 101]. The resulting case-by-case dataset of capability constructs provides the empirical basis for cross-case analysis. Each case firm’s sustainability profile is now briefly summarized to set context. Although details varied, all firms exhibit stages of embedding ESG into organizational routines, with industry-specific emphases. Highlights from each case are:

Air Astana, which is Kazakhstan’s flag carrier and the largest airline group in Central Asia and the Caucasus, increasingly presents sustainability as a competitive factor. In the Strategy domain, the Group’s ESG Strategy and its Low-Carbon Development Program from 2023 to 2032 set goals for reducing greenhouse gas emissions and were originally aligned with Kazakhstan’s aim of carbon neutrality by 2060. In 2024, the Group moved its net zero target to 2050 in line with the aviation industry and began to update the program with near-term targets that are to be independently verified. The Strategy PBC disclosures describe Board-level ESG oversight and a stakeholder-centric governance model that anchor these commitments in corporate decision-making. The report also describes substantial investment in human capital. An internal communication program, an employee fundraising campaign, and a new Flight Train-

ing Centre are presented as ways to encourage employee involvement and social purpose. ESG training for the Board, senior management, and employees, the expansion of e-learning and of the Leadership Essentials program, and planned investments in engineering and maintenance, pilot training, and ground handling indicate further capacity-building. In the Process domain, the airline reports the digitization of workflows such as the handling of passenger complaints via QR codes. Solutions for lower fuel consumption and a crew rostering optimizer are listed among its priorities for 2025, as is participation in IATA's Sustainable Procurement Pilot. Continuous-improvement audits cover both flight operations and treasury controls. Data management and third-party assurance of selected sustainability information support the ESG disclosure. The report links strategy, people, process, and technology and presents the climate commitments with operational measures. Supplier governance and large-scale uptake of sustainable aviation fuel remain open tasks. The report states the aim of becoming one of the most sustainable airlines in the CIS and Central Asia.

Bank CenterCredit JSC (BCC) is an emerging sustainability reporter among Kazakh banks. Its Process capability is developing. The bank reports a Risk Management system aligned with international practice. Supply-chain and sustainable lending policies are at an early stage but are referenced through formal procurement ethics and alignment with the UN SDGs. The bank is also establishing a broad multi-channel stakeholder engagement framework that addresses its social license. Continuous improvement is implicit in ESG rating goals and policy updates. The People PBC includes structured communication and basic empowerment, for example the involvement of employees and clients through surveys and feedback loops. Inductive coding identified a digital mortgage application process and "client sustainability onboarding" through an ESG self-declaration questionnaire for SME clients. The within-case synthesis describes formal structures and new practices in all four PBCs, such as the Sustainability (ESG) Directorate, but also gaps in supplier oversight and climate risk modeling. The pattern is typical of a bank in transition: it builds basic risk and reporting structures and shows an early shift toward using sustainability as a competitive and operational factor.

BI Group stands out for a strategic, city-building approach. The analyzed integrated annual report was issued by BI Development Ltd., part of the BI Group holding. Under Strategy, BI Group explicitly integrates sustainability into urban-development projects and planning. Its People capability is demonstrated by advanced empowerment practices: structured performance rewards, as well as community-oriented programs in its housing developments, signal an employee and stakeholder focus. On the Process side, BI Group employs Lean/Kaizen in construction and is extending product warranties to encourage lifecycle responsibility. It experiments with advanced materials and building technologies as part of innovation for sustainability. BI Group's profile combines systematic governance with innovation in construction methods and community programs.

Eurasian Resources Group S.à r.l. (ERG) reports a strong strategic anchoring of sustainability. Its ESG Committee is supporting the integration of sustainability practices into Group strategy, and the company operates a "Decarbonisation Think Tank" as a center of excellence for decarbonization. The company has also launched a 2023-

2025 transformation program to improve its efficiency by enhancing its operational model. In People, Eurasian Resources Group established regional sustainability committees and an "ERG Corporate University" for skills training in Kazakhstan, which points to internal capacity-building. The sustainability reports also describe employee engagement programs and differentiated pay raises. Eurasian Resources Group's Process capabilities span seven sub-categories: it is rolling out multi-sensor rock and core scanning platforms in Africa to standardize data collection in exploration, outsourcing aviation services in Africa to third-party providers, and developing technologies for low-carbon chromium and lower-carbon alumina at its R&D Centre in Kazakhstan. The within-case synthesis describes Eurasian Resources Group as developing and institutionalizing sustainability-oriented PBCs across organizational domains. The case is marked by organizational change and leadership commitment, although the analysis notes that further work is needed to cascade these initiatives to all operational levels.

Halyk Bank of Kazakhstan JSC (hereafter Halyk Bank) reports an ESG Strategy for 2025-2027, board-level oversight, participation in the UN Global Compact and distributed ESG responsibilities. Its People disclosures include D&I practices and stakeholder engagement. The reports also describe a digital banking ecosystem and data centres commissioned by its group company Kazteleport JSC. As detailed in Appendix P, the material does not link these broader digital investments to sustainability analysis. The case therefore combines reported ESG governance arrangements with digital infrastructure whose sustainability-related role remains unspecified.

Karachaganak Petroleum Operating B.V. (KPO), which operates the Karachaganak Field on behalf of Shell, Eni, Chevron, Lukoil, and KazMunayGas, shows a more advanced sustainability capability profile. Its strategy is explicitly integrated: the KPO 365 Strategy is tied to social, environmental, and economic sustainability, and the Green Strategy follows the country's strategic plans. KPO also describes an approach to assessing climate-related risks and opportunities over different time horizons and includes regulatory changes such as carbon pricing in its energy transition scenarios. The reports do not describe an internal carbon price and do not refer to the TCFD recommendations. Inductively, the reports show a Women's Club and a mentoring initiative for women in the oil and gas industry, as well as awareness raising on environmental requirements for contractor employees. In the People PBC, a Sustainability Sub-committee at Operator level addresses social, economic, and environmental topics, and staff involved in sustainability reporting take part in ESG and GRI training. The Technology disclosures show digital tools in operations: KPO acquires real-time data from wells through telemetry, lists drones for remote inspection among smaller digital projects, and provides contractors with an e-guide on environmental reporting and compliance. Supply-chain efforts include environmental requirements for contractors and pre-tender sessions that explain tender requirements to local suppliers. KPO thus shows strategic alignment and capacity development, consistent with expectations for a major production operator in a global energy project.

Kaspi.kz JSC (hereafter Kaspi) represents a very different model. Its core business is a digital "super-app" platform, and sustainability appears in the context of long-term growth and governance. Under the Strategy PBC, Kaspi's sustainability capability

is essentially its platform strategy: the company manages customer-engagement metrics and regulatory compliance to sustain investor confidence. Inductively, a Disaster-Response Lending capability was identified: after the floods of early 2024, Kaspi donated KZT 620 million and offered interest-free repayment holidays to affected loan customers, which links social responsiveness with its core finance operations. Its People PBC is changing. While initial communications on ESG were minimal, Kaspi reports training and development initiatives and a Kaspi Lab corporate university program that recruits top university graduates. In the Process PBC, the report presents the Super Apps as reducing paper consumption, for example because the need to sign more than 54 million documents was eliminated in 2023. Kaspi also reports an automated, big data-driven loan approval process and describes its merchant services as promoting inclusion. Kaspi's capabilities center on digital innovation and stakeholder trust. The company is less focused on environmental issues as such, and uses its platform to support financial inclusion and crisis resilience.

KAZ Minerals, one of the country's leading mining groups, presents itself in its reporting as proactive and innovative on sustainability. In the Strategy domain, it evaluates climate-related risks in decisions on significant new projects, has begun to apply an internal carbon price of $100/t to investment decisions, and publishes standalone sustainability reports, which indicates a shift from ad hoc CSR to integrated planning. Its People dimension includes a Leadership Development Programme for potential future leaders and safety training on the psychological causes of unsafe behavior. Process capabilities are technology-intensive: KAZ Minerals uses artificial intelligence in its mine to mill process to raise production efficiency and to lower energy use per ton of copper, and it monitors water inflow and wall movements in open pits, underground mines, and tailings storage facilities. A remotely controlled drill rig and drones reduce the exposure of employees in hazardous areas. In the Technology PBC, the company reports continuous environmental monitoring, annual key performance indicators, Scope 1 and 2 emissions calculated in line with the GHG Protocol, and a partnership with Motion Metrics on an AI-based solution that aims to minimize energy consumption. The reports do not describe the data systems behind these disclosures. According to the within-case analysis, some of these practices are not covered by the deductive framework, which is consistent with dynamic capability-building [128]. KAZ Minerals thus combines engineering innovation with strategic planning for long-term resilience.

Kazatomprom, the world's largest uranium producer, reports a systematic anchoring of ESG in governance. In the Strategy domain, it has a formal Sustainable Development Program for 2024-2030 and participates in international organizations and industry associations such as the UN Global Compact. Its People capability includes a multi-channel communication system and educational programs such as Murager and Izbasar. In Process, Kazatomprom emphasizes safety and efficiency: it has introduced an electronic permit-to-work system, reports measures to reduce the consumption of reagents and energy as well as R&D aimed at lower mining costs, and links UN SDG targets on productivity and resource efficiency to science and innovation. Occupational safety is part of its key performance indicators. In the Technology domain, the company reports against SDG indicators and quantified targets for its ESG

rating and emissions, tests a technology against snow and ice accumulation on overhead power lines in a pilot project, and has agreed with Siemens on the local production of automation systems. The case shows a risk-oriented profile with a focus on innovation that fits the nuclear-energy context.

Kazakhstan's national oil and gas company KazMunayGas shows a heavily compliance-oriented approach. Its reports emphasize traditional CSR and risk-management practices. For example, its 70 energy-efficiency initiatives of 2024 upgrade existing equipment and are therefore incremental, although their savings are quantified. HSE risks, including environmental, climate change, and water scarcity risks, are monitored quarterly, while social risks are not named in this context. Its social responsibility consists mainly of funding for social facilities and the development of the producing regions under subsoil use contracts, together with job creation in major projects and social benefits for employees and retirees, and is therefore largely set by contractual obligations. Emerging inductive capabilities include a "Green Office" concept and renewable energy projects, such as a hybrid wind, solar, and gas power plant with Eni and a planned wind power plant with energy storage. They indicate first steps toward greener operations and the energy transition, and many initiatives remain at the concept or construction stage. The Technology PBC is mixed: an automated information system for environmental monitoring data exists, and two subsidiaries were the first in the group to install automated emission monitoring systems, and advanced technology use is still exploratory.

Samruk-Energy's focus is on operational reliability, with growing ESG credentials. Its Process PBC is pronounced in energy-efficiency measures (61 measures completed in 2023, with reported savings of fuel and costs) and in the management of greenhouse gas risks through mitigation activities. It has launched projects to replace pulverized coal equipment with combined-cycle gas turbines, which the report expects to reduce environmental impact and, at CHPP-3, to cover a deficit of maneuvering capacity. Automated emission monitoring systems are being introduced step by step. Social Responsibility remains largely traditional, although the Management Board manages a structured stakeholder engagement process. On the People side, the company reports training investments of over KZT 440 million in 2023 and approved a roadmap for improving its sustainable development management system, which it presents as part of enhancing corporate governance through the perspective of sustainability. A new Personnel Policy commits to equal opportunities in recruitment, and a "Youth Forum" brings together young employees of the group. Communication sub-business capabilities are used for external legitimacy, while internal culture-building is at an early stage. Samruk-Energy's profile is that of a large state-owned energy firm that integrates efficiency and risk controls step by step and has begun cultural changes (e.g. equal opportunity policies) in line with national sustainability objectives.

Collectively, these within-case profiles show that all the firms are taking steps to manage sustainability-related complexity, but at varying depths and with different emphases. The largest extractive and banking firms often emphasize formal governance and risk, while technology-driven firms (Kaspi, Halyk Bank) draw on digital innovations. Across cases, even state-controlled companies (KazMunayGas, Samruk-

Energy) are beginning to adopt transformational capabilities (e.g. hybrid energy infrastructure) in line with global trends. These case summaries establish the basis for the comparative cross-case analysis below.

Both common patterns and differences emerged in how Kazakh firms build sustainability capabilities. The cross-case synthesis is organized by the four PBCs.

Cross-case analysis common patterns

Certain sub-business capabilities recur widely. Most firms have at least token Strategic Management of sustainability: they articulate ESG goals in their corporate plans or board charters (e.g. Halyk Bank's ESG Strategy for 2025-2027, Air Astana's board-level ESG oversight). As Neske et al. [53] argue, organizations first must "view and understand" their sustainability-related complexity (e.g. via formal programs or standards) before reducing them. The sustainability reports describe how all companies communicate via standard frameworks (GRI, TCFD or national equivalents), reflecting structural coupling to the global sustainability environment [15]. For instance, every case references UN SDGs or global ESG ratings, which is consistent with seeking legitimacy by aligning internal discourse with international norms.

In the People PBC, Organizational Structure and Empowerment are common dimensions. Almost every company has set up dedicated roles or committees for sustainability (e.g. Eurasian Resources Group's regional sustainability committees, KPO's Sustainability Sub-committee, Air Astana's ESG Committee). Workforce training and incentives are reported in all cases: the airline runs ESG training for employees and management, banks run ESG training courses for their staff, and mining companies report technical and safety training. Even where explicit "empowerment programs" are limited, most firms at least encourage employee participation in CSR (such as fundraising campaigns at Air Astana or gender-inclusion programs at KPO). Communication sub-business capabilities are also found in nearly all cases: internal newsletters, annual ESG reports, and stakeholder forums make the organizational sustainability narrative public. Bank CenterCredit's extensive stakeholder engagement process and Halyk Bank's multi-stakeholder tables are examples. The emphasis is on building legitimacy through transparency.

Across Process PBCs, several sub-business capabilities stand out as widespread. *Risk Management* is the most uniformly advanced: all banks and extractive firms at least acknowledge climate or operational risks, often integrating them into enterprise risk systems. This mirrors global trends where companies extend financial risk frameworks to include ESG factors [129]. *Continuous Improvement* (Kaizen-like cycles) is also a common theme: from Air Astana's systematic safety KPIs to Samruk-Energy's energy-efficiency measures. Innovation-oriented process changes (new turbine tech, digitalization of services) appear in many cases, though their scale differs. All firms show at least incipient supply-chain sustainability efforts: mining and industry players report on supplier audits or codes of conduct (Kazatomprom's supplier code), while banks mention green lending and ethical procurement frameworks. This suggests a shared recognition that upstream partners must be engaged for sustainability along the entire chain.

In the Technology PBC, Data Management & Reporting is coded in nearly all cases: the firms report processes for collecting and disclosing key indicators. The level of development varies (from spreadsheets and manual logs to automated information systems), and some reports do not describe the systems used. Formal technology adoption for sustainability (e.g. advanced renewables, AI tools) is less widespread but still common among the larger or technology-oriented firms. For example, KAZ Minerals uses artificial intelligence in its mine to mill process and drones for geotechnical monitoring, Halyk Bank's group company Kazteleport has commissioned data centers for AI workloads, and KPO uses telemetry and drones in operations. Smaller or more traditional firms (some state utilities, Bank CenterCredit) are more tentative technologically. However, all cases report the digitalization of core processes (e.g. banks' fintech platforms, the airline's automated procurement planning) in ways that also yield sustainability outcomes.

Cross-case analysis differences

While the above patterns hold broadly, this dissertation observed clear sectoral and organizational differences. Sector effects are pronounced. Resource-extraction companies (KazMunayGas, KPO, Kazatomprom, KAZ Minerals, Eurasian Resources Group) focus strongly on environmental and safety sub-business capabilities: emissions reduction technologies, waste management, and hazard control receive more attention than social innovation. In these cases, *Process innovation* often means technical upgrades (energy-efficient mining equipment, leak detection) and *Risk Management* covers climate transition and local pollution.

In contrast, service-sector firms (banks, fintech, aviation) emphasize governance and community engagement. Banks (Halyk Bank, Bank CenterCredit) center on *Continuous Improvement* and *Social Responsibility* via credit products (green loans, financial literacy) more than on tangible environmental controls. Kaspi's standout capability is its digital growth strategy, not any emissions metric. Samruk-Energy bridges both worlds: as a power utility it invests in turbines, but as a state company it is also judged on its social contributions.

Ownership and maturity also shape capabilities. Multinational or joint-venture firms (KPO, KAZ Minerals) generally display more advanced systems than purely domestic ones. For example, the operating companies of KPO are represented in its Sustainability Sub-committee, and Shell organized ESG training for sub-committee members and for reporting staff of joint ventures such as KPO, whereas KazMunayGas (state-controlled, with minority shareholders) shows more tentative steps and an emphasis on legacy CSR. Similarly, Kaspi (with foreign shareholders) maintains rigorous ADS governance, whereas purely local firms can be slower on such mechanisms.

Generally, the firms with the broadest external investor exposure (Halyk Bank, Kaspi, Kazatomprom) articulate their strategy and disclose externally in more detail. Companies with less external investor exposure (Samruk-Energy, whose sole shareholder is Sovereign Wealth Fund Samruk-Kazyna JSC, Bank CenterCredit) are still building the "institutional infrastructure", e.g. policies, committees, and reporting channels, that other companies already have in place.

Even among similar sectors, differences emerge. Among banks, Halyk Bank leads in technology adoption and ESG reporting, whereas Bank CenterCredit is still at an early stage of sustainability integration. In the extractive sector, KAZ Minerals reports extensive technology use (AI in the mine to mill process, drones), while Kazatomprom emphasizes R&D and measures to reduce the consumption of reagents and energy, and KazMunayGas has only recently started renewable energy projects. Among people-oriented practices, some firms emphasize internal empowerment (Air Astana's volunteer culture, KPO's gender initiatives), whereas others focus on hiring or committees. These variations may reflect differences in organizational culture, leadership vision, and stakeholder pressures.

Cross-case analysis capability profiles

Synthesizing the cross-case patterns, three broad "capability profiles" emerge.

First, Institutional Integrators. These firms (e.g. Halyk Bank, KAZ Minerals, Eurasian Resources Group, BI Group) have highly structured capabilities across multiple PBCs and report formal governance, ESG anchored in strategy, and advanced technology. They pursue both compliance and innovation: risk committees coexist with R&D and innovation units (e.g. Eurasian Resources Group's R&D Centre, Halyk Bank's software subsidiary Halyk Lab). Their reports present sustainability as strategic and describe first changes of the core business model (e.g., smart mining, green financing, sustainable urban development). These organizations correspond to what Teece [130] terms dynamic capabilities, which are routines that allow sensing and seizing sustainability opportunities. In Luhmannian terms, their self-descriptions draw extensively on the language of sustainability, and they have strong "structural couplings" (partnerships, certifications) to the environment.

Second, Compliance Builders. This group (e.g. KazMunayGas, Samruk-Energy, Bank CenterCredit) is characterized by foundational, compliance-oriented capabilities. They have mainly instituted policies and committees, focusing on regulatory risk, CSR programs, and basic reporting. Operationally, their sustainability efforts tend to be incremental (efficiency improvements, community donations). This dissertation might call them "reactive" in that their self-description is still dominated by legacy operational identity (oil & gas producer, energy utility, bank). Complexity management is achieved mostly through formal controls and outsourcing. However, even these firms show emergent innovation in specific sub-business capabilities (e.g. hybrid energy projects, digital customer onboarding) as they adapt.

Third, Emergent Innovators. The remaining cases (e.g. Air Astana, KPO, Kaspi, Kazatomprom) show mixed but flexible profiles. They add new capabilities in response to immediate challenges. For instance, Air Astana digitized its handling of passenger complaints and lists a crew rostering optimizer among its priorities for 2025, while KPO reports initiatives for women in the oil and gas industry and agreed the greening plans for its sanitary protection zone with local stakeholders. These firms may not have full system-wide integration, but they report individual innovations that cut across PBCs. They also emphasize relational capabilities (stakeholder engagement, training ecosystems). They are labeled "adaptive strategists": their core identity remains rooted

in the original business, and they use sustainability as a lever for innovation and resilience. Some (like Kazatomprom) show features of the Institutional Integrator pattern, while others (like Kaspi) remain specialized and externally focused.

Table 19 summarizes these typologies and illustrative features. The table provides a comparative overview of how different clusters of companies manage sustainability-related complexity through distinct capability patterns. The Capability Type column describes each group's overarching approach to ESG challenges. The second column, *Representative Companies*, names the firms within this study that most clearly exemplify each type, grounding the abstract patterns in concrete examples. The third column, Core PBC Strengths, indicates which of the four Packed Business Capabilities are most fully developed and most actively used within the group. These strengths reflect the foundational capabilities that shape each cluster's ESG effectiveness. The Illustrative Recurring Sub-Capabilities column lists deductively coded practices found consistently across firms in each group. These capture common, embedded operational patterns. Finally, *Distinctive Inductive Capabilities*, shows novel or emergent practices that set each cluster apart. These inductively identified capabilities show where companies move beyond established routines in addressing sustainability-related complexity.

Table 19 – Cross-case capability profiles

Capability Type	**Representative Companies**	**Core PBC Strengths**	**Illustrative Recurring Sub-Capabilities**	**Distinctive Inductive Capabilities (examples)**
Institutional Integrators	Halyk Bank, KAZ Minerals, Eurasian Resources Group, BI Group	Balanced, system-wide maturity across Strategy, People, Process, Technology	Strategic Management (board-level ESG KPIs), Organizational Structure & Staff (board and regional sustainability committees), Risk Management (climate-related risk assessment), Data Management & Reporting (GRI-based sustainability reporting)	Decarbonisation Think-Tank (Eurasian Resources Group), Smart-home IoT ecosystem (BI Group), Drone-based hazard mapping (KAZ Minerals), Portfolio carbon footprint methodology (Halyk Bank)

Compliance Builders	KazMunayGas, Samruk-Energy, Bank CenterCredit	Stronger on formal Process/Risk controls, early-stage Strategy & Tech depth	CSR/Philanthropy programs, Supply-Chain Sustainability policies (codes of conduct and contractual supplier requirements), Continuous Improvement via energy-efficiency retrofits	Automated environmental monitoring (Samruk-Energy), Digital mortgage application (Bank CenterCredit), Hybrid wind, solar, and gas power plant (KazMunayGas)
Emergent Innovators	Air Astana, KPO, Kaspi, Kazatomprom	Agile Process & People capabilities, selective Tech or Strategy breakthroughs	Employee Empowerment (employee fundraising, volunteering), Process Innovation & Adaptation (digitized complaint handling, electronic work permits), Stakeholder Communication (multichannel forums)	Disaster-response lending holidays (Kaspi), Mentoring for women in oil and gas (KPO), In-house training and maintenance facilities (Air Astana), Science and technology hackathon (Kazatomprom)
Note – Compiled by the author based on the sustainability and annual reports of Study II.				

The typology suggests that firms combine compliance-driven and innovation-driven sustainability management in different proportions. It aligns broadly with literature on organizational ambidexterity and maturity, where firms progress from reactive (reduction of negative externalities) to proactive (sustainability as value driver) approaches [130; 131]. The cross-case patterns also indicate that national and sectoral context influences how these capability types manifest in Kazakhstan's economy.

Theoretical embedding

The findings can be interpreted through the lens of Niklas Luhmann's Social Systems Theory and related constructs of organizational communication and complexity management. Luhmann posits that organizations are systems that observe their environment and self-create through internal complexity [15]. In this view, a sustainability report functions both as a disclosure and as a system's self-description that reduces

environmental complexity by specifying selective meanings [127]. This is visible in practice: for example, the recurring adoption of global frameworks (GRI, UN SDGs) can be read as an organization structurally coupling to the world of sustainability expectations. By embedding such standards into codes of conduct or risk models, companies symbolically align their "own language" with the larger social system's language of environmental responsibility.

Luhmann also emphasizes self-reference: systems interpret information primarily through their existing structures. The cross-case analysis shows that firms' internal structures (committees, policies) and past practices (e.g. legacy CSR) shape how they respond to sustainability-related complexity. The inductively discovered capabilities such as KPO's initiatives for women in the oil and gas industry or BI Group's urban innovation programs represent points where the system has extended its own categories (e.g. expanding "innovation" to social domains) in reaction to new environmental demands. This corresponds to Luhmann's idea that complexity is managed by generating new codes and routines (as complexity) internally. For instance, the agreement of greening plans with local stakeholders at KPO, coded as Community Co-Design for Ecological Planning, can be read as a structured process through which the firm's system deals with the social complexity of community relations.

From a complexity perspective [131], organizations facing "wicked" sustainability problems require both adaptive and administrative functions. The identified patterns correspond to this requirement. The Institutional Integrators have strong administrative systems (formal governance, iterative planning) that reduce uncertainty through hierarchy and process. At the same time, emergent innovations and decentralized elements were observed (e.g. Air Astana's employee campaigns, Eurasian Resources Group's Corporate University) that fulfill adaptive functions. Eurasian Resources Group, for example, established a Decarbonisation Think Tank that acts as a center of excellence for decarbonization and launched a transformation program. These are procedures that build complexity at the edge of the organization. The data are thus consistent with Luhmann's point that complex problems (ecological, social) can only be "observed" and processed by the organization through its own resources (understood as complexity), which must evolve.

Finally, the analysis resonates with notions of organizational learning and sensemaking [132] in complex environments. The sustainability reports describe how many firms established continuous-review and feedback loops (process KPIs, ESG committees) that constitute a learning infrastructure. Communication capabilities such as stakeholder dialogues support sensemaking. Mapping stakeholders and incorporating their input extends system boundaries and brings external complexity into internal discourse.

Social Systems Theory helps interpret how the reported capabilities organize responses to sustainability expectations [15; 53]. Policies, responsibilities, reporting arrangements, and supplier interfaces determine which issues enter organizational decisions. They also define how those issues are handled. The reports describe initiatives that extend these arrangements. The analysis reconstructs selection and stabilization

from organizational self-description. It does not verify the operational effects of the reported capabilities.

Theoretical implications

This study advances theory on organizational capabilities and sustainability in several ways.

First, it demonstrates that **business capabilities can be fruitfully understood within a social-systems framework**. Traditional capability research [22] treats capabilities as firm resources or routines. Here it becomes clear that there are also constructs, i.e. shared codes and structures, that help an organization navigate external complexity. For example, new capability constructs that go beyond prior typologies are identified. Such constructs suggest that the capability literature should incorporate more of the sociological dimension of how capabilities emerge from organizational self-description and cultural context.

Second, the deductive-inductive cross-case approach illustrates how organizational self-referential closure coexists with openness. It was found that firms often publicly signal progress (adhering to GRI, UN Global Compact) while their internal emphasis may lag or differ. This supports a Luhmannian insight that social systems cannot control their environment but only produce internal representations [127]. Theoretical models of sustainability governance should thus account for this asymmetry, since a capability may exist on paper but not (yet) in practice, or vice versa. In other words, the presence of formal structures (deductive codes) does not automatically mean effective systemic change without the inductively emergent practices to activate them. The findings extend complexity theory in organizations by highlighting the nested nature of sustainability capabilities from strategy to technology and the need to align them.

Third, this work links the literature on **organizational complexity and capability development**. The proposed typology echoes the literature and suggests that emerging-economy firms combine building reliability (compliance) and building innovation in different sequences. It echoes the viable-systems perspective that the survival in complex scenarios requires maintaining resource and process configurations that are sustainable over time [133]. The cross-case results thus inform a richer theory of how heterogeneous firms evolve different sustainability capability configurations depending on their structural couplings (state ownership, global integration, etc.).

Practical implications

For Kazakh firms and policymakers, the analysis yields concrete lessons. At the firm level, the recurring sub-business capabilities suggest a “capability roadmap” for sustainability. Companies still focused on compliance might progress fastest by developing missing sub-business capabilities observed in peers. For example, a national energy company could move beyond CSR donations by agreeing environmental planning with local stakeholders (as seen at KPO) or by setting up an R&D center and a decarbonization think tank (as done at Eurasian Resources Group). The prominence of data management in all cases suggests that firms should invest in digital ESG platforms, which can support reporting and strategic decision-making.

Notably, human-capital capabilities emerged as central: communication and empowerment at all domains. Practitioners should therefore increase the involvement of

the whole firm, e.g. by setting up cross-functional ESG committees, training schemes, and internal communication campaigns to embed sustainability culture. Several companies showed that employee-driven initiatives (fundraisers, suggestion schemes) can activate otherwise unused potential, a finding that encourages leaders to empower staff.

For industry leaders, the typology indicates that leadership vision and resource allocation are relevant. Leading companies (e.g. Kaspi, Halyk Bank, KAZ Minerals) treat sustainability capabilities as strategic assets and invest accordingly. Other firms, especially those under state ownership, could learn from these peers by pursuing public-private partnerships and benchmarking against global best practices. For instance, aligning with industry-specific initiatives (like IATA for aviation) could accelerate supply-chain sustainability.

At the policy level, the study indicates the value of supportive frameworks. Regulators and government agencies might consider incentivizing the development of sub-business capabilities. For example, policy could encourage mandatory ESG training or require climate-risk disclosure. The hybrid public-private nature of many Kazakh organizations suggests that state holding companies could mandate ESG targets for their subsidiaries, diffusing capabilities more widely. The observed gap in climate scenario planning hints at a role for government guidance or capacity-building programs in climate resilience.

Future research

The study relied methodologically on reports and single-coder analysis. Future research could use mixed methods to validate and extend these findings. Interviews with sustainability managers could show how capabilities are mobilized. Longitudinal studies could trace their development. Comparisons across Central Asia and other emerging markets could test whether the typology transfers or remains context-specific. Quantitative surveys might statistically link specific capabilities to performance outcomes (market value, emissions reduction).

Theoretically, the identification of inductive sub-business capabilities opens paths for further conceptual work. Scholars could investigate the microfoundations of these new constructs (e.g. what drives the emergence of youth forums or of supplier capability building) and how they interact within the social system. Also, examining how informal communication networks (stories, narratives) propagate these capabilities could enrich the social-systems perspective on organizational change. Finally, incorporating perspectives from complexity science (e.g. agent-based modeling of organizational learning) might show how different capability configurations affect resilience under stress (e.g. commodity shocks, regulatory change).

Limitations

Several limitations should be acknowledged. First, the analysis is based entirely on documentary data (sustainability reports). These sources provide extensive official information. They are self-reported and may favor positive framing. Second, coding was performed primarily by one researcher. Although reliability checks were employed, qualitative interpretation remains subjective. Some context-dependent meanings in the reports might have been missed or misclassified. Third, the study is cross-

sectional: it captures a snapshot. Capabilities change over time, so longitudinal research would better capture their development. Fourth, the sample emphasizes large, prominent firms with relatively mature reporting. The findings may not apply to smaller companies, which may follow different patterns. Finally, the study emphasizes systems and communication. Other perspectives, such as institutional theory, could add explanations. Within these limits, the study provides a cross-case account of capabilities.

Inductively derived themes complement the deductive sub-business capabilities. They reveal emerging areas that the theoretical model alone did not capture. Combining both approaches helps examine how sustainability is described as part of organizational routines and structures.

The analysis identifies fragmented capability areas, limited cross-functional integration, and inconsistent communication of technology-based ESG initiatives. These gaps point to a need for further coordination and integration as ESG practices develop.

2.3 Cross-context synthesis of German and Kazakh organizational response patterns

The two studies provide different evidence. Study I uses interviews and associated public sources to reconstruct accounts of embedded routines, governance, and practical responses. Study II uses public sustainability and annual reports. It captures self-description, public capability claims, and the evidence firms disclose. Section 2.3 compares capability patterns, disclosed priorities, and context-dependent configurations. It does not treat the evidence sources as equivalent. Differences must be interpreted in terms of institutional context, period, and evidence modality [14; 15; 16; 25; 102].

All comparisons in Section 2.3 concern these two forms of evidence. Statements such as "Western firms X, while Kazakh firms Y" compare interview-based accounts of practice with report-based capability claims. The DACH evidence reconstructs embedded practice from interviews. The Kazakh evidence shows how reports articulate capabilities. Such statements do not compare operational practice observed in the same way. This caution applies throughout the section.

Comparative framing

In Luhmann's Social Systems Theory, organizations process environmental demands through their own communication and decision structures [137]. Sustainability expectations enter organizational activity through strategies, reporting categories, responsibilities, and procedures. A climate-related demand may become a risk-management rule or a supplier requirement [138]. This perspective guides the comparison of reported responses. The empirical analysis examines capability patterns. Social Systems Theory provides the interpretive lens.

Organizational capabilities, in this context, are understood as repeatable patterns of actions in the use of assets to achieve desired outcomes. In complex environments, dynamic capabilities, i.e. those enabling adaptation, learning, and innovation, become critical for survival and differentiation [130; 60; 136; 26; 139]. The Packed Business

Capabilities framework, developed in the first study, clusters such capabilities into four interrelated categories: Strategy, People, Process, and Technology. Each category comprises multiple sub-business capabilities such as Strategic Management, Employee Empowerment, Risk Management, or Technology Adoption. The sub-business capabilities operationalize organizational responses.

Comparative procedure

The studies are compared along the four PBC domains: Strategy, People, Process and Technology. Study I provides interview-based accounts of internal organizational responses, while Study II examines public self-description in reports [140]. The comparison identifies shared patterns, differences and inductive additions. Differences are interpreted in light of evidence modality and observation period. Section 1.3 specifies the research design.

Findings

The findings are organized by the four core Packed Business Capabilities: Strategy, People, Process, and Technology. Each section examines how organizations construct and operationalize each sub-capability and contrasts their manifestations across both empirical contexts.

Strategy

Both studies describe Strategic Management, but with different emphasis. It was rated Low in five German cases and Mid in one, as shown in Table 18. Interviewees mainly described sustainability through structures and processes. Ukko et al. [136] find that sustainability strategy strengthens managerial capabilities in Western SMEs. Kazakh reports give strategy more prominence, with substantial variation between firms. Some leading banking and energy firms describe roadmaps linked to frameworks such as the UN SDGs. Others show symbolic alignment. Scenario-based planning emerged inductively in Kazakh banks. This suggests increasing attention to risk-aware foresight and possible convergence with Western patterns at different stages.

People

German People capabilities were described through organizational structures and routines. Organizational Structure & Staff was rated High or Mid in five cases. Employee Empowerment was rated High in three, as shown in Table 18. Interviewees emphasized internal champions, cross-departmental alignment, and incentives. Ukko et al. [136] similarly stress managerial capabilities under digital and sustainability pressures. Kazakh reports often describe a dedicated ESG unit under communications or risk. Several also received high scores for training and empowerment, particularly in finance and transport.

Communication differs most clearly. It was rated Low in all German cases and was largely part of internal coordination. Kazakh firms use it to support transparency and investor confidence. Internal training infrastructure and cross-functional integration emerged inductively in both contexts.

Process

In the German cases, Process Innovation & Adaptation was rated Mid or High throughout. Supply Chain Sustainability received these ratings in five cases, and Risk Management was rated Mid in all six. Continuous Improvement, Product Innovation

& Adaptation, Social Responsibility, and Innovation for Sustainability were rated Low throughout, as Table 18 shows. Firms described audits, certifications, and collaborative supplier programs.

Kazakh process capabilities were uneven. Some reports describe structured innovation and embedded CSR partnerships. Others emphasize compliance. Risk Management and Social Responsibility were the most frequently addressed areas, often through compliance or philanthropy. Customer experience and logistics optimization emerged inductively, especially in aviation and construction. These resemble Western patterns of integrating sustainability into customer-facing processes.

Technology

Technology capabilities were limited in the German cases and mixed in the Kazakh reports. In the German cases, Data Management and Reporting and Technology Adoption were rated Low in all six cases (Table 18), and one interviewee described data collection in "folders and Excel tables". In Kazakhstan, this area was uneven but shifting. Digital logistics standards, centralized ESG data warehouses, and fleet modernization efforts were observed in reports from advanced sectors. While deductive indicators were weaker overall, inductively observed elements suggest emergent convergence. A systematic difference in technology maturity between the two corpora therefore cannot be derived from the present material.

The following table summarizes the prior elaboration and provides a consolidated overview of the Packed Business Capabilities with their sub-constructs (Business Capability) and contrasts the firms.

Table 20 – Cross-regional contrasts of Business Capabilities

Construct (Packed Business Capability)	**Sub-Construct (Business Capability)**	**Western firms**	**Kazakh firms**
Strategy	Strategic Management	Rarely formalized as a sustainability strategy, sustainability anchored in structures and processes (Low in five of six cases, Mid in one)	Strategy present but less formalized; goals often high level; selective alignment with business model
People	Organizational Structure & Staff	Dedicated sustainability departments or decentralized functions with embedded roles (High or Mid in five of six cases)	Small central teams; role ambiguity; reliance on champions; emerging governance

	Employee Empowerment	Training and management support, local empowerment with oversight (High in three of six cases, Low in two)	Ad hoc training; less role-tailoring; empowerment uneven and dependent on leadership support
	Communication	Rarely articulated as a separate capability, largely absorbed by internal coordination (Low in all six cases)	Communication used for signaling and legitimacy; internal channels less structured
Process	Supply Chain Sustainability	Supplier development, audits, and supplier management systems (High or Mid in five of six cases), traceability still limited	Compliance-driven onboarding; selective supplier engagement; limited traceability depth
	Risk Management	Supplier and internal management systems with guidelines and supplier risk analyses (Mid in all six cases)	Policy-centric, compliance oriented; risk tools partial; limited cross-functional integration
	Process Innovation & Adaptation	Adapted sourcing and operational processes (Mid or High in all six cases), continuous improvement rarely articulated	Project-based adaptation; fewer standardized routines; dependence on external prompts
	Product Innovation & Adaptation	Reformulations and design changes rarely articulated (Low in all six cases)	Isolated substitutions; constraints from supply and performance; slower diffusion
Technology	Data Management & Reporting	Basic reporting with limited system support, one interviewee reports data held in folders and Excel tables (Low in all six cases)	Manual data collection; inconsistent KPIs; basic reporting processes

	Technology Adoption	Minimal tool and system changes, ERP integration named as a challenge by one interviewee (Low in all six cases)	Low to moderate adoption; limited system integration; spreadsheets and point tools dominate
Note – Compiled by the author based on Study I and Study II.			

The cross-regional contrasts documented in the table above vary by capability and by case. A comparable aggregate maturity score cannot be derived from the present synthesis, because the two studies rest on different evidence types. The German cases show capability configurations built on people and process routines, while Kazakh cases more often reflect emerging or partially embedded routines, especially in standardized process controls. Data and technology enablement is weakly developed in the German cases and uneven in the Kazakh reports.

To consolidate the cross-regional contrasts, the propositions synthesize recurring patterns across cases. The propositions function as analytic generalizations grounded in the comparative rationale of Study I and Study II, and they complement the table above by articulating the mechanisms that underlie the observed differences. To make the contribution of this comparative chapter explicit, the next eight propositions synthesize the replicated patterns across both empirical view (interviews in Germany vs. public reporting in Kazakhstan). They are not descriptive restatements, but mid-range scientific claims that link contextual conditions (e.g., policy and assurance density, data maturity, supply-chain position) to how Packed Business Capabilities (PBCs) are configured and sequenced under sustainability pressure. The subsequent subsection then explains the mechanisms through which these propositions are proposed to generate the observed cross-context differences.

P1. Strategy formalization. In the interview data, German organizations rarely describe formalized sustainability strategies with targets and KPI regimes and anchor sustainability in structures and processes instead (Strategic Management rated Low in five of six cases, Table 18). In their public reporting, Kazakh firms articulate strategic intent prominently, often with reference to international frameworks, while its execution remains uneven.

P2. Organization design and empowerment. In the interview data, German organizations combine a central sustainability function with embedded roles and employee empowerment (Organizational Structure & Staff rated High or Mid in five of six cases), enabling local decision rights under clear oversight. In their public reporting, Kazakh firms rely more on small central teams and informal champions, which constrains diffusion and slows embedding.

P3. Communication role. In the interview data of German organizations, communication is rarely articulated as a separate capability (rated Low in all six cases) and is largely absorbed by internal coordination. In the public reporting of Kazakh firms, it

is more performative and legitimacy oriented, which increases visibility but can substitute for deeper internalization.

P4. Supply chain operating model. In the interview data, German organizations balance auditing with supplier development and segmentation, supported by traceability pilots (Supply Chain Sustainability rated High or Mid in five of six cases). In their public reporting, Kazakh firms emphasize compliance at onboarding and episodic controls, with limited capability transfer to suppliers.

P5. Risk integration. Risk management is an established capability in both corpora. In the interview data, it is rated at a medium level in all six German cases and linked to supplier and sourcing decisions. In their public reporting, Kazakh firms present Risk Management as the most uniformly advanced Process capability (sub-chapter 2.2).

P6. Data and technology. Data Management and Reporting and Technology Adoption were rated Low in all six German cases. They were the least developed capabilities in the interviews. Kazakh reports describe manual data collection and point solutions. These limit feedback loops and learning over time.

P7. Process innovation and adaptation. In the interview data, German organizations adapt sourcing and operational processes (Process Innovation & Adaptation rated Mid or High in all six cases), whereas continuous improvement routines are rarely articulated (rated Low in all six cases). In their public reporting, Kazakh firms adapt more project-by-project with fewer standardized routines and stronger dependence on external prompts.

P8. Product innovation and adaptation. German interviewees rarely described product reformulations or design changes. Product Innovation & Adaptation was rated Low in all six cases. Kazakh reports describe isolated substitutions limited by supply availability and performance requirements.

The propositions organize the discussion that follows. P1 to P2 frame differences in Strategy and People. P3 addresses the role of Communication in alignment versus signaling. P4 to P5 specify contrasts in supply chain operating models and the integration of risk. P6 covers data and technology enablement. P7 to P8 address process and product innovation and adaptation. The following figure summarizes the propositions at a glance.

Propositions at a glance (P1-P8)

- P1: Strategy formalization. German organizations anchor sustainability in structures and processes more than in formal strategy. Kazakh reporting articulates strategic intent prominently.
- P2: Organization design and empowerment. German organizations combine a central sustainability function with embedded roles. Kazakh reporting shows small central teams and informal champions.
- P3: Communication role. In German organizations communication is absorbed by internal coordination. In Kazakh reporting it is more legitimacy oriented.
- P4: Supply chain operating model. German organizations balance auditing with supplier development. Kazakh reporting emphasizes onboarding compliance and episodic controls.
- P5: Risk integration. Risk management is established in both corpora, at a medium level in the German cases.
- P6: Data and technology. Least developed domain in the German cases. Kazakh reporting shows manual collection and point solutions.
- P7: Process innovation and adaptation. German organizations adapt sourcing and operations. Kazakh reporting shows project-by-project adaptation.
- P8: Product innovation and adaptation. Rarely articulated in the German cases. Kazakh reporting shows isolated substitutions.

Figure 3 – Propositions at a glance

Note – Compiled by the author based on Study I and Study II.

This dissertation refers back to P1 to P8 when interpreting convergence and divergence across sectors, when noting boundary conditions, moderators, and when connecting the comparative insights to the response model developed in Chapter 3. The comparative patterns summarized in Table 20 and the propositions from above hold under specific conditions that shape how capabilities are built and sequenced across regions.

Industry intensity: Capital- and asset-intensive sectors emphasize "Risk Management" and "Data Management and Reporting" because their operational exposure is high and measurable. Retail and service contexts rely more on "Employee Empowerment" and "Communication" to align everyday decisions. In Kazakhstan, heavy industries tend to formalize compliance and permits faster than cross-functional integration.

Organization size/internationalization: Multinationals exposed to export markets adopt standardized KPIs, supplier programs, and audits to meet global customer and assurance requirements. Domestic and regional firms show more variation. Their capability building concentrates on areas with the strongest customer pressure.

Policy/assurance density: Dense reporting frameworks and active audit markets are proposed to encourage comparability, automation, and regular assurance. In Germany, these conditions strengthened after Study I's interviews. Where enforcement and

market expectations are changing, firms may start with policy statements and communication. Basic data capture may follow before risk and technology routines become integrated.

Supply chain position: Position affects which responses are feasible. Upstream producers can use backward integration and supplier development. This collaborative complexity can partly replace additional internal variety. Intermediaries and retailers have less influence over production. They therefore emphasize product standards, selective supplier screening, and consumer-facing narratives.

Data maturity: Baseline data quality is proposed to affect the speed and impact of technology adoption. Fragmented historical records and weak master data create barriers in both regions. Data Management and Reporting and Technology Adoption were rated Low in all six German cases, as shown in Table 18.

These boundary conditions may explain some differences in maturity and pace across cases. They qualify the expected similarities and differences and connect the propositions with the Chapter 3 response model.

Discussion

The comparison identifies shared and differing capability patterns under sustainability-related complexity. Kazakhstan's document analysis supports the public visibility and contextual applicability of the PBC framework developed from Western interviews. This support concerns organizational self-description and disclosed evidence, rather than direct observation of practice.

Capability maturity and its drivers differ between the corpora. Ukko et al. [136] similarly find that sustainability strategy can strengthen managerial capabilities while inhibiting operational capabilities in relation to financial outcomes. German interviewees described capabilities embedded in People and Process routines. This is consistent with Campbell's discussion of institutional and stakeholder pressure [141]. German regulatory enforcement intensified after Study I's interview period. In Kazakhstan, symbolic alignment, external legitimacy, and state ownership shape how capabilities are built and presented.

Some Kazakh reports describe sub-business capabilities absent from the Western interviews. These include strategic data infrastructures and logistics digitization standards. The inductive findings extend the understanding of sustainability capabilities in non-Western contexts. They also suggest hypotheses about how communication maturity and technical system sophistication may develop together.

Gaps between capability claims and operational detail are more visible in the Kazakh reports. Ambitious narratives often contain limited operational specification. Social Systems Theory suggests that this can reflect the reporting modality. Communication presents the system's self-description, while action requires separate evidence [142]. Sustainability reports may help firms build reputational capital while experimenting with embedded practices. Reports alone cannot establish these practices.

The comparison also shows how maturity signals and disclosed priorities vary between sub-business capabilities. Employee Empowerment was rated High in three of six German cases and linked to culture and training. Kazakh reports more often connected it with symbolic or philanthropic activities. Technology Adoption was rated

Low in all German cases, as shown in Table 18. In Kazakh reports, it was fragmented and tactical. Market maturity, institutional infrastructure, and cultural and governance norms may help explain these patterns.

Social Systems Theory helps interpret gaps between strategy and implementation. German accounts describe People and Process routines as the main response. Data Management and Reporting and Continuous Improvement remain weakly articulated, as Table 18 shows. Feedback mechanisms are less visible in Kazakh reports. Reports alone cannot establish the distance between communication and execution. Capability development therefore appears to involve both technical processes and maturity within the organizational system.

The cases do not suggest a uniform progression from low to high maturity. Capabilities may develop unevenly. Leadership commitment, sector norms, or international exposure may accelerate some areas before others. This challenges linear maturity models and supports further research on capability sequencing and interdependence.

Internal resources and external pressures both shape capability development. Through "capability signaling", organizations present sustainability narratives before capabilities are fully internalized. This aligns with Lyon & Montgomery [143]. Some cases may involve greenwashing. Others may reflect a transitional development stage. Future research should examine when signaling becomes connected to embedded structures.

Mechanisms proposed to explain the cross-context differences

The comparative contrasts summarized in Table 20 and the contextual moderators synthesized in this sub-chapter (formalized as Table 22 in sub-chapter 3.1) can be interpreted through four mechanisms that are proposed to explain why similar sustainability pressures are associated with different maturity profiles in the German and the Kazakh corpora. These mechanisms do not replace the propositions (P1-P8). Because Study I and Study II differ in period and modality, as specified in sub-chapter 1.3, the propositions P1 to P8 are read as context and period contrasts. Part of the observed differences may reflect the pre-regulatory timing of the German interviews. M1 and M2 refer to conditions that intensified in Germany after the interviews of Study I, so the contrasts they address are partly period contrasts. The mechanisms explain the "how" behind the propositions by specifying a proposed causal pathway from institutional conditions to observable capability configurations.

M1: Enforcement & grievance-channel mechanism (pressure becomes actionable)

Formal due-diligence obligations and accessible grievance or complaints channels can make sustainability risks more actionable. Kazakhstan's disclosure infrastructure has become more formal through the Kazakhstan Stock Exchange's ESG Data Platform and the Astana Financial Services Authority's ESG-related guidance within the AIFC. These initiatives improve comparability and documentation. Assurance capacity and verifier availability can still differ by sector and firm type.

When firms expect third parties to detect incidents and review remediation, routine risk identification becomes more valuable. The same applies to corrective-action

tracking and documented closure evidence. The proposed mechanism strengthens auditable control points and tends to shorten time-to-mitigation. Issues are less easily handled through symbolic communication alone. Under weaker enforcement, firms may treat the same pressures as discretionary CSR. This weakens escalation and the urgency of building end-to-end remediation routines.

M2: Assurance & verification mechanism (auditability disciplines capability design)

Assurance density affects how information is produced inside organizations. When sustainability statements require assurance, including limited assurance, firms need clear data definitions, traceable evidence, documented methods, and accountable governance roles. This supports data management, controls, supplier evidence capture, and technology-enabled consolidation. These capabilities reduce assurance exceptions and rework. Under lower assurance density, narrative and programmatic disclosure can coexist with fragmented measurement. Transparency alone does not establish auditability. The assurance regime influences whether firms invest in audit-grade traceability or rely mainly on narratives and indicators.

M3: Legitimacy & decoupling mechanism (communication can lead practice)

Sustainability communication can provide legitimacy before practices are embedded. Under institutional complexity, firms may adopt structures and narratives that signal alignment with globally accepted expectations. The result depends on whether communication later connects with operating routines. It may mobilize attention and resources and gradually support practical alignment. Weak feedback loops and verification incentives can instead leave communication loosely connected to practice. This is the risk of decoupling. The mechanism is proposed to explain the prominence and earlier sequencing of Communication in Kazakhstan. It may also explain uneven maturity across Strategy, People, Process, and Technology, with strong narratives alongside selected initiatives.

M4: Capability-cost and infrastructure mechanism (data maturity gates scaling)

Capability building has different costs across contexts. Mature data infrastructure, professional services, and standardized templates can lower the marginal cost of ESG data collection, supplier monitoring, and technology adoption. With lower data maturity, firms face higher costs for definitions, metering, and data ownership. They may therefore rely on manual workarounds, narrow indicators, and tactical technology pilots. This proposed mechanism helps explain why technology adoption and data integration appear less developed than strategy disclosures in Kazakh reports. Policies, training, and CSR initiatives can be developed locally. Supplier evidence chains and assurance-ready ESG data architecture need broader infrastructure. This may contribute to uneven development across PBC domains.



Figure 4 – Mechanism pathway proposed to explain cross-context differences

Note – Compiled by the author based on Study I and Study II.

Implications

The study applies Social Systems Theory to research across national contexts and evidence methods. It suggests that organizations manage sustainability-related complexity through internal differentiation and structures. Capability signaling through documentation adds a way to examine this process empirically.

Combining interviews and document analysis supports triangulation. The PBC coding frame provides a shared structure for both corpora. Study I applied it in NVivo and Study II in an Excel matrix. Future research could add a longitudinal dimension or integrate automated content analysis.

The German cases illustrate how sustainability can become part of People and Process routines. Kazakh reports show early adaptation and hybrid capability configurations. Policymakers and regulators in emerging markets may use the comparison to benchmark maturity and support capacity building.

Capability building is recursive. Organizational actions and narratives both contribute to capabilities. Narratives can then influence internal structures. Understanding this relationship helps design interventions and governance mechanisms.

This study offers a structured comparison of how organizations in Western and Kazakh contexts develop and use business capabilities to manage sustainability-related complexity. Drawing on Social Systems Theory, it indicates that such capabilities are internally constructed in response to external pressures. The PBC framework appears analytically transferable across contexts. Maturity, representation, and structural embedding still vary. By identifying both convergent patterns and context-specific deviations, the study contributes to theory development, practical benchmarking, and methodological advancement in the field of sustainability management.

The limitations of the comparative analysis, in particular the asynchronous time windows of the two studies and the different evidentiary modalities (interviews vs. public reports), are addressed in the structured limitations discussion in the Conclusion. Despite these constraints, the findings support that organizations, regardless of context, must continuously adapt internally to meet the changing complexity of sustainability requirements [70; 15; 55].

The comparative findings strengthen the core claim that organizations reduce environmental complexity by constructing internal complexity through business capabilities, while varying the mix of internal and collaborative responses [54]. First, Table 20 and the propositions indicate that "Communication" can operate as legitimacy work that precedes deeper internalization. In Kazakhstan, visible initiatives and narratives often come first, consistent with a capability signaling mechanism that can catalyze later capability build-up once attention and resources accumulate. Second, the German cases combine Organizational Structure & Staff, Employee Empowerment, and Process Innovation & Adaptation with Risk Management, while Data Management and Reporting and Technology Adoption remain weakly articulated (Table 18). Their routines are stabilized mainly through people and processes and less through data systems. Third, supply chain position acts as a structural moderator. Upstream producers can use backward integration and supplier development as collaborative responses that partly substitute for expanding internal variety, while retail and intermediary positions rely more on standards and selective screening. Fourth, the Kazakh reports are consistent with a sequence in which policy and communication are articulated before data capture and technology routines. This sequence is reconstructed from reports of different companies and years and was not observed within firms over time. Finally, policy and market infrastructure are proposed to function as ambient enablers. Where reporting, audit, and investor expectations are dense, internal capability building is expected to proceed faster and to be more codified. Chapter 3 encodes these insights as pathways and boundary conditions in the response model.

The language and the logical consistency of this chapter were reviewed with ChatGPT [194]. All revisions were made by the author.

3 EVIDENCE-INDUCED DEVELOPMENT OF AN ORGANIZATIONAL RESPONSE MODEL AND RECOMMENDATIONS FOR MANAGING SUSTAINABILITY-RELATED COMPLEXITY

Chapter 3 develops the Organizational Response Model (ORM) from the patterns reconstructed in Chapter 2. Sub-chapter 3.1 specifies its constructs and proposed relationships, sub-chapter 3.2 develops the scoring and classification instrument, and sub-chapter 3.3 sets out recommendations for application. Social Systems Theory informs the interpretation of selection and stabilization.

3.1 From Empirical Findings to the Organizational Response Model

Sub-chapter 3.1 translates the empirical response patterns into model constructs, relationships and decision rules. The derivation protocol records how these elements are carried forward from the two studies [144; 145]. The ORM specifies how sustainability pressures are translated into decision points, response portfolios, and auditable outcomes.

Status of Social Systems Theory and the Organizational Response Model

Social Systems Theory provides sensitizing concepts for interpreting selection and stabilization under sustainability-related complexity. The ORM is a capability-based management model developed from the empirical analysis and structured through design-science reasoning. Its constructs and decision rules are not direct deductions from Social Systems Theory.

The model uses a bounded SST vocabulary. It does not operationalize autopoiesis or the reproduction of communication. Its managerial contribution is specified below through capability portfolios, routing conditions and proposed outcome relationships.

Accordingly, references in this chapter to selection, stabilization, complexity reduction, and requisite variety should be read as interpretive concepts. They help explain the mechanism rationale behind the ORM, but they do not mean that the ORM is a formal operationalization of Social Systems Theory as a whole. In particular, the dissertation does not operationalize autopoiesis, self-reproduction of communication, or the full theoretical architecture of Luhmann’s social systems theory. It uses a bounded SST vocabulary to support the interpretation of organizational responses, while the ORM remains an independent management model developed for sustainability-related complexity in supply chains.

Derivation protocol

Sources of abstraction

The ORM draws on two complementary studies. Study I comprises 23 interviews with 17 German organizations. The interviews took place between August 2019 and March 2020. Their analysis established the four PBC domains and their sub-business capabilities. Study II applies this coding scheme to 20 reports from 11 Kazakhstani companies. The reports were published between 2022 and 2025. Inductive analysis adds context-specific sub-capabilities. The comparison in sub-chapter 2.3 informs the moderators and routing rationale. Chapter 3 documents how these findings enter the

model. The proposed outcome metrics support later evaluation. Their values and effects were not measured in the two studies.

Abstraction steps

The conversion from the empirical evidence to model constructs proceeds in four steps. First, the response-mechanism vocabulary is stabilized by adopting the PBC architecture and sub-capability labels as coded in Study I and confirmed/refined in Study II. This means that the ORM is derived from a capability-based empirical coding architecture, while SST remains the interpretive background for understanding why such capability portfolios matter for organizational complexity reduction and stabilization. The scheme comprises Strategy, People, Process, and Technology, each housing labeled sub-business capabilities used in sub-chapter 3.2 to specify how firms respond.

Second, moderators are lifted from the comparative analysis. Sub-chapter 2.3 identifies the model's scope conditions. These are industry intensity, supply-chain position, size and internationalization, policy and assurance density, and data maturity. They shift PBC weighting and sequencing. This limits the *re-reporting* of findings while making the ORM conditional [146; 147; 148].

Third, measurable outcomes are defined using constructs observable in the evidence and relevant to decisions. These are time-to-mitigation, auditable tier coverage, and coordination cost. They combine Study II's public-report orientation with Study I's documented risk, process, and data routines. They enable mechanism-oriented outcome metrics in sub-chapter 3.3 [130; 60; 136].

Fourth, routing conditions are added as conditions. Perceptual convergence and prevalent cross-firm orchestration operate as gates that route organizations toward different internal versus collaborative portfolio mixes in sub-chapter 3.2.

This derivation protocol adheres to analytic generalization in the sense of Yin [24], consistent with broader guidance on non-statistical generalizability [111]. Reliability and validity measures embedded in Studies I/II ensure carrying forward these constructs without re-describing cases.

Construct dictionary

Response mechanism: the PBC portfolio

The Organizational Response Model (ORM) treats the Packed Business Capabilities (PBC) as a configurable portfolio of organizational capabilities, clustered into four domains through which firms respond to sustainability-related complexity: Strategy, People, Process, and Technology. The portfolio view is necessary because organizations combine and re-weight sub-business capabilities across these domains in line with the signals of the routing conditions. The derived PBC portfolio items are explained below on the basis of the empirical insights. Strategy comprises strategic management activities such as roadmapping, portfolio steering, and board-level anchoring. People covers organizational structure and staffing, employee empowerment, and internal communication/liaison mechanisms. Process includes process and product innovation and adaptation, risk management, social responsibility, continuous improvement, and innovation for sustainability. It also includes supply-chain sustainability through supplier development, onboarding, and screening. Technology encompasses

data management and reporting as well as the adoption of systems and tools (e.g., Enterprise Resource Planning (ERP) systems) to capture and mobilize sustainability information. Empirically, Study I inductively identified the PBC categories and sub-capability labels from interview data (cross-case patterns), while Study II deductively applied this scheme to public reports and, where warranted by the evidence, added context-specific refinements. The lineage of each label (Study I to Study II) is documented in the following table.

The PBC portfolio connects issue selection to outcomes. It is the model's mechanism layer for translating how issues are framed and filtered into responses. Subchapter 3.1 specifies how moderators re-weight this portfolio and how routing conditions route the mix toward more internal or more collaborative realizations.

Table 21 – Mechanism's role in the ORM

Role in ORM	Domain	Construct	Operational definition	Lineage	Measurement cues / indicator
Mechanism	Strategy	Strategic Management	Formal steering of sustainability priorities (roadmaps, portfolio choices, target setting, board anchoring) that allocates resources across S/P/Pr/T in response to field conditions.	Inducted to Confirmed/refined	Existence of approved roadmap; budgeted initiatives; board minutes/mandates
Mechanism	People	Organizational Structure & Staff	Dedicated roles, reporting lines, and staffing patterns that embed responsibility for sustainability work across functions and tiers.	Inducted to Confirmed	Headcount/FTE by role; span of control; RACI clarity index
Mechanism	People	Employee Empowerment	Decision rights, incentives, and local autonomy enabling frontline closure of incidents within defined guardrails and escalation paths.	Inducted to Confirmed	% cases closed at edge; incentive linkage; training coverage

Mechanism	People	Communication (internal liaison)	Structured channels (intra-firm, cross-function) for timely coordination on sustainability issues and exceptions.	Inducted to Confirmed	Review schedule of liaison forums; SLA for responses; message reach
Mechanism	Process	Process Innovation & Adaptation	(Re)design of operational processes to incorporate sustainability constraints and improvements.	Inducted to Confirmed	# processes redesigned; time to embed; auditability of changes
Mechanism	Process	Supply-Chain Sustainability	Supplier onboarding, development, screening, and relationship routines that diffuse requirements and support corrective action across tiers.	Inducted to Confirmed/refined	% suppliers pre-qualified; # development engagements; audit pass rate
Mechanism	Process	Risk Management	Integration of ESG risks in enterprise risk systems (registers, heat maps, escalation, scenario testing) to stabilize corrective workflows.	Inducted to Confirmed	Risk register completeness; escalation SLA; variance in T2M

Mechanism	Process	Product Innovation & Adaptation	Adjustments in product design/specifications to meet sustainability constraints or targets.	Inducted to Confirmed	# SKUs adapted; compliance rate; lifecycle metrics available
Mechanism	Process	Social Responsibility	Structured social impact programs connected to supply/value chain practices (beyond philanthropy), with traceable outcomes.	Inducted to Contextualized	Program KPI set; beneficiary coverage; verification artifacts
Mechanism	Process	Continuous Improvement	Kaizen-like routines that capture incidents/learned lessons and update SOPs to reduce recurrence.	Inducted to Confirmed	# lessons logged; SOP updates; recurrence rate
Mechanism	Process	Innovation for Sustainability	Dedicated exploration/exploitation pipelines (pilots, proofs-of-concept) targeting sustainability performance.	Inducted to Contextualized	# pilots; pilot-to-scale ratio; time to scale
Mechanism	Technology	Data Management & Reporting	Canonical data layer (master data, audit trails, KPI architecture) and reporting processes that render performance auditable and portable.	Inducted to Confirmed/refined	Data completeness; % records with audit trails; # integrated systems/APIs

Mechanism	Technology	Technology Adoption (ERP/infrastructure)	Deployment of digital tools (ERP/QMS/modules) capturing sustainability events, evidence, and interfaces to external schemes.	Inducted to Confirmed/refined	Module uptake; API availability; interoperability score
Note – Compiled by the author based on Study I and Study II.					

Moderators (scope conditions)

Moderators identify ambient or structural conditions that shape how the PBC portfolio is configured and how quickly it embeds. This chapter imports them from sub-chapter 2.3 and they are used later in this sub-chapter to condition mechanism claims, configuration rows (CIMO), and routing conditions. Five moderators are carried forward: **industry intensity**, **supply-chain position**, **organization size/internationalization**, **policy/assurance density**, and **data maturity**. Industry intensity (e.g., asset-intensive versus retail contexts) raises demand for routinized risk/process responses and typically accelerates formalization of technology/data. Supply-chain position differentiates points of leverage: upstream producers tend toward supplier development, while downstream retailers/intermediaries emphasize standards and screening. This implies distinct collaborative shares. Interviewees and reports indicate that organization size/internationalization lower per-unit coordination costs and favor earlier formalization of People/Process/Technology. Policy/assurance density, which comprises applicable standards, mandatory reporting, and verification capacity, tends to accelerate technology/data formalization, increase auditable tier coverage, and make collaborative mechanisms cheaper to operate. Data maturity formalizes the feasibility and speed of risk/process routines and the ability to achieve time-bounded mitigation and coverage. These moderators represent a **sufficient set** repeatedly implicated in the comparative synthesis in sub-chapter 2.3 and visible across Studies I/II as drivers of differential embedding and sequencing. However, adding more moderators would dilute explanatory focus, while fewer would under-specify observed heterogeneity. The following table summarizes the above elaboration.

Table 22 – Overview ORM moderators

Role in OR	Construct	Operational definition	Lineage	Measurement cues / indicators
Moderator	Industry intensity	Sectoral exposure to hazards, scrutiny, and regulation shaping the urgency and depth of routinized Process/Technology responses.	Imported from sub-chapter 2.3	Incident prevalence; regulatory triggers; sector indices
Moderator	Supply-chain position	Position in the chain (upstream producer vs. downstream intermediary/retailer) determining use (development vs. screening).	Imported from sub-chapter 2.3	% make vs. buy; control over specs; supplier leverage metrics
Moderator	Organization size / internationalization	Scale and geographic dispersion affecting formalization speed, coordination costs, and feasibility of shared infrastructure.	Imported from sub-chapter 2.3	Headcount; countries; revenue; network centrality
Moderator	Policy / assurance density	Density of applicable standards, mandatory reporting, and verification capacity that lowers joining friction and boosts auditability.	Imported from sub-chapter 2.3	# applicable standards; # accredited verifiers; disclosure obligations
Moderator	Data maturity	Availability, quality, and systemization of sustainability-relevant data enabling risk/process routines and reliable mitigation timelines.	Imported from sub-chapter 2.3	Data quality score; % systems integrated; lineage completeness
Note – Compiled by the author based on Study I and Study II.				

Operational routing conditions

The ORM uses two field-level routing conditions. Perceptual convergence is the extent to which actors across tiers share priorities, issue framings and basic control logics. Prevalent cross-firm orchestration is the availability and maturity of coordination infrastructure, including standards, verifiers, joint audit arrangements and shared platforms. Their conceptual origin is acknowledged in the author's chapter in a collective monograph [161].

These conditions inform the proposed allocation of effort between internal capability building and collaboration. They are distinct from system boundaries in Social Systems Theory [14; 15; 16; 23]. Table 23 summarizes the constructs. Their response-type logic is specified later in sub-chapter 3.1 and their scoring procedure in sub-chapter 3.2.

To support the routing conditions in sub-chapter 3.2 without the necessity of a conceptual detour, two operational routing conditions from the author's chapter in a collective monograph [161] are adopted as conditions to route portfolio allocation. First, Perceptual convergence is the degree to which salient actors across tiers (buyers, suppliers, auditors, civil society) share a common *problem framing, salience,* and *basic control logic* for a given sustainability issue. High convergence means the same issues are prioritized, hazard-mitigation pairings are similar, and priorities remain aligned over time. Second, Prevalent cross-firm orchestration refers to the maturity and practical visibility of field-level coordination infrastructure, such as recognized standards, accredited verifiers, and shared platforms that make collaborative screening, assurance, and mitigation feasible at scale. Later in this sub-chapter, these routing conditions structure a four-cell response type matrix (low/low, high/low, low/high, and high/high) and define transition triggers (e.g., rising orchestration). Because both routing conditions are measurable from the same empirics in chapter 2 (interviews plus public documents), they enhance the auditability of the managerial guidance in sub-chapter 3.3. Table 23 summarizes the two operational routing conditions.

Table 23 – Operational routing conditions

Role in ORM	Construct	Operational definition	Lineage	Measurement cues / indicator
Routing conditions	Perceptual convergence	Degree to which salient issues and framings are shared across tiers (buyers, suppliers, auditors, civil society).	Neske [161] Operationalized here	Topic-overlap index; materiality-map convergence; co-mention frequency
Routing conditions	Prevalent cross-firm orchestration	Presence/maturity/visibility of standards, joint audits, verifiers/MSIs furnishing shared instruments for screening/assurance/mitigation.	Neske [161] Operationalized here	Scheme membership; supplier coverage under standards; verifier capacity
Note – Compiled by the author based on [161].				

Outcomes (for model alignment and governance)

The ORM proposes three outcomes for managerial evaluation. Time-to-mitigation measures the time from validated detection of a non-conformity to verified closure. Auditable tier coverage measures the share of a defined scope supported by verification-grade evidence. Coordination cost measures the resources required for a stated level of coverage or mitigation. These variables support future evaluation. The present dissertation does not test the model's effects on them.

These are proposed managerial outcomes, not direct measures of communication reproduction in Social Systems Theory [149; 150]. Table 24 summarizes them [71; 125]. Sub-chapter 3.2 specifies their measurement and sub-chapter 3.3 their use in governance reviews.

Table 24 – Overview outcomes of the ORM

Role in OR	Construct / Label (exact)	Operational definition	Lineage	Measurement cues / indicator
Outcome	Time-to-mitigation (T2M)	Days from validated detection of a non-conformity to verified closure by an effective corrective action.	Aligned across I/II	Median/95th-percentile T2M; SLA adherence; dispersion (σ)
Outcome	Auditable tier coverage (ATC)	Share of spend/suppliers/sites for which audit-ready evidence of conformity exists (own or shared).	Aligned across I/II	% spend/suppliers covered by verified controls; tier breakdown
Outcome	Coordination cost per covered spend (CC/S)	Internal + external orchestration cost to achieve a unit of verified coverage or mitigation, normalized by covered spend.	Aligned across I/II	Internal FTE hours; assurance fees; €/covered € (or %)
Note – Compiled by the author based on [71; 125].				

Scope and boundaries

Evidence scope

The empirics span two complementary temporal windows and data modalities that support analytic generalization. Study I was conducted between August 2019 and March 2020 in Germany. Its interview-based design foregrounded embedded routines and enabled the inductive development of the Packed Business Capabilities (PBC) architecture from practice. Study II analyzed sustainability reports issued between 2022 and 2025, capturing post-2020 disclosure dynamics and the maturation of ESG frameworks in Kazakhstan. These windows are intentionally complementary: whereas Study I emphasizes how capabilities are enacted within organizations, Study II emphasizes how capabilities are articulated and assured in the public domain.

Sectoral and positional coverage were selected to elicit variation in capability portfolios and ambient conditions. Study I spans textiles, food, beverages, cosmetics/cleansing, chemicals, and retail, with cases situated at both producer and retailer positions, thus varying supply-chain position, asset intensity, and customer proximity. Study II covers banking, energy/mining, transportation, construction, and adjacent sectors in Kazakhstan in which public reporting is substantively developed. Case listings and within-case materials are provided in Chapter 2 and the appendices.

The two studies also differ by data modality and triangulation measures. Study I combines interview transcripts with public sources under a case protocol/database to ensure transparency and replication approach. Study II applies a transparent coding matrix with intra-coder checks to stabilize the codebook and its application. These design features collectively secure construct stability and traceability, which are prerequisites for the analytic generalization pursued in Chapter 3.

Analytic generalization

The Organizational Response Model (ORM) is analytically generalized from replicated patterns across heterogeneous cases (Study I) and is corroborated and extended through document evidence (Study II). This generalization step, made explicit in the protocols, databases, replication approach, and codebook stability of both studies, allows constructs, moderators, and routing conditions to be lifted into the model.

Limitations of the empirical findings and model

Several limitations follow directly from the design. First, the Western evidence concentrates on Germany and the broader DACH context, where sustainability expectations and assurance/reporting density are comparatively stringent. Transfers to jurisdictions with lower assurance density should anticipate slower formalization and a higher internal burden before collaborative scaling becomes efficient. Second, because Study II relies on public reports (English-language, official publications), it captures articulated capabilities more readily than embedded practice. This orientation is advantageous for auditable coverage but may understate behind-the-scenes routines. The ORM's routing conditions therefore combine the two views: internal routines derived from Study I and external orchestration visible in Study II. Third, outcomes and routing conditions are selected for practical measurement. They use Chapter 2 data streams such as audit counts, supplier coverage, and incident-to-closure timestamps. In fields with very low visibility the ORM explicitly routes portfolios towards a longer internal

build-up phase, consistent with the routing conditions rationale set out in sub-chapter 3.2. Finally, a non-duplication principle applies. Sub-chapter 3.1 formalizes what is derived from Chapter 2, and sub-chapter 3.2 operationalizes it. Therefore, it does not restate comparative findings. Substantive cross-case contrasts remain in sub-chapter 2.3, and within-case materials remain in the respective appendices. Evidence claims in this sub-chapter are referenced to those locations.

Implications for the Organizational Response Model

The model links the PBC portfolio to proposed outcomes under the moderators and routing conditions defined above. The mechanism claims, CIMO configurations and evidence map refer to the comparative analysis in sub-chapter 2.3. Sub-chapter 3.3 translates this specification into a KPI dictionary, review procedures and proposed implementation horizons. The practical effects of these recommendations require evaluation in organizational settings [147; 146; 151].

Scholarly Positioning and Contribution

The theoretical core of the Organizational Response Model is a routing mechanism. Social Systems Theory explains that organizations reduce environmental complexity by building internal complexity, and capability theory explains that this internal complexity takes the form of capabilities. Neither theory explains when an organization generates the required variety internally and when it absorbs it through collaborative arrangements with other firms, verifiers or multi-stakeholder initiatives. The ORM specifies this decision as a function of two conditions of the organizational field. Perceptual convergence determines whether the issues and framings that an organization must respond to are shared across tiers, so that standardized instruments become usable. Prevalent cross-firm orchestration determines whether shared instruments for screening, assurance and mitigation actually exist and are accessible. The combination of the two conditions routes the organization to one of four response types and thereby to a distinct composition of its capability portfolio. This routing mechanism is the dissertation's independent theoretical contribution. It was reconstructed abductively from the two empirical studies and contributes a routing mechanism beyond those specified in the theories it draws on. Its claim is open to empirical contradiction: organizations that build internally under high convergence and high orchestration incur higher coordination cost for the same auditable coverage than organizations that join. A second, subordinate theoretical contribution is the mechanism of capability signaling identified in sub-chapter 2.3, which explains why sustainability communication can precede embedded practice in transitional institutional contexts without necessarily indicating decoupling. Both mechanisms are mid-range explanations. They do not extend Social Systems Theory itself and do not claim the status of a general theory of organizational response.

The Organizational Response Model as specified in this sub-chapter provides a qualitatively grounded, mechanism-based account of how organizations translate sustainability pressure into manageable internal response. The current model is a narrative specification. It identifies firms' actions and links them to outcomes. It does not yet provide a formal procedure for scoring capability portfolios or assigning response types

from public information alone. Nor does it generate directional predictions about outcome trajectories through such a procedure. Sub-chapter 3.2 develops a quantitative operationalization of the ORM using the Global Reporting Initiative (GRI) Standards. It makes constructs measurable and classification executable. It also makes outcome propositions formally testable in future empirical research.

In both empirical settings, the interview accounts and reports are consistent with a recognizable sequence when organizations face sustainability pressure. Organizations first articulated the specific pressure, then chose a feasible response path, and then re-weighted or built concrete internal capabilities to make that path executable. The ORM starts from a reconstruction of how firms in the data describe their attempts to remain able to act under sustainability-related demands.

Conceptual explanation of the ORM

Figure 5 brings together the constructs defined above. It shows the proposed pathway from sustainability pressure through selection and the PBC portfolio to outcomes, with moderators, routing conditions and feedback from governance reviews [147; 146]; 148].

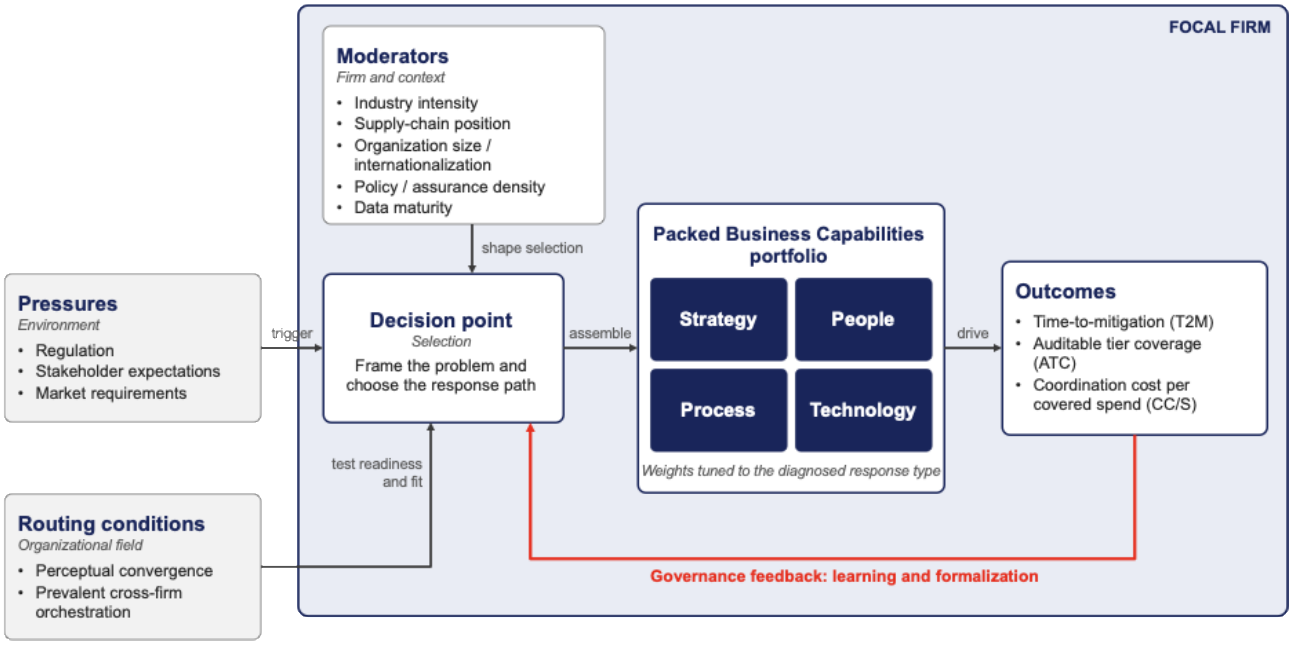


Figure 5 – Organizational Response Model (SST-informed capability-routing and governance artefact)

Note – Compiled by the author.

At the decision point, the organization defines the sustainability issue and the feasible scope of its response. The moderator profile affects what it can implement. Routing conditions guide the proposed balance between internal capability building and collaboration.

The construct dictionary translates the selected issue into a portfolio across Strategy, People, Process, and Technology. Response types describe alternative balances

between internal development and collaboration. Field conditions and existing capacity guide the next investment. The model does not require a fixed progression through the four types.

The proposed outcomes are time-to-mitigation, auditable tier coverage, and coordination cost per covered spend. Their links with capability configurations remain design propositions. The empirical studies do not test these effects.

Governance reviews reassess the routing conditions, review outcomes and leading indicators, and adjust the portfolio. The review procedures, responsibilities and implementation horizons are specified in sub-chapter 3.3.

Model specification

Path narrative

The ORM connects Environment, Selection, the PBC Portfolio, and Outcomes. Interviews and reports identify pressures from regulation, stakeholders, and supply-tier salience. These add environmental complexity. In Luhmannian terms, firms reduce complexity through selection. They filter and structure internal and collaborative responses [15; 70].

Two observable routing conditions guide the selected response. Perceptual convergence concerns how similarly actors across tiers define relevant issues. Prevalent cross-firm orchestration concerns the maturity and visibility of arrangements firms can join, including standards, joint audits, verifiers, and platforms. These conditions describe external coordination rather than the organization's system boundary [14; 15; 16; 23].[1] High levels of both increase the feasibility and impact of inter-organizational solutions. Unequal levels shift emphasis toward internal development or selective collaboration.

The response takes the form of a context-specific Packed Business Capabilities (PBC) portfolio across Strategy, People, Process, and Technology [130; 60; 136]. Execution produces short-run operational outcomes and medium-run coverage and learning effects. Five moderators affect selection and impact: industry intensity, supply-chain position, size and internationalization, policy and assurance density, and data maturity.

Moderators

The five moderators defined in the construct dictionary condition portfolio selection and the scope of the mechanism claims. Sub-chapter 2.3 provides their comparative rationale, and the configuration rows below specify their role in the proposed relationships [35; 124; 32].

Routing conditions

The routing conditions are assessed on an ordinal Low, Medium and High scale. Sub-chapter 3.2 specifies their observable indicators and aggregation rules. Their joint

[1] **Perceptual convergence** & **prevalent cross-firm orchestration** were first developed conceptually in the author's chapter in a collective monograph [161]. The present dissertation restates the constructs in independent wording and contributes the operational thresholds and boundary conditions.

assessment informs the response-type classification and the proposed balance between internal and collaborative effort.

Perceptual convergence concerns shared representations. Prevalent orchestration concerns available coordination infrastructure. Together, they form the model's minimal sufficient set for allocating effort between internal development and collaboration. Convergence makes joint templates feasible and credible. Orchestration makes them affordable and transferable. Further conditions would add detail without changing the decision boundary. Using fewer conditions would leave the observed portfolio shifts under-specified [55; 71].

PBC Portfolio

The PBC portfolio follows the construct dictionary's Strategy, People, Process, and Technology domains. Its configuration depends on moderators and routing conditions. Study I supplies the coding architecture. Study II applies it with inductive refinements.

Outcomes

The three outcome constructs are defined in Table 24 and operationalized in sub-chapter 3.2. The mechanism claims below specify the expected direction of their relationships with capability configurations and routing conditions. These relationships have not been tested against outcome data.

Mechanism claims with scope conditions

The six mechanism claims express explanations developed from Chapter 2. Each links a context, an intervention, a process, and an expected outcome. Each also states the conditions under which the relationship is expected to hold. Table 27 documents the connection to sub-chapter 2.3. The outcome effects remain untested. The design propositions FP1 to FP3 in sub-chapter 3.2 define the subsequent evaluation agenda.

MC1: When policy/assurance density is high, an internal data layer reduces coordination costs

In sectors with dense reporting regimes and active assurance markets, a harmonized internal ESG data layer standardizes capture and validation. It combines master data, auditable evidence trails, and a KPI architecture connected to ERP/quality systems. The proposed mechanism reduces rework and verification effort with auditors and partners. Expected outcomes are lower coordination cost per covered spend and more auditable claims. This relationship requires high policy/assurance density and at least medium data maturity.

MC2: Sufficient internal or third-party verification capacity is expected to make supplier development reduce time-to-mitigation. This applies especially in upstream, asset-intensive contexts within the policy/assurance density condition. The claim comes from the case material and has not been tested against outcome data.

Upstream producers may influence supplier processes and face physical or material risks. Structured supplier development assesses readiness, transfers capabilities, and follows with audits. It replaces episodic controls with continuous improvement loops. Corrective actions are linked to verifiable learning, shortening the proposed sensing-to-action pathway. Expected outcomes are lower average time-to-mitigation

and less variation between incidents. Improvements must be verifiable internally or by third parties. The mechanism is expected to be strongest under high industry intensity.

MC3: When perceptual convergence among focal actors is high, standards/screening increase auditable tier coverage (especially in retail/intermediary contexts)

Intermediaries and retailers often have broad supplier bases and limited control over production. Recognized pre-qualification standards, selective screening, and disciplined exception handling allow verification through shared schemes. The proposed mechanism aligns gatekeeping and assurance with instruments suppliers already understand. Expected outcomes are higher auditable tier coverage at manageable coordination cost. High perceptual convergence is required so that suppliers recognize and follow common criteria.

MC4: As data maturity increases, risk-management routines reduce mitigation-time variance (cross-sector).

ESG risk can be integrated into enterprise risk cycles through heat maps, escalation thresholds, and scenario analysis. These tools establish routines for detecting and closing non-conformities. Stable escalation paths turn weak signals into corrective actions with deadlines. Expected outcomes are less variation in mitigation times and more predictable closure. Data maturity must support early-warning indicators and reliable time-stamping.

MC5: When orchestration is high, cross-firm infrastructure increases internal process routinization (effect intensified by organization size/internationalization)

Mature shared infrastructure, templates, and recognized assurance bodies provide instruments that firms can join, extend, or complement together. External templates supply benchmarks and reduce uncertainty in process design. This can accelerate formalization and adoption in related categories. Expected outcomes are faster institutionalization of process standards and effects in related domains. Greater scale and internationalization can strengthen the mechanism by spreading joining costs and increasing the ability to shape complementary instruments.

MC6: When organizational complexity is manageable under clear governance, empowerment & roles increase corrective-action throughput (especially in service/retail contexts)

Service and retail work involves frequent decisions across many locations. ESG roles close to the work, clear decision rights, and aligned incentives and communication allow routine issues to be resolved locally. A small central ESG nucleus handles exceptions and changes to standards. The proposed mechanism increases local closure and reduces escalation bottlenecks. Expected outcomes are more corrective actions completed per period and better cross-functional alignment. Clear governance and a lean central nucleus are required to keep organizational complexity manageable.

Table 25 – Overview of Mechanism Claims

Claim	Context	Proposed intervention	Proposed operative process	Expected outcome	Scope conditions
MC1	High policy/assurance density with dense reporting and active assurance markets.	Create a common ESG data layer with master data, auditable evidence trails and KPIs linked to ERP and quality systems.	Standardize capture and validation. Reduce rework and verification effort with auditors and partners.	Lower coordination cost per covered spend and more auditable claims.	High policy/assurance density and at least medium data maturity.
MC2	Upstream, asset-intensive settings with control over process conditions and exposure to physical or material risks.	Develop suppliers through readiness assessment, capability transfer and subsequent audits.	Replace episodic controls with improvement loops. Link corrective action to verifiable learning and shorten the path from detection to action.	Lower average T2M and less variation across incidents.	Sufficient internal or third-party verification capacity. Expected to be strongest under high industry intensity.
MC3	Retailers or intermediaries with limited production control, broad supplier bases and high perceptual convergence.	Use recognized pre-qualification standards, selective screening and clear exception handling through shared schemes.	Align screening and assurance with instruments suppliers recognize to extend feasible coverage.	Higher ATC at manageable coordination cost.	High perceptual convergence so suppliers align with common criteria.

MC4	Across sectors as organizational data maturity increases.	Integrate ESG risks into enterprise risk cycles through heat maps, escalation thresholds and scenario analysis.	Use stable escalation routes to turn weak signals into corrective actions with deadlines.	Less variation in mitigation timelines and more predictable closure.	Data maturity sufficient for early-warning indicators and reliable timestamps.
MC5	High orchestration with mature shared infrastructure, templates and recognized assurance bodies.	Join and extend shared instruments. Develop complementary instruments jointly where appropriate.	Use external templates as benchmarks to reduce design uncertainty and support adoption across related categories.	Faster establishment of process standards and effects in related domains.	Expected impact grows with size and internationalization as joining costs are spread and firms can shape complements.
MC6	Service or retail settings with frequent local decisions and manageable complexity under clear governance.	Place roles near the work. Clarify decision rights and align incentives and communication. A small central team governs exceptions and standards.	Increase local case closure and reduce escalation bottlenecks.	More corrective actions completed per period and better coordination across functions.	Clear governance and a deliberately small central ESG team.
Note – Compiled by the author.					

Configuration logic (CIMO): integrating contexts, mechanisms, processes, and outcomes

The configuration logic connects context, intervention, operative process, and outcome. Boundary clauses state where each configuration may fail. The configurations draw on Chapter 2's comparative patterns and adapt realist evaluation's CMO reasoning. They ask what works, for whom, in which context, and why. Mechanisms and contexts follow RAMESES guidance [146; 148].

For volatile supply bases made up mainly of mid-tier suppliers, selective screening and supplier learning sets support oversight focused on exceptions and critical nodes. Persistent supplier turnover is the main vulnerability. It reduces the cumulative benefits of learning.

Table 26 – Configuration logic (CIMO/MCO matrix)

Context (C)	Intervention / Mechanism (I/M)	Process (mechanism detail)	Outcome (O)	Routing conditions
High policy/assurance density × Retailer/intermediary position	Standards + prequalification (MC3)	Use entry criteria, exception handling and shared audits.	Higher ATC.	Supplier turnover and verifier availability.
Upstream, asset-intensive × Medium verification capacity	Supplier development + re-audit review schedule (MC2)	Diagnose gaps, transfer capabilities, verify results and repeat.	Lower mean T2M and less variation.	Third-party capacity and access to remote sites.
Multinational × High perceptual convergence	Join mature infrastructure + internal data connectors (MC5 + MC1)	Adopt templates, integrate APIs and harmonize KPIs.	Lower CC/S and higher ATC.	Local rules may require exceptions.
Domestic/regional × Low convergence	Internal build-up (MC1 + MC4)	Build data foundations, create a risk register and use SLA-based escalation.	More reliable mitigation and stable variation in timelines.	Legitimacy pressure may lead to communication before capabilities are ready.
Mixed ownership × High legitimacy salience	Communication + policy formalization first	Build data capture in stages and prepare for assurance.	Gradually higher ATC with controlled CC/S.	Communication may become detached from practice if data systems lag.
High industry intensity (mining/energy) × Medium data maturity	Risk integration + data management (MC4 + MC1)	Use leading indicators, heat maps and rules for exceptions.	Less T2M variation and more predictable closure.	Fragmented master data may weaken early signals.
Retail/service × Distributed decisions	Empowerment + micro-governance (MC6)	Give local closure rights and define central escalation routes.	More corrective actions completed.	Unclear RACI and a backlog of exceptions.

Early-stage data maturity × Sparse standards	Pilot internal connectors (joinable later)	Log auditable evidence, use common IDs and prepare export schemas.	Ability to join schemes later and gradually lower CC/S.	Excessive customization may limit transferability.
Exporter with customer audits × High assurance expectations	Harmonize KPI lexicon + ERP bridges (MC1)	Use consistent data and a shared evidence repository.	Lower CC/S and fewer duplicate audits.	Supplier master data quality.
High convergence × Low orchestration (pre-standard field)	Co-create infrastructure with peers (MC2, MC4) + maintain internal bridge	Pilot protocols, share metrics and verify data exchange in both directions.	Greater feasibility of shared assurance later and stable T2M.	Dependence on prototypes and unclear governance.
Note – Compiled by the author.				

Evidence map of proposed links: credibility and routing conditions

A causal link in the evidence map is a proposed directed relationship. Construct A is expected to affect construct B through specified mechanisms under routing conditions. The evidence map records the qualitative support for each link from Study I and Study II.

The relationship between perceptual convergence and the collaborative share of the portfolio is supported qualitatively. Interviewees and reports indicate that the German cases combine audits and certifications with supplier development, and in Study II all seven reports with high orchestration also show high convergence under the PC3 rule of Appendix Q (Table 38). The boundary is the minimal assurance infrastructure necessary for credible participation.

Table 27 – Evidence map of proposed model links

Proposed model relationship	**Qualitative anchors in sub-chapter 2.3**	**Qualitative support**	**Boundary conditions**
Higher convergence is proposed to increase the collaborative portfolio share.	Retail/intermediary patterns, peer alignment	Moderate	Minimal assurance market required
Higher assurance density is proposed to lower CC/S through an internal data layer, MC1.	Mechanisms M2 and M4 (proposed), manual collection in both corpora	Limited	Data maturity ≥ Medium
Upstream supplier development is proposed to lower T2M.	Balanced auditing + development cases	Moderate	Third-party verification capacity
Retail standards and screening are proposed to increase ATC.	Emphasis on pre-qualification, shared audits	Moderate	Supplier turnover, category heterogeneity
Risk integration is proposed to reduce T2M variation.	Enterprise-risk integration contrasts	Moderate-Strong	Data maturity, alert fidelity
Shared infrastructure is proposed to strengthen internal formalization.	MNC convergence on standardized routines	Moderate	Size/internationalization
Empowerment and clear roles are proposed to increase corrective-action throughput.	Role diffusion vs. central bottlenecks	Limited-Moderate	Organizational complexity
Higher data maturity is proposed to strengthen risk and process routines.	Mechanism M4 (proposed)	Moderate	IT fragmentation, data lineage
Upstream supplier development is proposed to improve ATC at critical nodes.	Upstream leverage patterns	Moderate	Leverage over T1/T2, turnover
Convergence combined with orchestration is proposed to strengthen collaborative allocation.	Fields with shared schemes + aligned salience	Moderate	Scheme legitimacy, verifier quality

Note – Compiled by the author.

How moderators shift the portfolio

Table 28 – Moderator shift summary

Moderator / PBC	**Strategy (S)**	**People (P)**	**Process (Pr)**	**Technology (T)**
Industry intensity (Low to High)	↑	↑	↑↑	↑
Supply-chain position (Upstream to Retail)	↔	↑	Upstream: Dev ↑↑ to Retail: Screening ↑↑	↑ (traceability emphasis)
Size / internationalization (Small to MNC)	↑	↑	↑	↑
Policy / assurance density (Low to High)	↑	↔/↑	↑↑	↑↑
Data maturity (Low to High)	↑	↑ (data stewards)	↑	↑↑
Note – Compiled by the author.				

Response types and transitions by routing condition regime

From operational routing conditions to portfolio choice

The routing conditions correspond to perceptual convergence and prevalent cross-firm orchestration. Both are assessed as Low, Medium, or High using indicators in the evidence base. Perceptual convergence concerns overlap in the topics peers prioritize and their materiality framings. Prevalent cross-firm orchestration concerns the availability and maturity of shared schemes, verification bodies, and industry platforms. Portfolio allocation is the share of effort or budget assigned to collaboration rather than internal capability building across Strategy, People, Process, and Technology.

Decision rule DR1, Collaborative-first, applies when both routing conditions are high. Most effort goes to standards, shared infrastructure, and co-assurance. Quarterly reviews check the internal data-to-ERP bridges and escalation paths. The expected result is faster tier coverage at lower coordination cost.

Decision rule DR2, Internal-first, applies when both routing conditions are low. Internal development starts with the Technology data layer. It then builds Process routines for risk and screening, formalizes Strategy, and scales People capabilities. This sequence aims to keep communication connected to operating routines. It should improve internal reliability until the routing conditions change.

Decision rule DR3, Co-Developer, applies when convergence is high and orchestration is low. Firms develop infrastructure with near peers while maintaining internal data and risk capacity. These internal bridges help avoid dependence on immature templates. Supplier pilots can gradually increase external orchestration.

Decision rule DR4, Selective Joiner, applies when convergence is low and orchestration is high. Firms join mature schemes for generic issues such as health and safety or baseline labor criteria. They address specific exposures internally and keep templates and KPIs flexible.

The two axes define the four response types used in Chapter 3. Internal-first applies at Low/Low and builds from data through risk and process routines to formalized strategy. Co-Developer applies at High/Low and combines joint infrastructure development with strong internal bridges. Selective Joiner applies at Low/High and uses generic schemes selectively while managing specific risks internally. Collaborative-first applies at High/High and assigns most effort to collaboration, supported by tight internal connectors.

For example, peers that prioritize the same issues and cite comparable controls indicate high convergence. An accredited verifier directory and an active industry platform indicate high orchestration. The High/High score leads to Collaborative-first. Most effort then goes to standards, shared audits, and platform connectors. Internal data bridges remain necessary for handling exceptions.

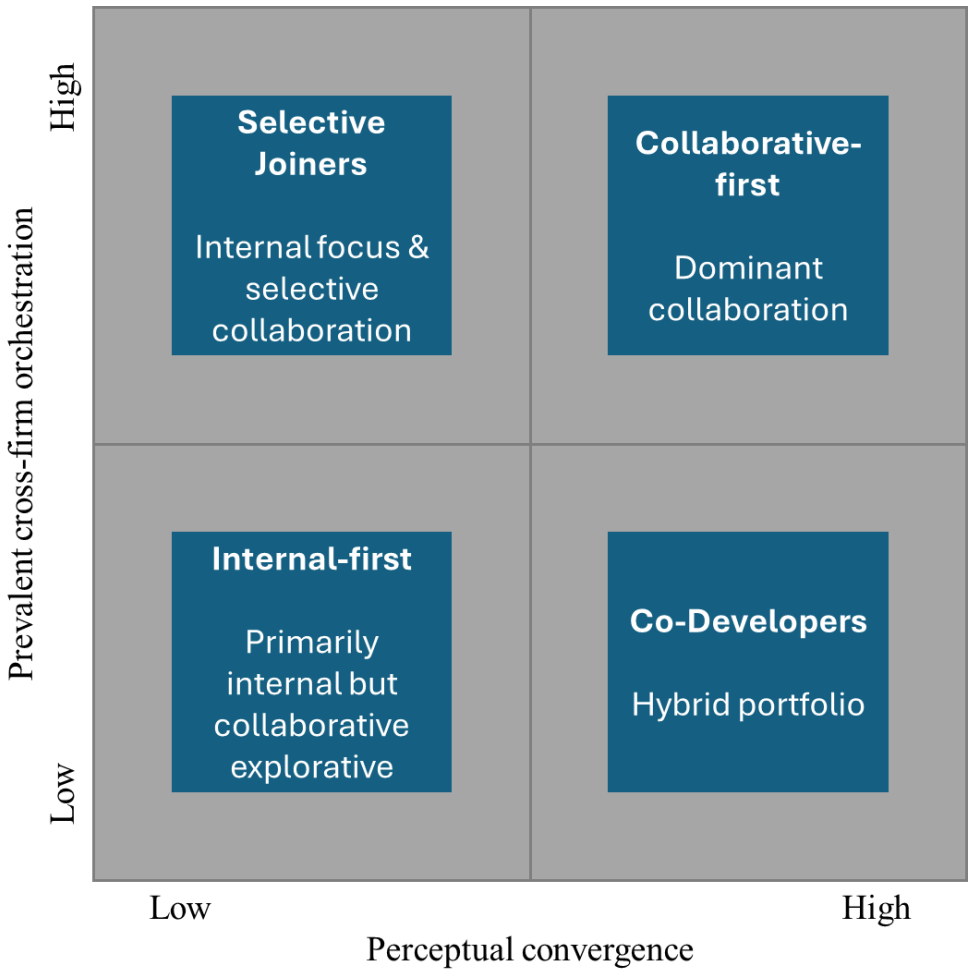


Figure 6 – Routing conditions to PBC Portfolio

Note – Compiled by the author.

Response types on the routing conditions matrix

Four response types describe stable portfolio logics and likely moves. They are located on the plane defined by Perceptual Convergence and Prevalent Cross-firm Orchestration.

Normative transition between capability profiles

The ORM uses capability profiles to describe observed patterns and identify what a transition requires. Profiles can change as an organization develops response capacity. The transition logic is normative in a limited managerial sense. It specifies the capabilities needed for a more integrated, auditable, and adaptive response. It does not prescribe one path for every company.

The transition from Emergent Innovator to Compliance Builder is primarily a formalization transition. It is triggered when issue-specific initiatives are exposed to stronger regulatory, customer, investor, lender, or reputational expectations. In this transition, the organization must convert isolated sustainability activities into documented policies, assigned responsibilities, basic indicators, reporting routines, and minimum evidence standards. The main managerial challenge is to avoid losing entrepreneurial experimentation while creating enough structure to make sustainability responses repeatable and reportable.

The transition from Compliance Builder to Institutional Integrator is an integration and auditability transition. It is triggered when compliance-oriented sustainability management becomes insufficient for external scrutiny, supplier requirements, assurance demands, or strategic risk management. In this transition, the organization must integrate sustainability into decision rights, procurement routines, risk management, supplier governance, cross-functional coordination, data systems, and management review. The main managerial challenge is to move from reporting compliance to operational control.

The transition from Institutional Integrator to a more advanced collaborative response profile is an orchestration transition. It is triggered when the organization's internal capabilities are sufficiently formalized, and the complexity of sustainability problems exceeds what the focal organization can efficiently manage alone. In this transition, the company increases the use of standards, supplier platforms, external assurance, certification schemes, industry initiatives, and collaborative verification mechanisms. The main managerial challenge is to reduce duplication and coordination cost without losing control over evidence quality and decision accountability.

Transitions may also move in the opposite direction. A company may regress from Institutional Integrator to Compliance Builder if governance routines become ceremonial, if reporting expands without operational evidence, or if cost pressure reduces supplier monitoring and data quality. Similarly, a Compliance Builder may remain locked in a compliance profile if it treats sustainability primarily as a disclosure exercise and does not invest in process ownership, technology-enabled evidence systems, and supplier-level control. For this reason, the ORM treats the profiles as dynamic capability configurations.

Table 29 – Transition between Kazakh capability profiles

Transition	**Main trigger**	**Required capability development**	**Observable evidence**	**Main risk if transition fails**
Emergent Innovator to Compliance Builder	Stronger regulatory, customer, lender, investor, or reputational pressure	Formal policies, assigned responsibilities, basic indicators, reporting routines and minimum documentation standards.	Sustainability topics appear in formal reports, responsibilities are named, selected targets or indicators are disclosed	Isolated initiatives remain symbolic or episodic
Compliance Builder to Institutional Integrator	Need for stronger auditability, supplier control, risk management, or assurance readiness	Link decision rights, procurement, risk management, supplier governance, management review and data systems.	Supplier standards, risk registers, audit routines, data ownership, corrective-action processes, and management review cycles are documented	Reporting improves faster than operational control, creating decoupling risk
Institutional Integrator to collaborative orchestration profile	Internal capabilities are formalized, but sustainability complexity exceeds efficient internal control	Build external assurance, shared supplier platforms, certification, industry collaboration, verification and data exchange standards.	Evidence of third-party assurance, supplier platform coverage, external certification, collaborative schemes, or shared verification infrastructure	Coordination cost increases and duplicated audits reduce efficiency
Regression from integrated profile to compliance profile	Cost pressure, weak governance attention, loss of data quality, or ceremonial reporting	Re-establish ownership, evidence routines, supplier monitoring and review cycles.	Declining evidence quality, fewer supplier controls, less frequent review, weaker corrective-action closure	Sustainability response becomes mainly report-oriented and less operationally reliable
Note – Compiled by the author.				

This transition logic strengthens the critical function of the typology. The profiles do more than classify companies after the analysis. They identify capability thresholds, transition triggers, and risks of stagnation or regression. In this way, the typology becomes a diagnostic instrument for managerial development.

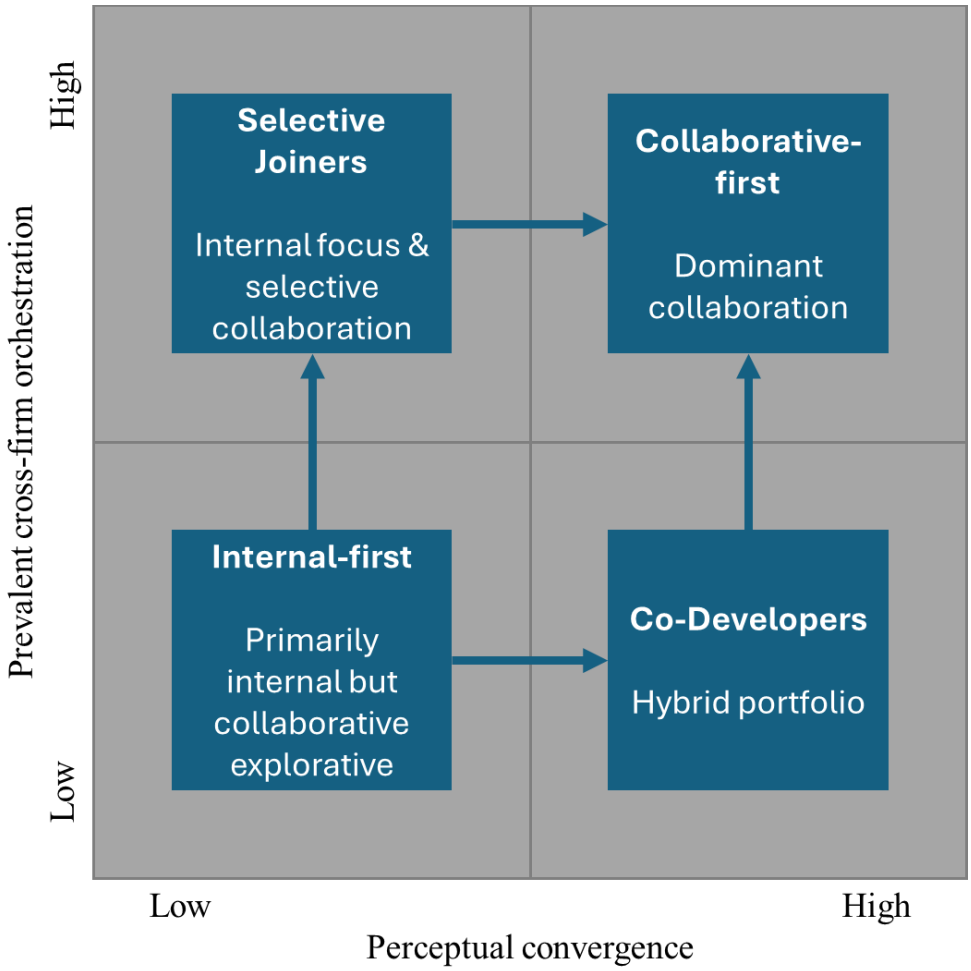


Figure 7 – Response types & transitions

Note – Compiled by the author.

Internal-first applies when convergence and orchestration are low. It prioritizes internal capability development. The proposed sequence starts with the data layer and risk/process routines. Strategy formalization and the scaling of roles and skills follow. Evidence trails and suitable interfaces prepare the organization to join external schemes later.

Co-Developers share an understanding of the relevant issues but have limited common infrastructure. They develop standards and verification arrangements with peers. At the same time, they maintain their own data and risk-management capacity. This supports collaboration while limiting dependence on incomplete schemes.

Selective Joiners can access established schemes even when priorities differ across actors. They use these schemes for generic requirements. Internal arrangements

address specific exposures. Flexible templates, KPIs, and monitoring help cover requirements that shared schemes do not address.

Collaborative-first directs most portfolio effort toward shared schemes. Internal capabilities connect the organization to these arrangements and govern exceptions. Recurring make-or-join reviews assess whether to develop an internal capability further or use an external solution. Changes in convergence and orchestration trigger reassessment. The expected cost and coverage benefits require evaluation.

Transition triggers & friction points

Transitions follow three recurrent triggers. First, the emergence of standards and verification capacity raises orchestration, moving Internal-first firms and Co-Developers toward collaborative regimes, provided internal connectors have been prepared to capture economies of scale. Second, rising convergence through alignment of salient issues among peers moves Selective Joiners towards Collaborative-first, with selective joining advised and carve-outs retained for field-specific risks. Third, maturing internal data lowers coordination costs, enabling moves without bespoke overhead. Frictions include low assurance capacity, supplier turnover, and fragmented IT, all of which elevate verification friction and re-work. Early-stage contexts exhibit a legitimacy-capability gap that requires deliberate coupling of signaling with investment in the data/process foundation.

Evidential warrant for the ORM

The ORM directly encodes comparative regularities from the preceding chapter. Sequencing under moderator pressure is patterned. The Kazakh reports are consistent with a sequence from policy and communication to data capture and then to technology routines, which decision rule DR2 reorders for Internal-first firms by placing the data layer first, whereas denser policy/assurance regimes are expected to reward earlier codification. The German cases, interviewed before these conditions intensified, show codified routines mainly in people and process capabilities (Table 18). Structural effects of position and scale are equally regular. Upstream producers substitute internal variety with collaborative development of suppliers, while retailers scale coverage through standards and screening. Internationalization amplifies the gains from joining shared infrastructure. Finally, the model proposes that cost-coverage trade-offs are governed by routing conditions. As convergence and orchestration rise, the collaborative share is expected to become more efficient, expanding auditable coverage while reducing coordination cost (FP2 and FP3 in sub-chapter 3.2).

The Packed Business Capabilities framework furnishes a stable vocabulary for the *what* of response, while routing conditions and moderators specify the *when* and *where* of configuration. The German cases combine people and process capabilities with Risk Management, while Data Management and Reporting and Technology Adoption remain weakly articulated (Table 18). The Kazakh reports are consistent with staged adoption that often begins with policy/communication and then integrates data/process. The present model captures both patterns by design and articulates explicit boundaries to avoid over-generalization.

Positioning the Organizational Response Model in the field of existing frameworks

The ORM builds on dynamic capabilities [60; 130; 22], sustainable supply chain management frameworks [35; 36] and organizational ambidexterity [152]. The following subsections specify the concepts it shares with these approaches and the contribution of its routing logic.

Relation to dynamic capabilities

The dynamic capabilities perspective conceptualizes organizational adaptation as the orchestrated capacity to sense changes, seize opportunities, and reconfigure resources under turbulent conditions [60; 130]. The ORM shares the premise that sustainability-related complexity is a non-stationary environmental condition under which organizations must build and continuously re-shape internal capabilities. The ORM differs in three ways. Teece [130] identifies sensing, seizing, and reconfiguring as high-level meta-capabilities. The ORM specifies a portfolio that managers can act on directly across Strategy, People, Process, and Technology. It names sub-business capabilities such as Risk Management, Data Management and Reporting, and Supply Chain Sustainability. Second, the ORM specifies the routing conditions (perceptual convergence, prevalent cross-firm orchestration) under which different capability configurations become more or less feasible, which is a contingency layer that is largely implicit in dynamic capabilities. Third, the ORM connects capability portfolios to time-to-mitigation, auditable tier coverage, and coordination cost. This translates capability theory into governance metrics.

Relation to sustainable supply chain management frameworks

The SSCM frameworks of Seuring and Müller [36] and Carter and Rogers [35] provide influential conceptualizations of sustainability integration in supply-chain governance. Seuring and Müller distinguish strategies of risk-and-performance management, sustainable supplier development, and sustainable product portfolio decisions as triggers for supply-chain action. Carter and Rogers integrate the triple-bottom-line rationale with organizational enablers including risk management, transparency, strategy, and culture. The ORM shares the substantive object, sustainability-related complexity in inter-organizational supply chains, with both frameworks, and it explicitly references the supply-chain repertoire they catalogue. The ORM differs in scope and explanatory aim. The SSCM frameworks specify what practices and strategies are available and what enabling factors matter, but they leave the selection and sequencing of these practices under-specified, particularly under heterogeneous institutional conditions. The ORM explains the choice and sequencing of internal build-up and cross-firm orchestration. Routing depends on measurable perceptual convergence and field-level orchestration. Five moderators shift these decisions: industry intensity, supply-chain position, size and internationalization, policy and assurance density, and data maturity. SSCM locates sustainability within the supply-chain governance space, whereas the ORM explains how organizations decide what to build first, when to join, and how to make the result auditable.

Relation to organizational ambidexterity

The ambidexterity perspective conceptualizes organizational adaptation as the capacity to balance exploration of new possibilities with exploitation of established routines, often through structural, contextual, or sequential separation [152]. The ORM also recognizes simultaneous demands that pull capability investment in different directions. Compliance with established disclosure regimes follows an exploitation logic. Developing new audit-grade data, governance, or supplier-engagement routines follows an exploration logic. Both demands coexist in sustainability management. The ORM differs in two aspects. On the one hand, ambidexterity theory typically frames the tension at the level of the organization as a whole. The ORM places this tension within an explicit routing logic. Internal build-up and cross-firm orchestration serve as the operational equivalent of the explore/exploit choice. The choice is specified through capability portfolio composition. On the other hand, the ORM links the routing decision to observable boundary conditions, which converts the abstract balancing problem into a decision rule that organizations can apply and review on a defined cadence. The ORM thus operationalizes a sustainability-specific ambidexterity rationale without subsuming the general theory of ambidexterity.

The following table summarizes the comparison along six dimensions that capture the core differentiation of the ORM. The table is intended as a synthesis. The dimensions are selected to make visible where the ORM extends, complements, or operationalizes existing frameworks for the specific problem of sustainability response under heterogeneous institutional conditions.

Table 30 – Positioning the Organizational Response Model relative to existing frameworks

Dimension	**Dynamic Capabilities [130; 60]**	**SSCM Frameworks [36; 35]**	**Organizational Ambidexterity [152]**	**Organizational Response Model (this dissertation)**
Primary unit of analysis	Firm (with environmental focus)	Firm and supply chain (cross-firm)	Firm (with explore/exploit subunits)	Focal organization with explicit cross-firm routing layer
Mechanism granularity	Meta-capabilities (sensing, seizing, reconfiguring)	Strategy archetypes and enabling factors	Structural/contextual/sequential separation logics	Named Packed Business Capabilities × sub-business capabilities × outcomes

Contingency logic	Implicit (turbulence, dynamism); rarely formalized	Issue-triggered (risk, supplier development, product)	Tension between explore/exploit; mode of separation	Explicit routing conditions (perceptual convergence × prevalent orchestration) plus five moderators
Domain coverage	Capability building in general	Sustainability integration in supply chain	Innovation versus efficiency tension	Sustainability response across Strategy / People / Process / Technology
Outcome specification	Performance and competitive advantage (often abstract)	Triple bottom line; supplier and product outcomes	Long-run adaptation and survival	Auditable outcomes: time-to-mitigation, auditable tier coverage, coordination cost
Cross-context applicability	Generic; institutional environment treated as background	Cross-supply-chain but largely Western / high-assurance contexts	Generic; institutional density not foregrounded	Designed for cross-context heterogeneity (DACH and Kazakhstan)
Note – Compiled by the author based on [35; 36; 60; 130; 152].				

Two consequences follow from this comparison. First, the ORM is additive. It does not replace dynamic capabilities, SSCM frameworks, or ambidexterity theory, and specifies a layer that these frameworks leave under-specified, namely, the routing logic and outcome specification through which organizations translate sustainability pressure into manageable, auditable capability portfolios under heterogeneous institutional conditions. Each of the three reference frameworks could be applied to interpret different parts of the ORM. Dynamic capabilities can interpret the maturation of sub-business capabilities over time, SSCM frameworks the inter-organizational repertoire that sub-business capabilities draw on, and ambidexterity theory the explore-exploit tension between internal build-up and cross-firm orchestration.

Second, the comparison clarifies the *kind* of contribution the ORM aims to make. It is a governance-oriented capability model designed to be field-applicable, with ex-

plicit routing rules, named sub-business capabilities, and auditable outcomes. Its contribution lies in integrating capability theory, the SSCM repertoire, and contingency-style routing into a coherent decision architecture that organizations can use to compose, sequence, and review their sustainability response under transparent boundary conditions. The empirical anchoring of this architecture in two heterogeneous institutional contexts (DACH and Kazakhstan) supports its claim to cross-context applicability, while the limitations of this anchoring are made explicit in the limitations discussion in the Conclusion. Two further reference points complete this positioning. Capability maturity models, which go back to the Capability Maturity Model developed for software organizations [242], describe a fixed sequence of levels in which each level lays the foundation for the next and no level can be skipped. The ORM shares the idea that capabilities mature in steps, and the Capability Maturity Score measures the maturity of disclosed evidence in four domains. It differs in that the next step does not follow from the level reached. It follows from the routing conditions, so two organizations with the same composite CMS can be assigned different response types and different next moves (Table 36). Typologies of organizational response, such as the strategic responses to institutional processes described by Oliver [243], classify how far organizations conform to external pressure, from acquiescence to manipulation. The ORM shares the premise that responses vary systematically with institutional conditions. Its response types classify the allocation of capability build-up between internal routines and collaborative arrangements.

Concluding synthesis

Sub-chapter 3.1 specifies the ORM's constructs, routing logic and mechanism claims. The evidence map records their qualitative anchors and scope conditions. The next sub-chapter develops a scoring and classification procedure for application to public disclosures [15; 70; 125]. The ORM should therefore be understood as an independent capability-based contribution that is informed by Social Systems Theory, and evaluated according to its explanatory coherence, empirical traceability, managerial usability, and operationalizability.

The dissertation contains several sets of statements with different epistemic status. To make their relationship explicit, the following table orders them from guiding questions to the provisions submitted for defense. Only the six provisions listed in the Introduction are submitted for defense. The comparative propositions P1 to P8 are empirical findings of Chapter 2, the mechanisms M1 to M4 are abductive explanations of these findings, and both are defended in aggregate through provisions 2 and 3. The mechanism claims MC1 to MC6 specify the model logic defended in provision 4 and are evidenced qualitatively through the evidence map of this sub-chapter. The design propositions FP1 to FP3 of sub-chapter 3.2 are derived from the model for future validation, have not been tested in this dissertation and are therefore not submitted for defense. Six provisions were chosen because each corresponds to one completed step of the research, from capability reconstruction through comparison and mechanism explanation to model specification, instrument proposal and recommendations, and because each can be traced to a specific body of evidence in the dissertation. The eight comparative propositions were not selected as provisions for defense because they are

contrasts between two studies that differ in period and modality, as discussed in sub-chapter 1.3, and are therefore defended as a pattern.

Table 31 – System of statements of the dissertation and their relation to the provisions submitted for defense

Level	**Statements**	**Epistemic status**	**Number**	**Formulated in**	**Evidenced by**	**Relation to provisions for defense**
Guiding questions	Research question, SQ1 to SQ3	Questions	1 + 3	Introduction, sub-chapter 1.3	Answered in the Conclusion	Frame for all provisions
Objectives	Research objectives 1 to 8	Tasks	8	Introduction	One sub-chapter each	Frame for all provisions
Empirical findings	Comparative propositions P1 to P8	Context-and-period contrasts between Study I and Study II	8	Sub-chapter 2.3, Table 20, Figure 3	Cross-case analyses of sub-chapters 2.1 and 2.2	Aggregated in provision 2
Explanatory mechanisms	Institutional mechanisms M1 to M4, capability signaling	Abductive explanations of the contrasts	4 + 1	Sub-chapter 2.3, Figure 4	Institutional analysis of sub-chapter 1.2 and the empirical patterns of Chapter 2	Aggregated in provision 3
Model constructs	Packed Business Capabilities, decision point, five moderators, two routing conditions, four response types, three outcome metrics	Model constructs derived by analytic generalization.	4 domains, 5, 2, 4, 3	Sub-chapter 3.1, construct dictionary, Tables 22, 23, 26, 28, Figures 5 to 7	Derivation protocol of sub-chapters 1.3 and 3.1	Provisions 1, 4 and 5

Model-level claims	Mechanism claims MC1 to MC6 with scope conditions	Proposed CIMO-type claims with qualitative anchors. Outcome effects remain untested.	6	Sub-chapter 3.1, Table 27 (evidence map)	Evidence map of proposed links in sub-chapter 3.1	Specify provision 4
Proposed instrument	Capability Maturity Score, response type classification function, outcome metric definitions	Formally specified and applied to all 20 reports. Outcome propositions remain untested.	30 indicators, 1 function, 3 metrics	Sub-chapter 3.2, Tables 32 to 38	Full-sample application (20 reports, 11 companies)	Provisions 5 and 6
Validation agenda	Design propositions FP1 to FP3	Propositions derived for future empirical testing. Not tested here.	3	Sub-chapter 3.2, Table 39	None in this dissertation	Not submitted for defense
Recommendations	R1 to R14, implementation guide, KPI dictionary	Model-based recommendations for the Kazakhstani context.	14	Sub-chapter 3.3, Table 40	Model logic and Study II evidence	Provision 6
Results	Points of scientific novelty 1 to 5	Results obtained by the author	5	Introduction	Sub-chapters 1.1 to 3.3 as indicated	Each point corresponds to one or two provisions

Defended statements	Provisions submitted for defense 1 to 6	Assertions substantiated in the dissertation	6	Introduction	As indicated in each provision	Defended
Note – Compiled by the author.						

3.2 Towards a Quantitative Operationalization of the Organizational Response Model

Rationale for formal specification

The three-layer instrument documents how to apply the ORM. It uses the concepts and findings of Chapters 1 and 2. These procedures support reproducibility and later field evaluation [145; 151]. Applying them to public reports demonstrates scoring and classification. Further research must establish whether the proposed configurations improve organizational outcomes.

Layer 3 defines propositions for future testing. In design science, formalized propositions provide the basis for empirical validation [151].

Selection of the GRI Standards as measurement anchor

The quantitative indicators draw on the Global Reporting Initiative (GRI) Standards. They use GRI 2: General Disclosures 2021 and GRI 3: Material Topics 2021. Selected topic standards are GRI 302 for Energy, GRI 305 for Emissions, and GRI 306 for Waste. Supplier assessments use GRI 308 for environmental aspects and GRI 414 for social aspects. Employment and safety use GRI 401 and GRI 403. Further standards are GRI 407 for Freedom of Association and Collective Bargaining, GRI 408 for Child Labor, and GRI 409 for Forced or Compulsory Labor.

GRI represents the most widely adopted sustainability reporting framework globally, with consistent application across sectors, governance systems, and reporting jurisdictions [153; 154]. Its indicators therefore furnish a cross-sectoral, cross-jurisdictional measurement base that accommodates both the Western firms covered in Study I and the Kazakh firms covered in Study II.

GRI 3's materiality logic provides a direct conceptual bridge to the ORM's Decision point. The process by which organizations identify, prioritize, and manage material topics under GRI 3-1 and GRI 3-3 corresponds structurally to the pressure-framing and response-selection mechanism that the ORM defines as its entry point. This alignment means that the GRI indicator set is a disclosure architecture that is itself organized around organizational responses to external sustainability demands. This is the phenomenon the ORM reconstructs.

GRI topic standards selected for the Process and Technology domains reflect the specific capability sub-categories documented in the empirical studies. GRI 308, GRI 407, GRI 408, GRI 409, and GRI 414 cover supply-chain governance. They map directly to the supply-chain sustainability sub-capability in the ORM's Process domain. GRI 302, GRI 305, and GRI 306 provide observable environmental performance outputs. These correspond to data management, reporting, and technology adoption in the Technology domain. The Technology domain score therefore measures the maturity of disclosed environmental data, which is the reporting-side trace of the construct, and not verified technology adoption. The selection therefore ensures internal coherence between the qualitative model constructs in sub-chapter 3.1 and the quantitative indicators in the present sub-chapter.

GRI was selected to match the ORM's cross-sectoral and cross-jurisdictional design. The European Sustainability Reporting Standards (ESRS), developed under the EU Corporate Sustainability Reporting Directive [155], provide considerable sectoral depth. They are increasingly mandatory for large European entities, including several Study I firms. Their regulatory scope does not cover Study II's Kazakh firms or firms mainly outside the European reporting sphere. The SASB Standards [156] provide detailed sector-specific measures. GRI is sector-agnostic and globally applicable. Its level of abstraction suits a model intended to span the Western-Kazakh institutional boundary.

Overview of the three-layer model

Layer 1 calculates a Capability Maturity Score (CMS) from disclosed sustainability practices. GRI-anchored indicators map to Strategy, People, Process, and Technology. Layer 2 combines the domain scores with independently scored routing conditions. It assigns Internal-first, Collaborative-first, Co-Developer, or Selective Joiner. Layer 3 derives three formal outcome propositions from the model. They link domain scores and response types with time-to-mitigation (T2M), auditable tier coverage (ATC), and coordination cost per covered spend (CC/S). Sub-chapter 3.1 defines these outcomes.

Layer 1: Capability Maturity Score

Indicator-scoring scheme

Each GRI indicator receives an ordinal score of 0, 1, or 2 according to the evidence disclosed. Zero means absent. The report omits the topic or declines reporting without substantive justification. One means described. The report gives a narrative or qualitative account of policy, approach, or activity, without quantified targets, measured performance, or third-party verification. Two means evidenced. Disclosure is quantified, time-bound, or externally verified, making the capability claim auditable. The scale distinguishes symbolic from substantive reporting [154]. It also reflects the ORM's distinction between articulated and embedded capabilities, used in its routing logic. Table 32 defines the scores and provides examples.

Table 32 – Indicator-scoring scheme for the GRI-anchored Capability Maturity Score

Score	**Label**	**Operational Definition**	**Illustrative Example from Sustainability Report**
0	Absent	No disclosure on the relevant topic; the indicator is omitted entirely or reporting is declined without substantive explanation.	No mention of energy consumption, supplier screening criteria, or related policies in the entire report.
1	Described	Narrative or qualitative disclosure of approach,	"We are committed to reducing our carbon footprint and work closely with

		policy, or activity is provided, but without quantified targets, measured performance outcomes, or independent verification.	our suppliers to identify environmental risks."
2	Evidenced	Quantified, time-bound, or externally verified disclosure that renders the claimed capability auditable and comparable across reporting periods.	"Scope 1 GHG emissions: 12,450 tCO_2e (2024 reporting year), representing a 15.3% reduction against the 2022 baseline. Independently assured by KPMG under ISAE 3000 (limited assurance)."
Note – Compiled by the author.			

GRI-to-PBC domain mapping and intra-domain indicator weights

Thirty GRI disclosures map to the four PBC domains using sub-chapter 3.1's construct dictionary. Strategy uses seven indicators from GRI 2 and GRI 3 for formal steering, policy commitments, and sustainability priorities. People uses eight from GRI 2, GRI 401, and GRI 403 for governance roles, staffing, empowerment, and training. Process uses seven from GRI 308, GRI 407, GRI 408, GRI 409, and GRI 414. These cover supply-chain screening, assessment, and remediation and map to Supply Chain Sustainability. Technology uses eight from GRI 302, GRI 305, and GRI 306. They cover energy, emissions, waste data, and quantified performance, corresponding to Data Management and Reporting and Technology Adoption.

Within each domain, all indicators are assigned equal intra-domain weight $w_{d,i} = 1/n_d$, where n_d denotes the number of indicators in domain d. This follows the GRI Standards' treatment of individual disclosures as equivalently required within their respective topic areas [157; 158; 159]. Equal intra-domain weighting preserves parsimony and replicability. Differential weighting would require additional justification beyond the support provided by the present evidence base. The following table presents the complete GRI-to-PBC domain mapping, including all thirty indicators with their intra-domain weights.

Table 33 – GRI-to-PBC domain mapping and intra-domain indicator weights

PBC Domain	**GRI Standard**	**Disclosure No.**	**Disclosure Title**	$\mathbf{n_d}$	$\mathbf{w_{d,i}}$
Strategy	GRI 2	2-22	Statement on sustainable development strategy	7	1/7

Strategy	GRI 2	2-23	Policy commitments	7	1/7
Strategy	GRI 2	2-24	Embedding policy commitments	7	1/7
Strategy	GRI 2	2-29	Approach to stakeholder engagement	7	1/7
Strategy	GRI 3	3-1	Process to determine material topics	7	1/7
Strategy	GRI 3	3-2	List of material topics	7	1/7
Strategy	GRI 3	3-3	Management of material topics (strategic dimension)	7	1/7
People	GRI 2	2-9	Governance structure and composition	8	1/8
People	GRI 2	2-17	Collective knowledge of the highest governance body	8	1/8
People	GRI 2	2-18	Evaluation of the governance body's performance	8	1/8
People	GRI 2	2-20	Process to determine remuneration	8	1/8
People	GRI 401	401-1	New employee hires and employee turnover	8	1/8
People	GRI 401	401-2	Benefits provided to full-time employees	8	1/8
People	GRI 403	403-1	Occupational health and safety management system	8	1/8
People	GRI 403	403-5	Worker training on occupational health and safety	8	1/8
Process	GRI 308	308-1	New suppliers screened using environmental criteria	7	1/7
Process	GRI 308	308-2	Negative environmental impacts in the supply chain and actions taken	7	1/7

Process	GRI 407	407-1	Operations and suppliers at risk for freedom of association violations	7	1/7
Process	GRI 408	408-1	Operations and suppliers at significant risk for child labor	7	1/7
Process	GRI 409	409-1	Operations and suppliers at significant risk for forced or compulsory labor	7	1/7
Process	GRI 414	414-1	New suppliers screened using social criteria	7	1/7
Process	GRI 414	414-2	Negative social impacts in the supply chain and actions taken	7	1/7
Technology	GRI 302	302-1	Energy consumption within the organization	8	1/8
Technology	GRI 302	302-3	Energy intensity	8	1/8
Technology	GRI 302	302-4	Reduction of energy consumption	8	1/8
Technology	GRI 305	305-1	Direct (Scope 1) GHG emissions	8	1/8
Technology	GRI 305	305-2	Energy indirect (Scope 2) GHG emissions	8	1/8
Technology	GRI 305	305-4	GHG emissions intensity	8	1/8
Technology	GRI 306	306-3	Waste generated	8	1/8
Technology	GRI 306	306-4	Waste diverted from disposal	8	1/8
Note – Compiled by the author based on [157; 158; 159].					

Domain score formulation

Let I_d denote the set of GRI indicators mapped to domain *d*, where *d* indexes the four PBC domains (S = Strategy, P = People, Pr = Process, T = Technology). Let $n_d = |I_d|$ denote the number of indicators in that domain, and let $s_{d,i}$ denote the ordinal score (0, 1, or 2) assigned to indicator *i* in domain *d* upon reading the firm's sustainability report. The maximum achievable score per indicator is $s_{max} = 2$. The domain score for domain *d* is defined as follows:

$$CMS_d = [\ \Sigma\ s_{d,i} / (n_d \times s_{max})\ ] \times 100 \ldots (1)$$

The expression divides observed indicator scores by the domain's maximum possible score. This yields a domain score from 0 to 100. A score of 100 indicates that every indicator in the domain received the maximum evidenced rating. A score of 0 indicates that no indicator in the domain was disclosed at any level.

Illustrative calculation: Consider a firm that discloses the seven Strategy indicators (GRI 2-22, 2-23, 2-24, 2-29, 3-1, 3-2, 3-3) with individual scores [2, 2, 1, 0, 1, 2, 1]. The sum of observed scores is 9. With $n_S = 7$ and $s_{max} = 2$:

$$CMS_S = [\ 9 / (7 \times 2)\ ] \times 100 = [\ 9 / 14\ ] \times 100 = \mathbf{64.3}$$

The firm's Strategy disclosures reach approximately 64% of the maximum evidenced level across all Strategy indicators. This suggests a moderate level of formalization in strategic sustainability governance. However, that formalization remains incomplete.

Inter-domain weight derivation

Each domain receives a weight based on its share of the selected GRI disclosures [153]. Domains with more indicators receive a larger share of the composite score. This provides a transparent baseline for aggregation. It remains a modeling assumption. Indicator counts do not establish how strongly each domain affects organizational outcomes. The sensitivity analysis therefore examines alternative weights. The weight for domain d is calculated as follows:

$$W_d = n_d / N \ldots (2)$$

where $N = \Sigma\ n_d$ is the total number of indicators across all domains. With $n_S = 7$, $n_P = 8$, $n_{Pr} = 7$, $n_T = 8$, and $N = 30$, the resulting inter-domain weights are displayed in the table below.

Together with Table 33's equal intra-domain weights, these weights assign 1/30 to each indicator. The composite CMS therefore equals total points divided by 60 and multiplied by 100. The weights therefore do not establish the relative importance of the four domains, and their influence on the results is examined in the sensitivity analysis at the end of this sub-chapter.

Table 34 – Inter-domain weight derivation from GRI disclosure density

PBC Domain (d)	**Indicator Count (n_d)**	**Total Indicators (N)**	**Inter-Domain Weight (W_d)**	**Interpretation**
Strategy (S)	7	30	$W_S = 7/30 = 0.233$	Strategy indicators account for 23.3% of total disclosure weight
People (P)	8	30	$W_P = 8/30 = 0.267$	People indicators account for 26.7%

				of total disclosure weight
Process (Pr)	7	30	W_{Pr} = 7/30 = 0.233	Process indicators account for 23.3% of total disclosure weight
Technology (T)	8	30	W_T = 8/30 = 0.267	Technology indicators account for 26.7% of total disclosure weight
Total	30	-	1.000	-
Note – Calculated by the author based on Table 33.				

Composite Capability Maturity Score

The composite Capability Maturity Score for a firm is defined as the inter-domain weighted sum of its four domain scores:

$$CMS = \Sigma\, W_d \times CMS_d \text{ for } d \in \{S, P, Pr, T\} \quad ... (3)$$

The CMS summarizes sustainability capability maturity as disclosed in the company's public report. Maturity here means how far practices in the four PBC domains meet a verifiable, auditable standard.

Continuing the illustrative calculation: Assume the firm from the Strategy example above also scores as follows: People scores [2, 1, 2, 2, 1, 0, 1, 2] yielding CMS_P = 11/16 × 100 = 68.8; Process scores [1, 0, 1, 2, 1, 0, 1] yielding CMS_{Pr} = 6/14 × 100 = 42.9; Technology scores [2, 2, 1, 1, 2, 2, 1, 0] yielding CMS_T = 11/16 × 100 = 68.8. The composite CMS is then:

$$CMS = (0.233 \times 64.3) + (0.267 \times 68.8) + (0.233 \times 42.9) + (0.267 \times 68.8)$$

$$= 14.98 + 18.37 + 10.00 + 18.37 = \mathbf{61.7}$$

The composite score suggests moderate disclosed capability maturity. Process, at 42.9, is lower than the other three domains. The firm therefore discloses less evidence of supply chain governance routines. An absent or narrative disclosure does not establish whether the underlying capability exists. Layer 2 uses this disclosure profile for classification. Interpretation remains subject to sub-chapter 3.1's distinction between public articulation and embedded practice.

The CMS identifies domains with less disclosed evidence. These may indicate capability or evidence gaps that need attention before moving beyond an emergent or compliance-oriented profile. It supports a transition toward more integrated, auditable responses.

Layer 2: Response type Classification

Operationalization of routing conditions

Perceptual convergence (PC) and prevalent cross-firm orchestration (OR) are scored on an ordinal scale from 0 (Low) to 2 (High). Each is the rounded arithmetic mean of three sub-scores. The criteria preserve the distinction between shared issue framing and the availability of collaborative arrangements.

PC1 concerns cross-tier stakeholder input in materiality assessment, using GRI 2-29 as a proxy. PC2 concerns shared materiality frameworks or topic alignment with peers, using GRI 3-1. PC3 concerns shared incident definitions or standards referenced in incident disclosures and corrective actions. Its proxies include GRI 308-2, GRI 414-2, GRI 403-9, ICMM, IOGP 456 and IFC Performance Standards.

OR1 concerns participation in recognized multi-stakeholder initiatives or shared audit programs. OR2 concerns accredited external assurance of material disclosures, including its scope. OR3 concerns shared supplier platforms, joint screening tools or collaborative certification, using GRI 308-1 and GRI 414-1 as proxies.

Table 35 specifies the scoring thresholds and observable evidence for these criteria. Each classification can be retraced through page-anchored evidence and the decision rules in Appendix Q. Retracing checks consistency with the recorded evidence. Independent reproduction of the underlying scores requires a separate coding exercise because the author assigned the scores as a single coder.

Table 35 – Routing condition scoring rubric for PC and OR

Routing condition	**Score**	**Operational Criterion**	**Observable GRI Proxy**
Perceptual Convergence (PC)	0 (Low)	No evidence of cross-tier issue alignment or shared framing in materiality process	GRI 2-29 absent or internal only; GRI 3-1 absent; no shared standard referenced in incident disclosures
	1 (Medium)	Stakeholder engagement present but limited in cross-tier scope or shared framing not evidenced beyond nominal reference	GRI 2-29 present but narrowly scoped; GRI 3-1 references frameworks nominally; incident framing internal
	2 (High)	Multi-stakeholder, cross-tier materiality process documented; shared frameworks ac-	GRI 2-29 with multi-stakeholder and cross-tier evidence; GRI 3-1 cites recognized external frameworks; GRI

		tively referenced; incident framing aligned to recognized standards	308-2/414-2 or an external incident classification (GRI 403-9, ICMM, IOGP 456, IFC) references shared norms
Prevalent Orchestration (OR)	0 (Low)	No shared audit programs, third-party assurance, or collaborative supply chain platforms referenced	No multi-stakeholder initiative membership; no third-party assurance; GRI 308-1/414-1 absent or entirely internal
	1 (Medium)	One or two collaborative mechanisms present but without documented coverage metrics or limited to non-material disclosures	Initiative membership referenced without coverage metrics; limited assurance scope; collaborative platform referenced without supplier data
	2 (High)	Active participation in recognized schemes with documented coverage; third-party assurance on material disclosures; shared supply chain platforms with quantified coverage	Multi-stakeholder initiative with coverage data; ISAE 3000 or equivalent assurance on material topics; GRI 308-1/414-1 references shared platform with supplier counts
Note – Compiled by the author.			

Response type classification function

Given a firm's PC score and OR score, the response type assignment follows the classification function *A(PC, OR)* defined by the threshold rules below. The rules are derived directly from the quadrant logic of the ORM as specified in sub-chapter 3.1. Formally:

A(PC, OR) = Internal-first if PC ≤ 1 and OR ≤ 1 and not (PC = 1 and OR = 1) ... (4a)

A(*PC*, *OR*) = Collaborative-first if PC = 2 and OR = 2 ... (4b)

A(*PC*, *OR*) = Co-Developer if PC = 2 and OR ≤ 1 ... (4c)

A(*PC*, *OR*) = Selective Joiner if PC ≤ 1 and OR = 2 ... (4d)

$A(1, 1)$ = Internal-first if $CMS_{Pr} + CMS_T < CMS_S + CMS_P$, otherwise Co-Developer ... (4e)

One boundary case is excluded from rule (4a) and resolved by rule (4e), which takes precedence over the general rules wherever the pair PC = 1 and OR = 1 occurs. In this case the firm scores at medium on both dimensions and does not fall cleanly into any response type, and the CMS domain profile determines the classification. If CMSPr + CMST < CMSS + CMSP, the firm is classified as Internal-first. Its operational domains are the weakest part of its profile and are built internally first. Table 36 describes this approach. Otherwise, it is classified as Co-Developer, because an operational base at least as developed as its strategic and organizational base allows standards to be co-developed with peers while internal control is maintained. The following table presents the complete response type classification rules with CMS profile tendencies associated with each quadrant.

Table 36 – Classification rules for response types and typical capability profiles

Response type	**PC Score**	**OR Score**	**Typical CMS Domain Profile**	**Primary Capability Implication**
Internal-first	0 or 1 (except the pair 1, 1)	0 or 1 (except the pair 1, 1)	CMS_{Pr} and CMS_T tend to be below CMS_S and CMS_P; overall CMS typically low to medium	Build Process and Technology capabilities internally before drawing on collaborative mechanisms
Collaborative-first	2	2	Balanced high CMS across all four domains; ATC supported by shared schemes	Leverage shared assurance mechanisms and collaborative platforms to extend tier coverage at lower coordination cost
Co-Developer	2	0 or 1	CMS_S relatively high; CMS_{Pr} and CMS_T may lag; co-development of standards with peers is a priority. In the boundary case (4e), Co-Developer requires $CMS_{Pr} + CMS_T$ at	Co-develop minimal viable standards with industry peers while maintaining strong internal control to avoid premature lock-in

			least equal to CMS_S + CMS_P	
Selective Joiner	0 or 1	2	CMS profile variable; generic risk areas covered by schemes while specific risks show lower CMS_{Pr}	Selectively adopt shared schemes for generic supply chain risks; retain bespoke internal routines for non-standardized risk areas
Boundary case (PC = 1, OR = 1), rule (4e), precedence over the Internal-first row	1	1	Tiebreaker: if CMS_{Pr} + CMS_T < CMS_S + CMS_P to Internal-first; else to Co-Developer	Apply tiebreaker rule based on CMS domain profile; treat classification as provisional pending routing condition reassessment
Note – Compiled by the author.				

In the illustrative CMS example, assume PC = 1 and OR = 0. Medium convergence reflects a multi-stakeholder materiality process with limited cross-tier scope. Low orchestration reflects absent third-party assurance and no reference to shared supply-chain audit platforms. Applying rule (4a), $A(1, 0)$ = Internal-first. This classification fits the CMS profile, where Process has the lowest score, 42.9. Supply-chain governance therefore has the least disclosed evidence. It is the first candidate for internal investment or for evidence production where routines already exist. These steps precede efficient use of collaborative mechanisms.

Justification of ORM outcome metrics and measurement units

The ORM uses metrics for response speed, evidence coverage, and coordination effort. Each metric needs a defined scope, unit, calculation, data source, review frequency, and managerial use [150]. Clear definitions support comparison across functions and supply-chain partners. Existing SSCM frameworks measure environmental, social, economic, and supply-chain performance [160]. The ORM adds measures of organizational response. T2M, ATC, and CC/S should complement relevant sustainability indicators. Their proposed links with capability configurations still require testing.

The first metric, time-to-mitigation (T2M), measures the speed with which an organization converts an identified sustainability issue into a completed or formally accepted mitigation response. Its unit is calendar days. The metric is justified because the ORM treats sustainability-related complexity as a problem of selection and stabilization under time pressure. If sustainability issues remain open for long periods, the organization may have identified the issue. It should be calculated as the number of

calendar days between formal issue registration and mitigation closure or accepted corrective-action completion. Suitable data sources include risk registers, supplier audit findings, and corrective and preventive action logs. The recommended review frequency is monthly for operational monitoring and quarterly for management review.

Auditable tier coverage (ATC) measures how far sustainability evidence reaches across relevant supply-chain tiers. It is expressed as a percentage of suppliers, spend, or risk categories within a defined scope. The preferred calculation uses the share of in-scope supplier spend supported by verification-grade evidence. This reflects the ORM's focus on auditability. Organizations need to demonstrate evidence coverage across their supplier base or risk perimeter. Data sources include supplier master data, procurement spend, self-assessments, audit reports, and certification records. ESG questionnaires, traceability systems, and external assurance documents can also be used. Quarterly review is recommended for high-risk categories. Lower-risk categories can be reviewed semi-annually or annually.

Coordination cost per covered spend (CC/S) measures the resources needed for sustainability control and evidence coverage. It expresses monetary cost per unit of covered procurement spend, for example KZT or EUR per one million KZT or EUR of covered spend. Uncoordinated routines, audits, supplier engagement, reporting, and assurance can increase costs. CC/S helps assess whether a response can scale without excessive coordination effort. It divides total sustainability-related coordination cost by covered procurement spend within the same scope. Costs may include internal full-time equivalents, external audit and assurance fees, supplier engagement, platforms, data management, consulting, and verification directly related to the response. Quarterly review is recommended during active transformation programs. Annual review is recommended for stable governance systems.

Table 37 – Operational definition of ORM outcome metrics

Metric	**Purpose**	**Unit**	**Calculation logic**	**Main data sources**	**Review frequency**	**Managerial interpretation**
Time-to-mitigation (T2M)	Measure time from validated detection to verified closure of a non-	Calendar days	Date of mitigation closure or accepted corrective-action completion minus date of formal issue registration	Risk registers, supplier audit findings, CAPA logs, pro-	Monthly operational review and quarterly management review.	Lower T2M means faster verified mitigation within the same scope.

	con-formity.			cure-ment risk sys-tems, inci-dent data-bases, com-pliance moni-toring records		
Auditable tier coverage (ATC)	Meas-ure how much of the rele-vant supplier or risk scope has ver-ifica-tion-grade evi-dence.	Percent-age of covered suppli-ers, cov-ered spend, or cov-ered risk catego-ries	In-scope supplier spend with valid verifi-cation-grade evi-dence di-vided by to-tal in-scope supplier spend, mul-tiplied by 100	Sup-plier master data, pro-cure-ment spend data, audit reports, certifi-cation rec-ords, ESG ques-tion-naires, tracea-bility sys-tems, assur-ance docu-menta-tion	Quarterly for high-risk cate-gories. Every six or twelve months for lower-risk cate-gories.	Higher ATC means greater evidence cov-erage. Define the scope and unit before comparing values.

Coordination cost per covered spend (CC/S)	Measure the resources needed for sustainability coordination and evidence coverage.	Monetary cost per one million KZT or EUR of covered procurement spend	Total sustainability-related coordination cost in scope divided by covered procurement spend in the same scope	Finance records, procurement spend data, sustainability team time allocation, audit invoices, platform costs, supplier development budgets	Quarterly during active implementation. Annually for stable governance systems.	Lower CC/S indicates more efficient coordination if T2M and ATC do not deteriorate.
Note – Compiled by the author.						

Application of the CMS and the classification function to the Study II sample

The instrument specified in Layer 1 and Layer 2 was applied to the complete document corpus of Study II, that is, to all 20 sustainability, integrated and annual reports of the 11 Kazakhstani companies listed in Table 50. The unit of scoring is the report, so companies with two or three reports in the corpus receive one score per report, which makes changes between reporting years visible. Each report was read against the 30 GRI disclosures of Table 33 and scored on the three-point scale of Table 32, and the six routing sub-criteria of Table 35 were scored on the same scale. A score above 0 is anchored to a page of the underlying report and a short quotation or paraphrase, and every score of 0 to a recorded search, documented in the case-study database and summarized in Appendix Q. Domain scores follow equation (1), the composite CMS follows equation (3), PC and OR are the rounded means of their three subscores, and the response type follows the classification function (4a) to (4e). The scoring was performed by the author as a single coder under the decision rules documented

in Appendix Q. Throughout this sub-chapter, CMS values denote the maturity of disclosed evidence. They are not read as verified maturity of organizational capability, in line with the boundary between public articulation and embedded practice stated in sub-chapter 3.1. KAZ Minerals is included with both of its reports and was scored against the same 30 disclosures of Table 33 as all other reports, so that one indicator set governs the main text and Appendix Q.

Table 38 – Capability Maturity Score, routing conditions and response type for the 20 reports of Study II

ID	Company	Report	CMS S	CMS P	CMS Pr	CMS T	CMS	PC	OR	Response type
R01	Air Astana	IAR 2023	100.0	100.0	28.6	87.5	80.0	2	2	Collaborative-first
R02	Air Astana	IAR 2024	100.0	93.8	35.7	81.3	78.3	2	2	Collaborative-first
R03	BI Group	IAR 2024	85.7	81.3	35.7	62.5	66.7	2	0	Co-Developer
R04	Bank CenterCredit	ESG 2023	100.0	100.0	35.7	100.0	85.0	2	1	Co-Developer
R05	ERG	SDR 2022	100.0	62.5	85.7	75.0	80.0	2	1	Co-Developer
R06	ERG	SDR 2023	100.0	62.5	78.6	75.0	78.3	2	1	Co-Developer
R07	Halyk Bank	SR 2022	92.9	81.3	21.4	75.0	68.3	2	0	Co-Developer
R08	Halyk Bank	AR 2024	57.1	56.3	21.4	0.0	33.3	1	0	Internal-first
R09	KAZ Minerals	SR 2021	92.9	43.8	57.1	93.8	71.7	2	0	Co-Developer
R10	KAZ Minerals	SR 2023	100.0	50.0	57.1	87.5	73.3	2	0	Co-Developer
R11	KPO	SR 2022	92.9	87.5	78.6	100.0	90.0	2	1	Co-Developer
R12	KPO	ESG 2023	100.0	87.5	78.6	100.0	91.7	2	2	Collaborative-first
R13	Kaspi.kz	ESG 2022	71.4	81.3	21.4	68.8	61.7	1	0	Internal-first
R14	Kaspi.kz	20-F + SIR 2023	64.3	81.3	21.4	62.5	58.3	1	0	Internal-first

R15	KazMunayGas	SR 2022	100.0	93.8	71.4	100.0	91.7	2	2	Collaborative-first
R16	KazMunayGas	SR 2023	100.0	93.8	57.1	100.0	88.3	2	2	Collaborative-first
R17	KazMunayGas	AR 2024	78.6	93.8	50.0	87.5	78.3	2	1	Co-Developer
R18	Kazatomprom	IAR 2023	100.0	93.8	50.0	93.8	85.0	2	2	Collaborative-first
R19	Kazatomprom	IAR 2024	100.0	100.0	50.0	93.8	86.7	2	2	Collaborative-first
R20	Samruk-Energy	IAR 2023	100.0	100.0	57.1	100.0	90.0	2	1	Co-Developer
	Mean (20 reports)		91.8	82.2	49.6	82.2	76.8			Co-Developer 10, Collaborative-first 7, Internal-first 3, Selective Joiner 0

Note – CMS S, P, Pr, T = domain scores for Strategy, People, Process and Technology (equation 1). CMS = composite score (equation 3). PC = perceptual convergence, OR = prevalent cross-firm orchestration (rounded means of the sub-scores in Table 35). Response type per equations (4a) to (4e). Report abbreviations: IAR integrated annual report, SR sustainability report, SDR sustainable development report, ESG ESG report, AR annual report, 20-F + SIR Form 20-F with Social Impact Report. Source: author's scoring, case-study database.

Table 38 yields the following results. First, the composite CMS varies widely across the reports. The composite CMS ranges from 33.3 (Halyk Bank, Annual Report 2024) to 91.7 (KPO, ESG Report 2023, and KazMunayGas, Sustainability Report 2022), with a mean of 76.8 and a median of 79.2 across the 20 reports. Both statistics are document-level values: each report counts once, so the eight companies represented by two or three reports carry proportionally more weight than the three companies represented by one report. The company-level mean over the 11 companies is 74.5 by most recent report and 78.9 by most complete sustainability disclosure. Ten reports reach 80 or more, which reflects the sampling frame: the companies were drawn from the leading reporters of the PwC Kazakhstan ESG disclosure rating, and most of them report in accordance with, or with reference to, the GRI Standards. The instrument nevertheless separates the reports clearly. Its ordering does not reproduce the capability profiles of Table 19, because the profiles describe formalization and innovation as articulated in the reports, whereas the CMS scores disclosed GRI evidence.

The domain profile is uniform across the sample. Strategy is the strongest domain (mean 91.8, twelve reports at 100) and Process is the weakest domain (mean 49.6, range 21.4 to 85.7). Process is the lowest-scoring domain in 15 of the 20 reports, and in the remaining five the lowest domain is People (Eurasian Resources Group and KAZ Minerals, whose standalone sustainability reports delegate board composition, evaluation and remuneration to the annual report) or Technology (Halyk Bank's annual report, which contains no environmental data). The gap between the two domains extends across the whole corpus: policy commitments (2-23) and their embedding (2-24) are evidenced in all 20 reports, whereas no report quantifies the share of new suppliers screened on environmental criteria (308-1) or reports negative environmental impacts in the supply chain with actions taken (308-2) at the evidenced level. Social supplier screening (414-1) reaches the evidenced level in three reports and negative social impacts with actions (414-2) in seven, all of them through quantified contractor inspections. The People and Technology domains lie in between (both 82.2), with the governance disclosures 2-17 (collective knowledge of the board) and 2-18 (board evaluation) and the intensity ratios 302-3 and 305-4 as the recurrent gaps. The measured profile can be compared directly with the findings of Kazakhstani research. Orazalin and Mahmood [210] and Orazalin [211] show for listed companies and for KASE-listed banks that the depth of disclosure is explained by standalone reporting, firm size, profitability, auditor type, board gender diversity and foreign ownership, while board size and board independence do not explain it. The present sample reproduces the first of these determinants in a measured form: annual reports score systematically lower than the sustainability reports of the same company, and the three financial-sector documents without a documented materiality process are the only ones classified as Internal-first. Kuur, Varavin and Kozlova [212] relate the national ESG transformation to the strengthening of non-financial reporting. The Strategy mean of 91.8 in the present sample is consistent with that strengthening, and the Process mean of 49.6 locates its limit, because policy commitments are evidenced in all 20 reports and the screening of new suppliers on environmental criteria in none.

Three studies published in the journals of the Committee list allow a closer comparison. Mazbayeva, Aripova and Tokbergenova [219] analyse the non-financial reports of KazMunayGas, the Eurasian Resources Group, Development Bank of Kazakhstan JSC, First Heartland Jusan Bank JSC (renamed Alatau City Bank JSC in 2025) and Kazakhstan Petrochemical Industries Inc. LLP and conclude that ESG practices support long-term competitiveness and reduce reputational risk. Two of these companies are part of the present sample, and the instrument adds the level at which that conclusion holds: strong articulation of strategy against weak evidence of supplier-facing process. Kalibayev and Erkaboev [221] examine the Eurasian Resources Group over the period 2013 to 2024 and find corporate governance to be the strongest predictor of financial performance. In the present sample the two standalone sustainability reports of the same company have People as their weakest domain, because board composition, evaluation and remuneration are delegated to the annual report. Both readings locate the thin evidence in the same place, namely in governance disclosure. Ebesova, Imanbekova and Pencheva [224] compare international and Kazakhstani practice in sustainable logistics and find ESG integration in Kazakhstan at an early stage, with the first progress in larger companies and state institutions. That is the same field diagnosis on which the recommendations of sub-chapter 3.3 rest, namely that orchestration and verification capacity are emerging and uneven.

Neafie et al. [214] compare external disclosure scores with what employees perceive as embedded practice in 25 Kazakhstani firms and find, as reported in sub-chapter 1.1, that the disclosure scores fall short of the internal perception, above all in governance. That direction is the reverse of capability signaling, in which communication precedes embedded practice. The two results are compatible only if the direction differs by domain, and the present data cannot decide the question, because the Capability Maturity Score measures disclosed evidence and contains no measure of internal perception. Gimranova, Pritvorova and Gimranova [222] evaluate the Kazakhstani supplier development project and report weaknesses in monitoring and evaluation and risks that were not neutralized in time. This concerns mechanism claim MC2, which makes the effect of supplier development conditional on sufficient verification capacity. Their finding does not test the claim. It documents that the scope condition of the claim was not met in that project, which is the reading the model predicts. The measured profile is consistent with the central claim of the cross-context synthesis: Kazakhstani companies articulate strategy and quantify their own operations, and supplier-level evidence, the evidence that auditable tier coverage requires, is mostly described and rarely quantified.

Third, the routing conditions discriminate along the orchestration axis, not along the convergence axis. Perceptual convergence is high in 17 of 20 reports. Shared reporting frameworks are referenced in 19 reports (PC2), and incident definitions follow external standards such as GRI 403-9, ICMM, IOGP 456 or IFC in 17 reports (PC3). Cross-firm orchestration, by contrast, spreads across all three levels. Third-party assurance of sustainability disclosures under ISAE 3000 or an equivalent standard covers the whole report or a supply-chain disclosure in seven reports (OR2 = 2), is limited to

selected indicators in six, and is absent in seven. No report cites a shared supplier platform, joint screening tool or collaborative certification scheme with supplier coverage data (OR3 = 2 occurs zero times). Where such mechanisms appear at all, they are the procurement portal of the Samruk-Kazyna group or an international database without coverage figures. The reports therefore combine convergent framing with thinly documented verification infrastructure, which is the constellation the ORM associates with the Co-Developer position. Whether the field itself lacks such infrastructure cannot be decided from the reports.

Fourth, the classification function assigns the 20 reports to three of the four response types. Ten reports are Co-Developers (PC = 2, OR ≤ 1), seven are Collaborative-first (PC = 2, OR = 2) and three are Internal-first (PC = 1, OR = 0). No report is classified as a Selective Joiner, and the tiebreaker rule for PC = 1 and OR = 1 was not needed. At the level of companies, taking the most recent report in the corpus, six companies are Co-Developers (BI Group, Bank CenterCredit, Eurasian Resources Group, KAZ Minerals, KazMunayGas, Samruk-Energy), three are Collaborative-first (Air Astana, KPO, Kazatomprom) and two are Internal-first (Kaspi.kz, Halyk Bank). Collaborative-first coincides in every case with two conditions being met at once, namely third-party assurance of the whole report or of a supply-chain disclosure (OR2 = 2) and active membership in an international scheme with reporting obligations (IOGP and OGMP 2.0, EITI, the UN Global Compact with a published progress report, or CORSIA and EU ETS verification). Internal-first coincides with financial-sector documents that contain no materiality process and no assurance. The absence of Selective Joiners follows from the classification function. Under equation (4d) the type requires PC of 1 or lower together with OR of 2. Seven reports reach OR = 2, and all seven also reach PC = 2 and are therefore classified as Collaborative-first. The combination that defines the Selective Joiner does not occur in this corpus. That mature generic schemes are not visible in the supply-chain disclosures of the sample explains why orchestration is low in the remaining reports, and it is a statement about the disclosures, not about the field.

KAZ Minerals scores 71.7 for its Sustainability Report 2021 and 73.3 for its Sustainability Report 2023 against the 30 disclosures of Table 33, with a Strategy score of 100, a Technology score of 87.5, a Process score of 57.1 and a People score of 50.0 in 2023. A preliminary scoring with broader report-reading criteria had yielded a composite value of 91.7. The value under Table 33 is lower because Table 33 asks directly for the four governance disclosures 2-9, 2-17, 2-18 and 2-20, which the standalone sustainability report delegates to the annual report, and for supplier screening counts, which the report does not contain. The routing scores are PC = 2 and OR = 0, so the classification function assigns the company to the Co-Developer type in both years. The preliminary scoring had derived the same type with OR = 1. The formal type fits the Institutional Integrator profile in sub-chapters 2.2 and 3.1. The company has integrated sustainability into governance and operations. Its next step concerns externally verifiable supplier evidence. Table 19's capability profiles and Table 36's response types answer different questions. Profiles describe formalization in the qualitative within-case analysis. Response types use PC and OR to route the next capability investment. A company can therefore have one capability profile and different response

types. Halyk Bank is an Institutional Integrator in Table 19. Its Sustainability Report 2022 yields Co-Developer, while its Annual Report 2024 yields Internal-first.

Two features limit interpretation. First, the instrument measures disclosed evidence, so document type affects scores. Halyk Bank's Annual Report 2024 scores 35.0 points below its sustainability report. KazMunayGas's Annual Report 2024 scores 10.0 points below its sustainability report. Halyk Bank changes from Co-Developer to Internal-first because its annual report contains no materiality process or environmental data. This does not show a loss of capabilities. Users should score the most complete sustainability disclosure for the reporting year and compare companies using the same document type.

Second, the instrument produces interpretable profiles and classifications under Appendix Q's rules. Every score above 0 has a cited source page. Every score of 0 has a recorded search. This supports traceability, not independent inter-coder agreement below the PBC-domain level. It also does not test FP1 to FP3. These propositions require T2M, ATC, and coordination cost data absent from public reports. Layer 3 defines this validation agenda.

A sensitivity check selected each company's most recent standalone sustainability, ESG, or integrated report. This changed the selected document for three companies and the response type for two. Halyk Bank moved from its Annual Report 2024, with CMS 33.3 and Internal-first, to its Sustainability Report 2022, with 68.3 and Co-Developer. KazMunayGas moved from its Annual Report 2024, with 78.3 and Co-Developer, to its Sustainability Report 2023, with 88.3 and Collaborative-first. Kaspi.kz moved from its Annual Report 2023 with Social Impact Report, scoring 58.3, to its ESG Report 2022, scoring 61.7. Its type did not change.

Across the 11 companies, the resulting distribution is six Co-Developers, four Collaborative-first, one Internal-first, and no Selective Joiner. The most-recent-report rule produces six, three, two, and none respectively. The company-level mean rises from 74.5 to 78.9. Both type changes concern companies whose most recent document is an annual report. Co-Developer remains the modal type, and Selective Joiner remains absent under both rules. Provision 6's overall pattern therefore persists. Individual classification still depends on the document, as Table 57 in Appendix Q shows.

Three checks assess sensitivity to scoring and aggregation. First, CMS was recalculated using four inter-domain weight vectors in Strategy, People, Process, and Technology order: (0.25, 0.25, 0.25, 0.25), (0.20, 0.20, 0.40, 0.20), (0.20, 0.20, 0.30, 0.30), and (0.30, 0.30, 0.20, 0.20). Spearman rank correlations with the baseline range from 0.927 to 0.995. Domain profiles and response types remain unchanged by construction. Classification uses PC, OR, and unchanged domain scores rather than composite weights.

Second, median aggregation and explicit mean thresholds reproduce the baseline: seven Collaborative-first, ten Co-Developer, and three Internal-first reports. Conjunctive and upward-rounding rules change this distribution. Selective Joiner remains absent under all five rules.

Third, all 720 indicator and routing scores were perturbed by one scale step within the 0 to 2 range. Each probability of 5.0, 10.0, and 13.8 percent was tested in

5,000 runs. These are sensitivity scenarios, not estimated CMS scoring error rates. Process remains the lowest sample domain mean in 100 percent of runs. Co-Developer remains the modal type in 89.0 to 94.5 percent. Selective Joiner appears in some runs. Because PC and OR use rounded means, one routing sub-score can change a report's type. The checks support sample-level patterns while showing limits to individual classification stability.

Layer 3: Outcome-oriented design propositions and future empirical test agenda
Design science framing

Layer 3 derives outcome-oriented design propositions from the ORM as a formalized design artefact. It does not formulate Social Systems Theory hypotheses. In design-science and CIMO-oriented management research, such propositions state expected means-end relationships for later evaluation [147; 145; 151]. The three ORM propositions can therefore be translated into testable hypotheses in future quantitative studies.

Each proposition links ORM constructs with a managerial outcome in a specified direction. The rationale comes from sub-chapter 3.1's mechanisms. This dissertation defines the propositions. Later studies may test the corresponding hypotheses [147; 145; 151].

Design Proposition FP1 (Time-to-Mitigation)

> FP1: Firms with higher CMS_{Pr} and CMS_{T} scores exhibit shorter time-to-mitigation (T2M) than firms with lower CMS_{Pr} and CMS_{T} scores, holding response type classification constant. ... (5)

FP1 links Process and Technology with corrective-action workflows, escalation, and data traceability. These capabilities help detect, assign, and close supply chain nonconformities. In sub-chapter 3.1, Process includes Continuous Improvement and Risk Management, which govern response speed. Technology includes Data Management and Reporting, which support evidence assembly and verification. CMSPr and CMST are disclosed-evidence proxies for capabilities expected to affect T2M. FP1 predicts a negative partial correlation between (CMSPr + CMST) and T2M, controlling for response type classification.

Design Proposition FP2 (Auditable Tier Coverage)

> FP2: Firms classified as Collaborative-first exhibit higher auditable tier coverage (ATC) than firms classified as Internal-first with equivalent composite CMS scores. ... (6)

Collaborative-first firms document access to shared audit schemes, accredited verifiers, and collaborative screening platforms. These arrangements can extend auditable coverage beyond what internal resources alone support. Internal-first firms with equivalent CMS scores do not document this access. They are therefore expected to rely on internal supplier development and audits. FP2 predicts a positive coefficient for the Collaborative-first indicator in a regression of ATC on CMS, controlling for sector and firm size.

Design Proposition FP3 (Coordination Cost)

FP3: Firms with higher OR scores exhibit lower coordination cost per covered spend (CC/S) than firms with equivalent composite CMS scores and lower OR scores. ... (7)

FP3 assumes that prevalent orchestration lowers the marginal cost of additional auditable coverage. A higher OR score records disclosed access to and use of shared infrastructure under Layer 2's criteria. FP3 predicts a negative partial correlation between OR and CC/S, net of composite CMS. Table 39 summarizes the three propositions.

Table 39 – Outcome-oriented design propositions of the GRI-anchored ORM operationalization

FP	**Formal Statement**	**Theoretical Derivation**	**Criterion Variable**	**Test Variables**
FP1	Higher CMS_{Pr} and CMS_{T} are negatively associated with T2M, controlling for response type	Process and Technology support corrective workflows and traceable evidence. See the construct dictionary in sub-chapter 3.1.	T2M (median days from validated detection to verified closure)	CMS_{Pr}, CMS_{T} (predictors); Response type (control); Sector, firm size (covariates)
FP2	Collaborative-first exhibit higher ATC than Internal-first at equivalent composite CMS	High orchestration is expected to provide shared coverage mechanisms unavailable to Internal-first firms. See the response type logic in sub-chapter 3.1.	ATC (% spend or suppliers with audit-ready conformity evidence)	Response type classification (Collaborative-first vs. Internal-first dummy); CMS (control); Sector, OR score (covariates)
FP3	Higher OR scores are negatively associated with CC/S, net of composite CMS	Shared orchestration is expected to lower the marginal cost of auditable coverage. See the routing condition logic	CC/S (internal FTE cost + external assurance fees per unit of covered spend)	OR score (predictor); CMS (control); Response type, sector (covariates)

		in sub-chapter 3.1.		
Note – Compiled by the author.				

Scope conditions and validation agenda

The model applies to organizations with public sustainability reports that disclose a representative subset of the selected GRI standards. Firms without sustainability disclosure fall outside this scope. The same applies to firms using frameworks that cannot be mapped to the GRI indicators. Within these limits, the model is sector-agnostic and geographically unrestricted. Sub-chapter 3.1's five moderators remain relevant to expected CMS profiles and response-type distributions.

The specification has two limitations. First, PC and OR use public-report proxies. They capture articulated capabilities, following the boundary in sub-chapter 3.1, and may understate collaboration that is not fully disclosed. Three levels must be distinguished. The field may contain shared frameworks, schemes, and verification capacity. A company may have access through participation or assurance. Its report may disclose that access. The scores observe only the third level. A low OR score means the report does not document access. It does not establish that coordination is unavailable in the field.

Second, inter-domain weights use GRI disclosure density. This derivation is transparent and theoretically justified. Sensitivity analysis shows stable composite ordering under plausible alternatives. Future research could estimate weights statistically using observed T2M, ATC, and CC/S data.

Testing FP1 through FP3 would first require expanding the sample from 20 reports to at least 30 to 50 sustainability reports. These would be scored using the instrument in Tables 32 through 36. On the other hand, collecting corresponding outcome data and estimating the partial associations specified in FP1 through FP3 using ordinary least squares or Tobit regression. On both cases it depends on the distributional properties of each outcome variable. Response type classification would serve as a categorical moderator in the FP2 and FP3 tests. This constitutes a tractable extension of the present dissertation's empirical base, requiring no additional theoretical development: the measurement instrument, classification rules, and analytic propositions are fully specified in the present sub-chapter.

3.3 Implications and Recommendations

Sub-chapter 3.3 translates the model specification and scoring procedure into recommendations for capability investment, portfolio governance and outcome monitoring. It also considers ecosystem arrangements that may support convergence and orchestration. The conceptual origin of these routing conditions is acknowledged in [161]. The 90-day and 12-month horizons are proposed planning periods whose feasibility depends on the organization's routing regime and moderator profile [147; 151].

MC1-MC6, the configuration logic, routing conditions, and Table 28's moderator summaries on page 158 inform four outputs. These are a portfolio implementation guide for 90-day and 12-month horizons, context-specific implications, a KPI and governance architecture, and policy and ecosystem measures. The latter aim to strengthen perceptual convergence and prevalent cross-firm orchestration where evidence supports their relevance. The author's collective-monograph chapter [161] acknowledges these concepts' origin. Their routing role here is specific to the ORM. Allocation and pace in the 12-month build-out depend on the routing regime at each review [147; 151].

Prioritized recommendations roadmap (reading guide)

The priorities and time horizons in Table 40 – Prioritized recommendations roadmap on page 181 are not universal prescriptions. Recommendations depend on the organization's routing regime and moderator profile. The regimes are DR1 Collaborative-first, DR2 Internal-first, DR3 Co-Developers, and DR4 Selective Joiners. Subchapter 3.1 defines them, and Table 41 applies them. Moderators are industry intensity, supply-chain position, size and internationalization, policy and assurance density, and data maturity. The roadmap therefore identifies the *typical* sequencing observed across the empirical material, with explicit pointers to the sections where routing-condition-specific deviations are documented.

Table 40 – Prioritized recommendations roadmap

#	Recommendation	Target audience	Priority	Time horizon	Concrete first step	ORM linkage
R1	Create a common ESG data layer. Record the source, timestamp and owner of evidence.	Technology / CIO. supported by ESG Lead	High	Short (≤ 90 days)	Map the path from incident to evidence. Select two ERP/QMS connections to implement first.	MC1. precondition for ATC, CC/S
R2	Score perceptual convergence, prevalent orchestration and the five moderators.	Strategy / ESG Lead. co-owned with Procurement	High	Short (≤ 90 days)	Apply Table 35 using the five main peer disclosures and available schemes. See subchapter 3.2.	Routing conditions. basis for portfolio routing
R3	Pilot supplier development upstream or pre-qualification and screening for retailers and intermediaries.	Procurement / SCM Lead. supported by Risk	High	Short (≤ 90 days)	Select one critical category. Upstream, diagnose gaps, transfer capabilities and re-audit. In retail, define a prequalification gate.	MC2 or MC3
R4	Create a cross-functional Portfolio Council with clear decision rights.	CEO / COO. ESG Lead as standing chair	High	Short to medium (within first 90-180 days)	Write a one-page charter defining members, review frequency, decisions and escalation. Schedule the first quarterly review.	Governance layer of the ORM
R5	Integrate ESG risks and escalation SLAs into enterprise risk routines.	Risk / Process Lead. co-owned with ESG	High	Medium (3-9 months)	Add ESG risks to the risk register. Define	MC4

					SLA periods from detection to closure.	
R6	Join a mature scheme and adapt its templates internally when DR1 or DR4 applies.	Strategy / ESG Lead. supported by Process	Medium (high if DR1/DR4)	Medium (3-9 months)	Select a scheme for the sector and region. Compare its templates with internal SOPs and begin verification in both directions.	MC5. conditional on routing conditions
R7	Allow local closure of cases with low complexity.	People / HR Lead. supported by Process	Medium	Medium (3-12 months)	Define case categories and escalation thresholds. Train local owners in closure and verification criteria.	MC6
R8	Define T2M, ATC, CC/S and execution-health indicators.	Strategy / Finance. mechanism owners (Risk, SCM, Tech, People)	High	Medium (3-12 months)	Publish definitions, formulas, owners and review frequency. See Table 42. Create dashboards for monthly review.	All MCs. outcome layer
R9	Hold regular Make-or-Join reviews.	Strategy / ESG Lead. with Finance	Medium	Medium (recurring quarterly/semi-annually)	Hold the first MoJ review at month 6. Record exceptions and portfolio allocation decisions.	Routing conditions. portfolio re-weighting
R10	Establish routines, remove unnecessary exceptions as convergence rises and update the evidence map annually.	Portfolio Council	Low to medium	Long (> 12 months)	Add an annual evidence-map review to the agenda. Compare exceptions with current routing scores.	Routing conditions. portfolio integrity

R11	Expand verification capacity through accreditation, assurance pilots and public verifier registries.	Policy makers / regulators. sector associations	High (ecosystem)	Medium to long (12-36 months)	Map auditor capacity by sector and region. Pilot accreditation with sector association co-financing.	Force multiplier for MC1, MC3, MC5
R12	Develop common data schemas, identifiers and API certification.	Standard-setting bodies. regulators	High (ecosystem)	Medium (12-24 months)	Develop a minimum data model for non-conformities, corrective actions and audit findings using controlled terms.	Lowers cost of MC1 and MC5 across firms
R13	Use public materiality dialogues and coordinated regulatory signals to strengthen convergence.	Policy makers / industry associations	Medium (ecosystem)	Long (24-36 months)	Hold an annual materiality workshop across tiers in one priority sector. Publish the identified hazards and mitigation links.	Raises perceptual convergence (routing condition). enables DR1/DR3
R14	Make multi-stakeholder initiatives easy to join, modular and transparent.	MSI conveners. lead firms	Medium (ecosystem)	Medium (12-24 months)	Review joining instructions against clarity criteria. Publish revised instructions and example data.	Raises prevalent orchestration (routing condition). enables MC5 at scale
Note – Compiled by the author.						

First-90-day priorities by addressee. R1 to R4 provide practitioners with a 90-day starting set. Establish the data layer through R1 and score the routing baseline through R2. Pilot a mechanism suited to supply-chain position through R3. Convene the Portfolio Council through R4. Without these four, the subsequent medium-term build-out cannot anchor on observable signals. R11 and R12 are the highest-priority initial ecosystem steps for policymakers and regulators. Verification capacity and data interoperability can lower compliance costs across the field. They particularly benefit Internal-first and Co-Developer firms, which typically face the greatest implementation friction. For multi-stakeholder conveners, R14 (MSI legibility and modularity) is the first lever that translates field-level intent into concrete adoption pathways for late and resource-constrained adopters.

The detailed implementation rationale for each of these recommendations, which includes routing-condition-specific configurations, mechanism-to-action mapping, KPI definitions, and governance review rhythm, is developed in the subsections that follow.

Table 41 – Recommended actions by routing-condition regime (short term / medium term)

Routing conditions regime	**PBC**	**90-day initial actions**	**12-month build-out**	**Risks / safeguards**
DR1 Collaborative-first (High convergence / High orchestration)	Technology	Create the ESG data foundation, connect the scheme API and record audit trails. MC1.	Strengthen master data, automate ATC/T2M dashboards and extend APIs.	Preserve internal connections and evidence quality when adapting templates.
	Process	Define pre-qualification and exception SOPs. Integrate shared audits. MC3.	Extend coverage to lower tiers. Segment assurance by risk and set exception SLAs.	Use one evidence repository to limit duplicate audits. Monitor SLAs.
	People	Define local closure rights and establish a small central ESG team. MC6.	Assign procurement data stewards and assurance contacts in categories.	Clarify RACI and escalation routes to prevent role ambiguity.
	Strategy	Review Make-or-Join options and define exceptions.	Review MoJ quarterly and link incentives to outcomes.	Link bonuses to ATC/T2M to limit KPI misalignment.
DR2 Internal-first (Low convergence / Low orchestration)	Technology	Create an initial data layer with IDs and an incident and evidence repository. MC1.	Create connectors that can join schemes, open schemas and export routines.	Use open identifiers to keep data transferable.
	Process	Create a risk register, escalation SLAs and a closure protocol. MC4.	Add basic screening and pilot supplier development. MC2.	Keep communication linked to measured practice.

	People	Appoint functional champions and establish basic governance.	Formalize roles as workload grows.	Retain local ownership to avoid excessive centralization.
	Strategy	Define portfolio limits and criteria for future MoJ reviews.	Review routing conditions every six months. Plan external collaboration in stages.	Monitor emerging orchestration to avoid dependence on internal work alone.
DR3 Co-Developers (High convergence / Low orchestration)	Technology	Extend the data foundation to common KPIs. Pilot two APIs with peers.	Publish open protocol v0.9 and verify data exchange in both directions.	Keep interfaces modular to avoid dependence on prototypes.
	Process	Pilot supplier development with shared metrics and risk-based escalation. MC2 and MC4.	Scale pilots and prepare to join assurance schemes.	Require auditable logging in pilots.
	People	Assign a second data steward and a category integrator to the working group.	Build an internal team to connect with schemes as they mature.	Limit secondments and plan replacement capacity.
	Strategy	Create a working group before standards mature. Map legitimacy concerns.	If orchestration rises, hold an MoJ review. Reallocate at least 20 percentage points toward collaboration.	Publish the working group charter and update its review schedule.
DR4 Selective Joiners (Low convergence / High orchestration)	Technology	Connect to one mature scheme for a generic issue. Keep custom data objects separate.	Extend connectors selectively and retain alternatives.	Maintain a register of exceptions to control template expansion.

	Process	Pre-qualify generic categories. Use tailored screening where needed. MC3.	Refine exception governance and incorporate lessons.	Review exceptions regularly to avoid excessive generalization.
	People	Define local closure for generic cases and specialist roles for specific risks.	Cross-train staff and transfer knowledge.	Clarify exception thresholds to prevent fragmented decisions.
	Strategy	Record the reasons for exceptions. Schedule a review after six months.	Remove exceptions as convergence rises. Review the balance of internal work and collaboration.	Tie review triggers to changes in routing conditions.
Note – Compiled by the author.				

Portfolio design and sequencing implementation guide as 90-day and 12-month plans

The implementation guide proposes two planning phases. Around 90 days are used to stabilize the most material sustainability pressure. Around 12 months are used to institutionalize the related capabilities [55; 14; 70; 163]. Each plan depends on the boundary-condition regime, including high convergence and strong orchestration or low levels of both. Allocation and timing therefore remain contingent.

Context-specific implications

Patterns in the moderator-by-capability matrix (Table 28) imply distinct default stances and sequencing logics for three recurrent contexts.

Asset-intensive upstream producers

Default stance. Portfolio weighting should privilege Process (supplier development, risk integration) and Technology (traceability, monitoring), with Strategy specifying escalation rights and People embedding plant-level roles. Convergence tends to be medium and issue-specific, whereas orchestration is typically low to medium and varies by commodity.

Sequencing. The preferred sequence begins by establishing a data foundation, e.g., event and incident logging, tier identifiers, and, where relevant, technical bridges. Next, initiate supplier-development loops in a high-risk category and pair these with third-party verification pilots (MC2). Then embed ESG into enterprise risk cycles with leading indicators and escalation thresholds (MC4). Where convergence on a specific issue is high, co-create protocols with near peers to raise orchestration (regime DR3).

Performance expectation. Time-to-mitigation is expected to improve quickly once corrective and preventive actions mature. Auditable coverage beyond first tiers lags until orchestration deepens. The dominant cost levers are data standardization and verification capacity.

Failure modes and countermeasures. Bespoke traceability that does not interoperate and supply-base volatility that undermines capability transfer are recurrent risks. Countermeasures include open identifiers, and a rolling re-audit review schedule. Additionally, modular interfaces are set up. These remain joinable as schemes mature.

Retailers and intermediaries (broad supplier base)

Default stance. Process should be weighted toward screening and pre-qualification, and Technology toward scalable data capture to expand coverage. People should focus on empowerment for exception handling, while Strategy maintains time-bounded exceptions for specific risks.

Sequencing. The sequence starts with adopting recognized standards for pre-qualification and defining exception governance (MC3). Joining cross-firm infrastructure such as supplier portals and audit-sharing then accelerates internal formalization (MC5). Category teams receive local closure rights, while non-standard cases are handled centrally (MC6). A harmonized set of KPI definitions as well as interfaces to the ERP system support the supplier segmentation and the transfer of assurance artifacts.

Performance expectation. Rapid gains in auditable tier coverage and declines in coordination cost are expected. Local problem-solving on specific risks should be monitored for erosion, while justified, time-bounded exceptions are maintained.

Failure modes and countermeasures. Template creep and double audits are common risks. Mitigate with quarterly make-or-join reviews, or a single source of truth for verification artifacts, and exception SLAs to preserve discipline.

The Kazakhstan trajectory (transitional assurance density)

Default stance. Many firms are in a capability-building phase where public reporting functions both as signal and scaffold. Orchestration and verification capacity are emerging but uneven. The efficient path accelerates internal data/process formalization while selectively joining credible schemes as they mature.

Sequencing. First, establish a transparent internal data layer (initial capability set within 90 days) aligned with existing disclosures and capable of feeding future assurance. Second, pilot supplier screening and development in critical categories to generate verifiable improvements (MC2/MC4). Third, join one external initiative for a generic issue to learn orchestration mechanics, recording exceptions for specific risks. Fourth, as orchestration and verification capacity rise, rebalance the portfolio toward collaborative shares in line with regime DR1. Half of the reports of Study II combine high convergence with low or medium orchestration (regime DR3, Table 38).

Performance expectation. Mitigation reliability and report credibility improve early as internal trails substantiate claims. Stage third-party verification and shared infrastructure where policy/assurance density increases.

Failure modes and countermeasures. Risks include signaling outpacing substance and fragmented IT. Countermeasures are a no-decoupling rule for external claims, designated data stewards, and open identifiers to ensure future joinability.

Measurement and way of work (governance)

The value of the ORM in practice depends on measurements that are both auditable and decision-useful. Here, the KPI layer is therefore treated as a managerial performance-measurement system. Performance measurement systems are commonly understood as sets of metrics used to quantify the efficiency and effectiveness of action, and strategy-linked measures are selected to direct managerial attention toward those factors expected to shape desired outcomes [164; 150]. Accordingly, the ORM's KPI dictionary specifies managerial outcome indicators and mechanism-health metrics that make the model observable, auditable, and actionable in organizational practice. These indicators do not claim to measure communication as the basic operation of social systems or the self-reproduction of organizations in the strict Luhmannian sense [149; 14; 15; 16]. Explicit ownership, review schedules, and escalation rights for each capability reduce dependence on individual champions. Logically, it becomes an institutionalized management routine.

KPI dictionary (aligned to ORM outcomes)

The KPI dictionary specifies the proposed monitoring of ORM outcomes and implementation routines [149; 164; 150]. It links indicators to calculation rules, data sources, review schedules and accountable owners. Changes in these indicators provide information for governance reviews, but do not by themselves establish that a capability configuration caused an outcome.

Time-to-mitigation (T2M) is measured in days from validated detection to verified closure. Its scope may be category-specific or firm-wide. Auditable tier coverage

(ATC) measures the percentage of the defined spend, supplier or site scope supported by audit-ready evidence. It is calculated separately for each tier, such as T1 or T2, and aggregated at category level with a stated denominator. Coordination cost per covered spend (CC/S) is calculated at category or program level. It includes internal coordination time valued at the applicable rate and external assurance fees, divided by covered spend. One-off remediation costs are excluded.

Routing-condition monitoring follows the PC and OR criteria in Table 35. Table 42 presents the KPI dictionary, including data integrity, exception SLA adherence and local closure rate.

Table 42 – Managerial KPI dictionary aligned to ORM outcomes

KPI	Definition (unit)	Formula / method	Review schedule	Data source(s)	Accountable owner	Routing conditions link / decision use
Time-to-mitigation (T2M)	Days from validated detection to verified closure	Verified closure date minus validated detection date. Report the median and P95.	Weekly / Monthly	Incident log. CAPA. verification records	Process (Risk/Quality)	Use T2M variation to assess the proposed MC4 relationship. Delays under high orchestration can prompt review of MC1 and MC5.
Auditable tier coverage (ATC)	% spend/suppliers/sites with audit-ready evidence	Verified scope / total relevant scope × 100.	Monthly / Quarterly	Supplier master. scheme registry. audit repo	Procurement/SCM	ATC is expected to rise under DR1 or DR4. Stagnation can prompt review of MC3 and MC5.
Coordination cost per covered spend (CC/S)	€/covered € (or %)	Internal FTE cost plus external fees, divided by covered spend. Use consistent currency and scope. Multiply by 100 if expressed as a percentage.	Quarterly	Time accounting. POs. ATC denominator	Strategy/Finance	MC1 and MC5 are expected to lower CC/S. Use the metric in MoJ reviews.

Data integrity rate	% records with complete audit trails	Complete records / total records × 100.	Monthly	ESG data layer	Technology	Complete audit trails support external auditability under MC1.
Exception SLA adherence	% exceptions resolved within SLA	Exceptions resolved within SLA / total exceptions × 100.	Monthly	Exception workflow	Process / People	Monitor exception handling under MC3.
Local closure rate	% cases closed at edge	Locally closed cases / total cases × 100.	Monthly	Case system	People	Monitor local closure under MC6 alongside rework.
Note – Compiled by the author.						

Governance and ownership

A. Portfolio Council: The proposed council includes the ESG lead, COO/CPO, CIO, and Finance. It reviews convergence and orchestration. It approves make-or-join decisions and exceptions. It also adjusts effort across the four PBC domains. T2M, ATC, and CC/S provide the outcome measures for these decisions. The proposed meeting frequency is quarterly in Collaborative-first fields and semi-annually in Internal-first fields.

B. Decision rights: *Strategy* sets thresholds for the two routing conditions and authorizes make-or-join reallocations. *People* owns local closure rights and role clarity and governs the exception ladder. *Process* maintains CAPA, pre-qualification, and risk integration and ensures SLA discipline. *Technology* is custodian of the data layer and integration surfaces and co-owns the audit repository and dashboards.

C. Review rhythm and artifacts: *Monthly execution reviews* examine mechanism-health metrics (data integrity, exception SLA, CAPA velocity). *Quarterly routing conditions reviews* re-score convergence and orchestration and test portfolio re-weighting against the regimes DR1 to DR4. *Annual evidence-map refresh* (Table 27, page 140) updates edge strengths and boundary notes as field conditions evolve.

D. Controls against decoupling: Public communication references only measurable shifts in ATC and/or T2M, or verified improvements. To ensure that evidence is retrievable within hours, or at most within a few days, internal audits periodically test whether claimed coverage is audit-ready.

Policy and ecosystem levers as recommendations for organizations

The ORM proposes four groups of ecosystem measures for policymakers, regulators, sector associations, standard-setting bodies and multi-stakeholder initiative conveners. Table 40 links the recommendations to these actors. Their expected effects are design propositions that require evaluation in the relevant institutional setting.

Verification capacity and assurance density can be addressed through auditor training and accreditation, trial audits in assurance sandboxes, support linked to verified outcomes and public registers of recognized providers. Regulators and associations can use these measures to improve access to assurance. The intended effects are wider auditable tier coverage, shorter time-to-mitigation and lower coordination cost, subject to verifier quality and available capacity.

Data interoperability and traceability require open event schemas, persistent supplier and facility identifiers and interfaces for exchanging verification records. Standard-setting bodies, platform operators and lead firms can develop these arrangements jointly. The intended effect is less duplicate data collection and translation work between internal systems and shared schemes.

Perceptual convergence can be supported through cross-tier materiality dialogues, category-specific implementation guides and consistent expectations across authorities and associations. These actors can clarify issue definitions, relevant controls and evidence requirements. The intended effect is greater agreement on which sustainability issues warrant shared responses.

Multi-stakeholder initiative conveners can reduce joining barriers through clear entry requirements, practical templates and a core standard with risk-specific extensions. Transparent issue selection, update procedures and conflict-of-interest controls support the credibility of these arrangements. The intended effect is more accessible collaboration for Internal-first and Co-Developer organizations. Whether these measures change routing conditions or outcomes must be assessed through the monitoring procedures proposed in sub-chapter 3.3.

Evaluation of the ORM as a design-science artefact

The ORM is evaluated against design-science criteria [145; 144; 151]. The assessment covers the model and instrument developed in sub-chapters 3.1 and 3.2. It separates completed analytic and application-based evaluation from validation that remains open.

Six criteria guide the assessment. Explanatory coherence concerns the connection between pressure, selection, capability configuration, and measurable outcomes. Empirical traceability requires links between each ORM construct and Study I, Study II, or both. Internal consistency requires compatible decision points, capability domains, moderators, routing conditions, and outcome metrics. Operationalizability is provided by the GRI-anchored Capability Maturity Score, the response-type classification function, and three outcome-oriented design propositions. Application is demonstrated by applying the CMS and classification function to all 20 Study II reports. This produced interpretable capability profiles and response types. Comparative positioning is assessed through the functional-gap analysis. It identifies a response-rationale gap that existing ESG disclosure frameworks and SSCM governance models leave largely unspecified.

On this basis, the ORM has passed an initial analytic and application-based evaluation. It is internally consistent, traceable to the empirical material, and operationalized in a scoreable instrument applied across Study II. The outcome propositions have not been tested against outcome data. This evaluation supports a model-building dissertation aimed at developing prescriptive knowledge.

Several validation steps remain open. A structured external expert panel has not yet assessed the ORM's usefulness. The model has not been validated within companies using internal procurement, audit, and risk data. Its outcome metrics have also not been tested longitudinally. Stronger capabilities are expected to shorten time-to-mitigation, increase auditable tier coverage, and improve coordination cost efficiency. These expectations remain design propositions.

The dissertation completes model development, formal operationalization, and initial analytic and application-based evaluation. External expert assessment, company application with internal data, and longitudinal testing of FP1 to FP3 remain open. The ORM is therefore an initially evaluated design-science artefact.

The language and the logical consistency of this chapter were reviewed with ChatGPT [194]. All revisions were made by the author.

CONCLUSION

The dissertation examines how organizations describe and configure capabilities under sustainability pressure. It develops a model and an implementation guide. The research combines conceptual foundations, two empirical studies, cross-context synthesis, and model development. Eight comparative propositions describe patterns across the studies. Four abductive mechanisms propose explanations involving enforcement, assurance, legitimacy, and capability costs. Their independent effects remain untested. Institutional context, observation period, and evidence modality differ between the corpora, and the design cannot separate these influences. The organization is the focal unit of analysis. Supply chains provide the context for pressures and coordination.

The first objective established a conceptual perspective on selection under complexity. Social Systems Theory treats organizations in supply chains as social systems. Their viability depends on enough internal variety to absorb external variety, following Ashby's argument. Applied to sustainability, management selects which pressures to make visible, which responses to implement, and which collaborative interfaces to use. It cannot process the entire environment. Communication and structure help organizations select and establish responses as routines. Packed Business Capabilities provide a vocabulary for describing this internal variety across Strategy, People, Process, and Technology. The reviewed literature supports this perspective. It also anticipates patterns found in both corpora, including clustered capability maturity and possible gaps between communication and embedded practice.

The second objective mapped the institutional and regulatory environments of Germany and Kazakhstan, with an emphasis on Kazakhstan. The analysis identified rapid formalization over the past decade. Relevant frameworks include Strategy Kazakhstan 2050, the Green Economy Concept, the 2021 Environmental Code, corporate governance and social codes, AIFC ESG disclosure guidance, and the national net-zero pledge for 2060. These conditions later inform the model's moderators and routing conditions. The third objective established the two-study abductive design in sub-chapter 1.3. It combines a multiple-case study with qualitative content analysis of Kazakhstani reports.

The fourth objective examined how German organizations describe sustainability capabilities in complex supply networks. Study I used 23 in-depth interviews across 17 organizations in sectors with high sustainability exposure. People and Process capabilities formed the main basis of their responses. Structures and staff, employee empowerment, process innovation, supply chain sustainability, and risk routines were described as most developed. Strategic Management, Communication, Data Management and Reporting, and Technology Adoption were less developed, as shown in Table 18. These findings produced the initial Packed Business Capabilities architecture. Its shared vocabulary supports later analytic generalization.

The fifth objective examined sustainability and annual reports from 11 Kazakh companies. The 20 reports were published between 2022 and 2025 and covered report-

ing years 2021 to 2024. Analysis applied the PBC codebook deductively while allowing inductive additions. Reports often emphasize policy commitments and international frameworks. They also describe risk management, data infrastructures, and logistics digitization. These disclosures show differences in capability emphasis. They do not establish a longitudinal development sequence or provide the same access to embedded practice as the German interviews.

The sixth and seventh objectives translated the cross-context findings into the ORM and its quantitative operationalization. Sub-chapter 3.1 defines routing logic and capability configurations. Sub-chapter 3.2 develops a 30-indicator, GRI-anchored CMS and response-type classification function. Both were applied to all 20 Study II reports. FP1 to FP3 propose outcome relationships for future testing. The dissertation does not test them against outcome data.

The eighth objective produced an implementation guide. It proposes a 90-day planning phase followed by a 12-month institutionalization horizon. These periods are design assumptions informed by qualitative accounts. The same applies to two seconded full-time equivalents and a reallocation of 20 percentage points of effort. Their feasibility remains to be evaluated. High-convergence, high-orchestration regimes are expected to support cost and coverage benefits. Low-convergence, low-orchestration regimes start with internal data and risk routines. These routines can later connect to external arrangements when field orchestration develops. Explicit make-or-join reviews and a KPI dictionary govern the review schedule.

SQ1 concerns capability reconstruction. It is answered by the Packed Business Capabilities architecture developed in Study I and applied in Study II. Organizations build bundled capabilities across Strategy, People, Process, and Technology to respond to sustainability-related complexity. People and Process were most developed in the German cases. The Kazakh reports show a different capability pattern. SQ2 concerns contextual variation. Sub-chapter 2.3 and propositions P1 to P8 answer it through the cross-context synthesis.

The model proposes that portfolio choice should reflect conditions in the organizational field. High convergence and orchestration may support shared arrangements. Where both are weak, organizations may need internal capabilities before joining becomes feasible. These are conditional design propositions. The Kazakh reports show capability signaling, but further evidence is needed to establish its transition into embedded practice. German interviewees rarely described Communication as a separate capability, as Table 18 shows.

The Kazakhstan recommendations reflect Study II's disclosed configurations. Based on each company's most recent report, six of eleven firms are Co-Developers. Collaborative-first coincides with third-party assurance and scheme membership. No report is classified as Selective Joiner. All seven reports with OR = 2 also have PC = 2. These results describe the corpus. Missing supplier-platform coverage disclosures do not prove that the field lacks this infrastructure. Proposed priorities are data integrity and the connection between responsibilities and operating routines. Firms should review collaboration opportunities as verification capacity develops. ESG training and

climate-risk disclosure are possible portfolio measures. Their suitability depends on sector, organizational capacity, and routing conditions.

The artefact's economic and efficiency assessment consists of conditional design propositions. The ORM is expected to reduce time-to-mitigation, which would reduce incident externalities and exposure periods. It is also expected to increase auditable tier coverage through effort allocation. Timely make-or-join shifts should lower coordination cost per covered spend where convergence and orchestration allow economies of scale in verification and shared auditing. Chapter 2's mechanism evidence informs these relationships. The KPI dictionary makes them manageable. They remain FP1 to FP3, defined in sub-chapter 3.2, until matched baseline and follow-up outcome data are analyzed. As explained in sub-chapter 3.3, the KPI layer supports managerial evaluation and governance aligned with ORM outcomes.

The scientific contribution has three parts. First, the dissertation uses SST to interpret how organizations reduce sustainability-related complexity through selection and stabilization [14; 15; 16]. Second, it develops an analytically generalized Organizational Response Model from interview and public-reporting patterns. Third, it specifies a capability-based governance model as a design-science artefact. The implementation guide, make-or-join rationale, KPI dictionary, and quantitative operationalization support use, observation, and future evaluation [144; 145; 151]. The main contribution is a grounded management model for organizational sustainability responses. Its principal scientific result is the routing mechanism. Perceptual convergence and prevalent cross-firm orchestration guide make-or-join decisions. This specifies the contingency approach left underdeveloped by the frameworks in Table 30.

The limitations concern evidence, sampling, coding, scoring, and the scope of claims. Transparency measures help readers assess these limitations but cannot remove them [165; 166].

Both studies analyze organizational accounts. Study I uses interviews supported by public documents. Study II uses sustainability and annual reports. Different informant roles and contextual sources broaden the interview evidence. Transcript verification checks the recorded accounts, not every underlying organizational claim. Public reports show how companies describe capabilities and select evidence for disclosure. Neither source directly observes all routines, implementation, or outcomes. Social desirability, selective disclosure, and gaps between commitments and practice therefore remain relevant.

Sampling supports analytic rather than statistical generalization [24; 111]. Study I contains six embedded cases based on 23 interviews from 17 organizations headquartered in Germany. Their international supply chains do not make this a representative DACH sample. Theoretical and purposive selection vary industry, size, and supply-chain position while keeping the headquarters context broadly constant. Study II uses 20 reports from 11 Kazakh companies selected within the PwC ESG Disclosure frame. Sector variation broadens comparison, but the frame favors visible reporters. Language availability also affects inclusion. The findings cannot be generalized statistically to all German or Kazakh firms. Transfer beyond Germany and DACH, or to smaller and

mainly domestic Kazakh firms with limited reporting, needs further evidence. Applicability to firms with fewer resources or different supply-chain exposure also remains open.

The coding framework permits inductive additions to the Study I PBC categories. This helps capture other practices but cannot remove researcher judgment or confirmation bias. Recurring patterns informed the assessment, without a formal saturation procedure. Sample size and composition therefore limit the configurations the studies can identify.

The author conducted most Study II coding. Pilot testing, intra-coder checks, peer debriefing, and reflexive memos helped apply and clarify the codebook. An independent check covered 29 passages from five companies and all four PBC domains. Krippendorff's alpha was 0.818. Agreement was reached on 25 of 29 passages, or 86.2 percent, as shown in Table 51. These results concern PBC-domain assignment. The full corpus was not independently double-coded. Reliability below domain level was not separately quantified. This check does not establish the reliability of the 600 CMS indicator scores or 120 routing sub-scores assigned by one coder.

The scoring database records page references and quotations or paraphrases for all 643 scores above 0. The 77 scores of 0 include documented search terms for disclosures not found. Appendix Q defines rules for recurring borderline cases. These records allow scoring decisions to be retraced and checked. They do not replace independent rescoring. Sub-chapter 3.2 tests alternative weights, aggregation rules, and individual score changes. The analyses identify stable sample-level patterns and limits to individual classifications. Independent indicator-level scoring remains necessary for further validation. The CMS measures disclosed evidence rather than capability effectiveness. Annual reports score lower than the same company's sustainability reports in this corpus, as Table 38 shows. Comparisons must therefore account for document type and disclosure scope.

The empirical periods differ. Study I uses interviews from 2019 and 2020. Study II uses reports published between 2022 and 2025. Institutional context, period, and evidence modality vary together, so the design cannot separate their effects. This is neither a controlled country comparison nor a before-and-after analysis. There is no formal longitudinal design [103; 104]. Sequencing patterns are reconstructed from accounts of review cycles and implementation phases. The 90-day and 12-month implementation horizons are design abstractions whose feasibility still requires company-level testing.

Sustainability-related complexity is treated as a qualitative typology covering regulatory, stakeholder, data and auditability, interorganizational, and temporal aspects [37; 38]. No direct quantitative complexity index is calculated. Social Systems Theory provides a selective interpretive lens for complexity reduction and stabilization. Autopoiesis is not operationalized, and the empirical contribution remains capability-based. Routing scores and thresholds are anchored in the evidence and assumptions of the 2019 to 2025 setting and require reassessment as reporting and assurance arrangements change.

Finally, the empirical material does not test the model's proposed relationships with time-to-mitigation, auditable tier coverage or coordination cost per covered spend. These outcomes were selected for managerial observability and do not capture every dimension of sustainability performance. Limited visibility during internal capability building may also conceal progress. The ORM and its operationalization provide a basis for further testing with internal company data, independent scoring and longitudinal outcome measurement. They do not establish that the recommended portfolios improve sustainability performance.

Longitudinal studies should track boundary-condition movement and portfolio re-weighting over time. This would allow tests of whether make-or-join governance truly minimizes coordination cost while maintaining both coverage and mitigation speed. To observe whether capability signaling evolves into structural embedding and under what moderators, mixed-method designs should pair interviews and ethnography with digital trace data from corrective-action systems as well as supplier platforms. Comparative work across Central Asian economies can test whether the inductive sub-business capabilities observed in Kazakhstan, such as logistics digitization standards and strategic data infrastructures, generalize or remain context-bound. Finally, policy-intervention studies can exploit the model’s measurability by treating assurance-density shocks or platform convenings as natural experiments and by observing movements in T2M, ATC, and CC/S before and after. For Kazakhstan, a practical scenario is a state-sponsored convening that raises orchestration in a priority domain. The model predicts a Collaborative-first shift with coverage gains and falling coordination cost if internal connectors are prepared. This prediction follows from the routing approach of provision 4 and from FP2 and FP3, and it can be tested.

The dissertation reconstructs organizational response patterns and develops a model for selecting and governing capability portfolios under specified routing conditions. Its contribution is the model and its operationalization. Whether its recommendations improve time-to-mitigation, auditable tier coverage and coordination cost remains to be tested. The next research step is application with internal organizational data and longitudinal assessment of these outcomes.

The language and the logical consistency of this chapter were reviewed with ChatGPT [194]. All revisions were made by the author.

LIST OF REFERENCES

1 World Bank. Kazakhstan Country Climate and Development Report. World Bank Group. [Electronic resource]. – 2022. – URL: https://openknowledge.worldbank.org/entities/publication/dabff214-772e-50b4-89d9-a172e99accc3 (accessed: 31.07.2026).

2 Zlatev, V., Amann, M., Peszko, G., Wang, Q., & Schoepp, W. Clean Air and Cool Planet: Integrated Air Quality Management and Greenhouse Gas Reduction for Almaty and Nur-Sultan (Vol. II). – World Bank, 2022.

3 World Bank. Kazakhstan: General Water Security Assessment. – World Bank, 2024.

4 World Bank. Impacts of the CBAM on Kazakhstan: EU CBAM—Modelling the impacts on Kazakhstan's economy (Kazakhstan Background Note 1). [Electronic resource]. – URL: https://documents1.worldbank.org/curated/en/099420011012227804/pdf/P17736909f4ba20b20a09900704fa0830cb.pdf (accessed: 31.07.2026).

5 Republic of Kazakhstan. Strategy of the Republic of Kazakhstan for Achieving Carbon Neutrality by 2060. – United Nations Framework Convention on Climate Change, 2024.

6 Mahmood, M., & Orazalin, N. Green governance and sustainability reporting in Kazakhstan's oil, gas, and mining sector: Evidence from a former USSR emerging economy // Journal of Cleaner Production. – 2017. – Vol. 164. – P. 389–397.

7 Mahmood, M., & Humphrey, J. Stakeholder expectation of corporate social responsibility practices: A study on local and multinational corporations in Kazakhstan // Corporate Social Responsibility and Environmental Management. – 2013. – Vol. 20. – № 3. – P. 168–181.

8 Goby, V. P., & Karimova, G. Z. Kazakhstan's corporate social responsibility (CSR) lullabies: The power of culturally familiar narratives // REGION. – 2023. – Vol. 12. – № 1. – P. 121–138.

9 Baltabayeva, A. K., Altaibayeva, Z. K., Shelomentseva, V. P., Mutallyapova, S. E., & Alimkhanova, R. K. Promotion of the principles of corporate social responsibility and their implementation by large businesses in Kazakhstan // Australasian Accounting, Business and Finance Journal. – 2024. – Vol. 18. – № 1. – P. 172–186. – DOI: 10.14453/aabfj.v18i1.11.

10 Jumasseitova, A. K., & Alybayeva, D. Barriers to ESG standards implementation in Kazakhstan, Taiwan, and Singapore // Archives of Business Research. – 2025. – Vol. 13. – № 7. – P. 23–31.

11 Jamali, D., & Karam, C. Corporate social responsibility in developing countries as an emerging field of study // International Journal of Management Reviews. – 2018. – Vol. 20. – № 1. – P. 32–61.

12 Jamali, D., & Mirshak, R. Corporate social responsibility (CSR): Theory and practice in a developing country context // Journal of Business Ethics. – 2007. – Vol. 72. – № 3. – P. 243–262.

13 Visser, W. Corporate social responsibility in developing countries. – In A. Crane, A. McWilliams, D. Matten, J. Moon, & D. S. Siegel (Eds.), The Oxford handbook of corporate social responsibility Oxford University Press, 2008.

14 Luhmann, N. Soziale Systeme: Grundriß einer allgemeinen Theorie. – Frankfurt a.M.: Suhrkamp, 1984.

15 Luhmann, N. Social Systems. – Stanford University Press, 1995.

16 Luhmann, N. Organization and decision (R. Barrett, Trans.). – Cambridge University Press (Original work published 2000), 2018.

17 Freeman, R. E. Strategic Management: A Stakeholder Approach. – Pitman, 1984.

18 Meyer, J. W., & Rowan, B. Institutionalized Organizations: Formal Structure as Myth and Ceremony // American Journal of Sociology. – 1977. – Vol. 83. – № 2. – P. 340–363. – DOI: 10.1086/226550.

19 DiMaggio, P. J., & Powell, W. W. The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields // American Sociological Review. – 1983. – Vol. 48. – № 2. – P. 147–160.

20 Barney, J. B. Firm resources and sustained competitive advantage // Journal of Management. – 1991. – Vol. 17. – № 1. – P. 99–120. – DOI: 10.1177/014920639101700108.

21 Hart, S. L. A natural-resource-based view of the firm // Academy of Management Review. – 1995. – Vol. 20. – № 4. – P. 986–1014.

22 Teece, D. J., Pisano, G., & Shuen, A. Dynamic capabilities and strategic management // Strategic Management Journal. – 1997. – Vol. 18. – № 7. – P. 509–533.

23 Seidl, D., & Becker, K. H. Organizations as Distinction Generating and Processing Systems: Niklas Luhmann's Contribution to Organization Studies // Organization. – 2006. – Vol. 13. – № 1. – P. 9–35.

24 Yin, R. K. Case study research and applications: Design and methods (Sixth edition). – SAGE, 2018.

25 Mayring, P. Qualitative content analysis: Theoretical foundation, basic procedures and software solution. Klagenfurt. [Electronic resource]. – 2014. – URL: https://nbn-resolving.org/urn:nbn:de:0168-ssoar-395173 (accessed: 31.07.2026).

26 Govindan, K., Demartini, M., Formentini, M., Taticchi, P., & Tonelli, F. Unravelling and mapping the theoretical foundations of sustainable supply chains: A literature review and research agenda // Transportation Research Part E: Logistics and Transportation Review. – 2024. – Vol. 189. – P. 103685.

27 Touboulic, A., & Walker, H. Theories in sustainable supply chain management: A structured literature review // International Journal of Physical Distribution & Logistics Management. – 2015. – Vol. 45. – № 1/2. – P. 16–42.

28 World Commission on Environment and Development (WCED). Our Common Future. – Oxford University Press, 1987.

29 Elkington, J. Partnerships from cannibals with forks: The triple bottom line of 21st century business // Environmental Quality Management. – 1998. – Vol. 8. – № 1. – P. 37–51.

30 Bansal, T. Business sustainability defined. Network for Business Sustainability. [Electronic resource]. – 2010. – URL: https://nbs.net/from-timas-desk-what-is-business-sustainability/ (accessed: 31.07.2026).

31 Srivastava, S. K. Green supply-chain management: A state-of-the-art literature review // International Journal of Management Reviews. – 2007. – Vol. 9. – № 1. – P. 53–80.

32 Pagell, M., & Wu, Z. Building a more Complete Theory of Sustainable Supply Chain Management Using Case Studies of 10 Examplars // Journal of Supply Chain Management. – 2009. – Vol. 45. – № 45. – P. 37–56.

33 Ahi, P., & Searcy, C. A comparative literature analysis of definitions for green and sustainable supply chain management // Journal of Cleaner Production. – 2013. – Vol. 52. – P. 329–341.

34 Beske, P., & Seuring, S. Putting sustainability into supply chain management // Supply Chain Management: An International Journal. – 2014. – Vol. 19. – № 3. – P. 322–331.

35 Carter, C. R., & Rogers, D. S. A framework of sustainable supply chain management: Moving toward new theory // International Journal of Physical Distribution & Logistics Management. – 2008. – Vol. 38. – № 5. – P. 360–387.

36 Seuring, S., & Müller, M. From a literature review to a conceptual framework for sustainable supply chain management // Journal of Cleaner Production. – 2008. – Vol. 16. – № 15. – P. 1699– 1710.

37 Bozarth, C. C., Warsing, D. P., Flynn, B. B., & Flynn, E. J. The impact of supply chain complexity on manufacturing plant performance // Journal of Operations Management. – 2009. – Vol. 27. – № 1. – P. 78–93.

38 Serdarasan, S. A review of supply chain complexity drivers // Computers & Industrial Engineering. – 2013. – Vol. 66. – № 3. – P. 533–540.

39 Montabon, F. L., Pagell, M., & Wu, Z. Making sustainability sustainable // Journal of Supply Chain Management. – 2016. – Vol. 52. – № 2. – P. 11–27.

40 Nimsai, S., & Yoopetch, C. Mapping the knowledge base of sustainable supply chain management: A bibliometric literature review // Sustainability. – 2020. – Vol. 12. – № 18. – P. 7348.

41 Katenova, M., & Qudrat-Ullah, H. Corporate social responsibility and firm performance: Case of Kazakhstan // Heliyon. – 2024. – Vol. 10. – № 10. – P. e31580.

42 Zhaksybayeva, N., Serikkyzy, A.., Baktymbet, A., & Yousafzai, S. Circular shifts: Insights into Kazakhstan's circular business ecosystem // Cogent Business & Management. – 2024. – Vol. 11. – № 1. – P. 2431652. – DOI: 10.1080/23311975.2024.2431652.

43 Li, M., Maffei, A., Mukhanova, G., Kuldeyev, E., Amralinova, B., & Tymbayeva, Z. Reverse supply chain optimization in Kazakhstan’s mining industry: Unlocking value from waste // Sustainability. – 2025. – Vol. 17. – № 23. – P. 10589. – DOI: 10.3390/su172310589.

44 Bulkhairova, Z., Bermukhamedova, G., Dzhanegizova, A., & Primbetova, S. Corporate social responsibility in Kazakhstan: Current state and ways of development

// Eurasian Journal of Economic and Business Studies. – 2023. – Vol. 67. – № 1. – P. 27–38.

45 Astana Financial Services Authority (AFSA). AFSA issues AIFC ESG Disclosure Guidance [Press release]. Astana International Financial Centre. [Electronic resource]. – 2024. – URL: https://afsa.aifc.kz/afsa-issues-aifc-esg-disclosure-guidance/ (accessed: 31.07.2026).

46 Kazakhstan Stock Exchange. ESG Data Platform. [Electronic resource]. – Almaty : KASE. – URL: https://kase.kz/en/investors/esg-data-platform/ (accessed: 31.07.2026).

47 OECD. Responsible Business Conduct for Sustainable Infrastructure in Kazakhstan, Mongolia and Uzbekistan. – OECD Publishing, 2025.

48 Hartmann, J., & Moeller, S. Chain liability in multitier supply chains? Responsibility attributions for unsustainable supplier behavior // Journal of Operations Management. – 2014. – Vol. 32. – P. 281–294.

49 Baumann-Pauly, D., C. Wickert, L. J. Spence, & Scherer, A. G. Organizing Corporate Social Responsibility in Small and Large Firms: Size Matters // Journal of Business Ethics. – 2013. – Vol. 115. – P. 693–705.

50 Hall, J., Matos, S., & Silvestre, B. Understanding why firms should invest in sustainable supply chains: A complexity approach // International Journal of Production Research. – 2012. – Vol. 50. – № 5. – P. 1332–1348.

51 Wilhelm, M., Blome, C., Bhakoo, V., & Paulraj, A. Sustainability in multitier supply chains: Understanding the double agency role of the first-tier supplier // Journal of Operations Management. – 2016. – Vol. 41. – P. 42–60.

52 Sarkis, J., & Zhu, Q. Environmental sustainability and production: taking the road less travelled // International Journal of Production Research. – 2018. – Vol. 56. – № 1/2. – P. 743–759.

53 Neske, A., Bordiyanu, I., & Brauweiler, C. Sustainability complexities in supply chains: a qualitative study utilizing social systems theory // Eurasian Journal of Economic and Business Studies. – 2024. – Vol. 68. – № 1. – P. 58–76.

54 Delbridge, R., Helfen, M., Pekarek, A., Schuessler, E., & Zietsma, C. Organizing Sustainably: Introduction to the Special Issue // Organization Studies. – 2024. – Vol. 45. – № 1. – P. 7–29.

55 Schneider, A., Wickert, C., & Marti, E. Reducing Complexity by Creating Complexity: A Systems Theory Perspective on How Organizations Respond to Their Environments // Journal of Management Studies. – 2017. – Vol. 54. – № 2. – P. 182–208.

56 Yang, Y., Jiang, Y., Jia, F., & Chen, L. The impact of supplier instability on corporate social responsibility performance over the firm lifecycle: a social systems theory perspective // British Journal of Management. – 2023. – Vol. 34. – № 3. – P. 1259–1281.

57 Muñoz-Torres, M. J., Fernández-Izquierdo, M. A., Ferrero-Ferrero, I., Escrig-Olmedo, E. & Rivera-Lirio, J. M. Social Life Cycle Analysis of Textile Industry Impacts for Greater Social Sustainability of Global Supply Chains // Systems. – 2023. – Vol. 11. – № 8. – P. 1–19.

58 Rasche, A., Bakker, F. G. A. de, & Moon, J. Complete and Partial Organizing for Corporate Social Responsibility // Journal of Business Ethics. – 2013. – Vol. 115. – № 4. – P. 651–663.

59 Reinecke, J. & Ansari, S. Taming Wicked Problems: The Role of Framing in the Construction of Corporate Social Responsibility // Journal of Management Studies. – 2016. – Vol. 53. – № 3. – P. 299–329.

60 Eisenhardt, K. M., & Martin, J. A. Dynamic capabilities: what are they? // Strategic Management Journal. – 2000. – Vol. 21. – № 10-11. – P. 1105–1121.

61 Jensen, M. C., & Meckling, W. H. Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure // Journal of Financial Economics. – 1976. – Vol. 3. – № 4. – P. 305–360.

62 Burns, T., & Stalker, G. M. The management of innovation. – Tavistock, 1961.

63 Lawrence, P. R., & Lorsch, J. W. Organization and environment: Managing differentiation and integration. – Harvard Business School, Division of Research, 1967.

64 Donaldson, L. The contingency theory of organizations. – SAGE Publications, 2001. – DOI: 10.4135/9781452229249.

65 Schreyögg, G., & Steinmann, H. Strategic control: A new perspective // Academy of Management Review. – 1987. – Vol. 12. – № 1. – P. 91–103.

66 Levinthal, D. A., & Warglien, M. Landscape Design: Designing for Local Action in Complex Worlds // Organization Science. – 1999. – Vol. 10. – № 3. – P. 342–357.

67 Schuh, G., Sauer, A., & Döring, S. Managing Complexity in Industrial Collaborations Within Tool & Die Industry. – In IFIP International Federation for Information Processing Information Technology For Balanced Manufacturing Systems, 220,167-174.Boston, MA: Springer US, 2006.

68 Choi, T. Y., Dooley, K. J., & Rungtusanatham, M. Supply networks and complex adaptive systems: control versus emergence // Journal of Operations Management. – 2001. – Vol. 19. – P. 351–366.

69 Matos, S., & Hall, J. Integrating sustainable development in the supply chain: The case of life cycle assessment in oil and gas and agricultural biotechnology // Journal of Operations Management. – 2007. – Vol. 25. – № 6. – P. 1083–1102.

70 Ashby, W. R. Requisite variety and its implications for the control of complex systems // Cybernetica. – 1958. – Vol. 1. – № 2. – P. 83–99.

71 Daft, R. L., & Lengel, R. H. Organizational Information Requirements, Media Richness and Structural Design // Management Science. – 1986. – Vol. 32. – № 5. – P. 554–571.

72 Damanpour, F. Organizational Complexity and Innovation: Developing and Testing Multiple Contingency Models // Management Science. – 1996. – Vol. 42. – № 5. – P. 693–716.

73 Roundtable on Sustainable Palm Oil. About RSPO. [Electronic resource]. – Kuala Lumpur : RSPO. – URL: https://rspo.org/ (accessed: 31.07.2026).

74 Business & Human Rights Resource Centre. The Accord on Fire and Building Safety in Bangladesh. [Electronic resource]. – URL: https://www.business-human-rights.org/en/latest-news/the-accord-on-fire-and-building-safety-in-bangladesh/ (accessed: 31.07.2026).

75 Scandelius, C., & Cohen, G. Achieving collaboration with diverse stakeholders—The role of strategic ambiguity in CSR communication // Journal of Business Research. – 2016. – Vol. 69. – № 9. – P. 3487–3499.

76 Akorda - Presidential Administration of Kazakhstan. Address by the President: Strategy Kazakhstan-2050. [Electronic resource]. – 2012. – URL: https://www.akorda.kz/en/addresses/addresses_of_president/address-by-the-president-of-the-republic-of-kazakhstan-leader-of-the-nation-nnazarbayev-strategy-kazakhstan-2050-new-political-course-of-the-established-state (accessed: 31.07.2026).

77 International Energy Agency. Kazakhstan 2022 - Executive summary. [Electronic resource]. – 2022. – URL: https://www.iea.org/reports/kazakhstan-2022/executive-summary (accessed: 31.07.2026).

78 United Nations Economic Commission for Europe. Kazakhstan's Policy Brief (Energy Connectivity). [Electronic resource]. – 2024. – URL: https://unece.org/sites/default/files/2024-09/kazakhstans-policybrief%20%287%29.pdf (accessed: 31.07.2026).

79 United Nations Economic Commission for Europe. Energy Connectivity – Kazakhstan Policy Brief. [Electronic resource]. – 2025. – URL: https://unece.org/sites/default/files/2025-01/Energy%20Connectivity-Kazakhstan%20Policy%20Brief.pdf (accessed: 31.07.2026).

80 European Commission. Kazakhstan – Overview (International Partnerships). [Electronic resource]. – 2022. – URL: https://international-partnerships.ec.europa.eu/countries/kazakhstan_en (accessed: 31.07.2026).

81 Berdibekov, A.B., Kaigorodtsev, A.A., Bordiyanu, I.V., & Brauweiler, H.-Christian. The labor market of the Republic of Kazakhstan in the context of global challenges. – Bulletin of the Karaganda University, Economy Series, № 4(100)/2020, 2020.

82 Lim, N., Kalabin, V., Askanbai, A., Galimov, B., Tyo, D., & Khussainova, D. Top 50 ESG disclosure companies in Kazakhstan (4th ed.; based on 2022 reports). PwC Kazakhstan. [Electronic resource]. – 2023. – URL: https://www.pwc.com/kz/en/esg/new/esg-disclosure-2023-eng.pdf (accessed: 31.07.2026).

83 Federal Ministry of Labour and Social Affairs. Gesetz über die unternehmerischen Sorgfaltspflichten in Lieferketten (sogenanntes Lieferkettengesetz). [Electronic resource]. – URL: https://www.bmas.de/DE/Service/Gesetze-und-Gesetzesvorhaben/Gesetz-Unternehmerische-Sorgfaltspflichten-Lieferketten/gesetz-unternehmerische-sorgfaltspflichten-lieferketten.html (accessed: 31.07.2026).

84 George, C. Measurement, reporting and verification (MRV) technical paper. – UNDP Low Emission Capacity Building (LECB) Programme, 2014.

85 Perugini, L., Pellis, G., Grassi, G., Ciais, P., Dolman, A. J., House, J. I., Peters, G. P., Smith, P., Günther, D., & Peylin, P. Emerging reporting and verification needs under the Paris Agreement: How can the research community effectively contribute? // Environmental Science & Policy. – 2021. – Vol. 122. – P. 116–126.

86 Federal Office for Economic Affairs and Export Control. Complaints Procedure in the company. [Electronic resource]. – Eschborn : BAFA. – URL: https://www.bafa.de/EN/Supply_Chain_Act/Complaints_Procedure/complaints_procedure_node.html (accessed: 31.07.2026).

87 Federal Foreign Office. Germany and Kazakhstan: Bilateral relations. [Electronic resource]. – Berlin : Auswärtiges Amt, 2025. – URL: https://www.auswaertiges-amt.de/en/aussenpolitik/laenderinformationen/kasachstan-node/kazakhstan-218898 (accessed: 31.07.2026).

88 Observatory of Economic Complexity. Kazakhstan (KAZ) Exports, Imports, and Trade Partners. [Electronic resource]. – URL: https://oec.world/en/profile/country/kaz (accessed: 31.07.2026).

89 Rödl & Partner. Kazakhstan: ESG reporting and greenwashing. Rödl.com Insights. [Electronic resource]. – 2024. – URL: https://www.roedl.com/insights/kazakhstan-esg-reporting-greenwashing (accessed: 31.07.2026).

90 Akorda - Presidential Administration of Kazakhstan. The Head of State delivers a speech at the World Climate Action Summit. [Electronic resource]. – 2023. – URL: https://www.akorda.kz/en/123-111126 (accessed: 31.07.2026).

91 Brauweiler, H.-C. & Yerimpasheva, A. Challenges and opportunities to develop Kazakhstani logistic. – Ordnungspolitische Diskurse (OPO), Working Paper 2022-2, 2022.

92 International Energy Agency (IEA). Concept for the transition of the Republic of Kazakhstan to a "green economy" (Policy database entry, last updated 24 Jan 2022). Paris: IEA. [Electronic resource]. – 2022. – URL: https://www.iea.org/policies/2138-concept-for-the-transition-of-the-republic-of-kazakhstan-to-a-green-economy (accessed: 31.07.2026).

93 Republic of Kazakhstan. Concept on Transition towards Green Economy until 2050. [Electronic resource]. – 2013. – URL: https://policy.asiapacificenergy.org/sites/default/files/Concept%20on%20Transition%20towards%20Green%20Economy%20until%202050%20%28EN%29.pdf (accessed: 31.07.2026).

94 PAGE., Kazakhstan’s transition to a Green Economy: A stocktaking report. United Nations. [Electronic resource]. – 2020. – URL: https://www.oneplanetnetwork.org/sites/default/files/from-crm/10ffbd09b60eb67133f1a/2020-kazakhstan-stocktaking-report-en.pdf (accessed: 31.07.2026).

95 Satubaldina, A. Tokayev announces Kazakhstan’s pledge to reach carbon neutrality by 2060. The Astana Times. [Electronic resource]. – 2020. – URL: https://astanatimes.com/2020/12/tokayev-announces-kazakhstans-pledge-to-reach-carbon-neutrality-by-2060/ (accessed: 31.07.2026).

96 United Nations Development Programme. Kazakhstan's vision to achieve carbon neutrality presented at high-level conference in Nur-Sultan. [Electronic resource]. – 2021. – URL: https://www.undp.org/kazakhstan/news/kazakhstans-vision-achieve-carbon-neutrality-presented-high-level-conference-nur-sultan (accessed: 31.07.2026).

97 President of the Republic of Kazakhstan. Decree No. 121 of 2 February 2023 "On approval of the Strategy for achieving carbon neutrality of the Republic of Kazakhstan until 2060". [Electronic resource]. – 2023. – URL: https://adilet.zan.kz/rus/docs/U2300000121 (accessed: 31.07.2026).

98 Linn, J. F. Kazakhstan 2050: Exploring an ambitious vision // Global Journal of Emerging Market Economies. – 2014. – Vol. 6. – № 1. – P. 69–93.

99 Shayakhmetova, Z. New Environmental Code in Kazakhstan to promote green technology, sustainable development. The Astana Times. [Electronic resource]. – 2021. – URL: https://astanatimes.com/2021/03/new-environmental-code-in-kazakhstan-to-promote-green-technology-sustainable-development/ (accessed: 31.07.2026).

100 Organisation for Economic Co-operation and Development. OECD review of the corporate governance of state-owned enterprises in Kazakhstan. OECD Publishing. [Electronic resource]. – 2024. – URL: https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/02/oecd-review-of-the-corporate-governance-of-state-owned-enterprises-in-kazakhstan_6857718a/082c508b-en.pdf (accessed: 31.07.2026).

101 Hsieh, H.-F., & Shannon, S. E. Three Approaches to Qualitative Content Analysis // Qualitative Health Research. – 2005. – Vol. 15. – № 9. – P. 1277–1288.

102 Krippendorff, K. Content analysis: An introduction to its methodology (3rd ed.). – Sage, 2013.

103 Maier, C., Laumer, S., Mattke, J., & Weitzel, T. Cross-sectional research: A critical perspective, use cases, and recommendations for IS research // International Journal of Information Management. – 2023. – Vol. 70. – P. 102642.

104 Wanat, M., Weller, S., Borek, A. J., Newhouse, N., & McNiven, A. Crafting tempo and timeframes in qualitative longitudinal research: Case studies from health research // International Journal of Qualitative Methods. – 2024. – Vol. 23. – P. 1–12.

105 Alvesson, M. Beyond Neopositivists, Romantics, and Localists: A Reflexive Approach to Interviews in Organizational Research // Academy of Management Review. – 2003. – Vol. 28. – № 1. – P. 13–33.

106 Holstein, J. A., & Gubrium, J. F. The Active Interview. – SAGE, 1995.

107 Silverman, D. Doing Qualitative Research (5th ed.). – SAGE, 2017.

108 Eisenhardt, K. M. Building Theories from Case Study Research // The Academy of Management Review. – 1989. – Vol. 14. – № 4. – P. 532–550.

109 Eisenhardt, K. M., & Graebner, M. E. Theory Building from Cases: Opportunities and Challenges // Academy of Management Journal. – 2007. – Vol. 50. – № 1. – P. 25–32.

110 Patton, M. Q. Qualitative Research & Evaluation Methods: Integrating Theory and Practice (4th ed.). – SAGE, 2015.

111 Lee, A. S., & Baskerville, R. L. Generalizing generalizability in information systems research // Information Systems Research. – 2003. – Vol. 14. – № 3. – P. 221–243.

112 Flyvbjerg, B. Five Misunderstandings About Case-Study Research // Qualitative Inquiry. – 2006. – Vol. 12. – № 2. – P. 219–245.

113 Collier, D., & Mahoney, J. Insights and Pitfalls: Selection Bias in Qualitative Research // World Politics. – 1996. – Vol. 49. – № 1. – P. 56–91.

114 Chen, I. J., Paulraj, A., & Lado, A. A. Strategic purchasing, supply management, and firm performance // Journal of Operations Management. – 2004. – Vol. 22. – № 5. – P. 505–523.

115 Vachon, S., & Klassen, R. D. Extending green practices across the supply chain // International Journal of Operations & Production Management. – 2006. – Vol. 26. – № 7. – P. 795–821.

116 Zhu, Q., & Sarkis, J. Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises // Journal of Operations Management. – 2004. – Vol. 22. – № 3. – P. 265–289.

117 Miles, M. B., Huberman, A. M., & Saldaña, J. Qualitative data analysis: A methods sourcebook (3rd ed.). – SAGE, 2013.

118 Gibbert, M., Ruigrok, W., & Wicki, B. What passes as a rigorous case study? // Strategic Management Journal. – 2008. – Vol. 29. – № 13. – P. 1465–1474.

119 Luhmann, N. Soziologische Aufklärung: Aufsätze zur Theorie sozialer Systeme. – Westdeutscher Verlag, 1970.

120 Blau, P. M. A formal theory of differentiation in organizations // American Sociological Review. – 1970. – Vol. 35. – № 2. – P. 201–218.

121 Child, J., & Mansfield, R. Technology, size, and organization structure // Sociology. – 1972. – Vol. 6. – № 3. – P. 369–393.

122 Hsu, C.-K., Marsh, R. M., & Mannari, H. An examination of the determinants of organizational structure // American Journal of Sociology. – 1983. – Vol. 88. – № 5. – P. 975–996.

123 Tushman, M. L., & Nadler, D. A. Information Processing as an Integrating Concept in Organizational Design // The Academy of Management Review. – 1978. – Vol. 3. – № 3. – P. 613–624.

124 Klassen, R. D., & Vachon, S. Collaboration and evaluation in the supply chain: The impact on plant-level environmental investment // Production and Operations Management. – 2003. – Vol. 12. – № 3. – P. 336–352.

125 Schreyögg, G., & Sydow, J. Organizing for Fluidity? Dilemmas of New Organizational Forms // Organization Science. – 2010. – Vol. 21. – P. 1251–1262.

126 Du Toit, E. Thirty Years of Sustainability Reporting: Insights, Gaps and an Agenda for Future Research Through a Systematic Literature Review // Sustainability. – 2024. – Vol. 16. – № 23. – P. 10750.

127 Neisig, M. From neglect to resonance?—The twin transition and Luhmann's legacy // Management Revue. – 2025. – Vol. 36. – № 1. – P. 39361.

128 Winter, S. G. Understanding dynamic capabilities // Strategic Management Journal. – 2003. – Vol. 24. – № 10. – P. 991–995.

129 Eccles, R. G., & Serafeim, G. The performance frontier: Innovating for a sustainable strategy // Harvard Business Review. – 2013. – Vol. 91. – № 5. – P. 50–60.

130 Teece, D. J. Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance // Strategic Management Journal. – 2007. – Vol. 28. – № 13. – P. 1319–1350.

131 Uhl-Bien, M., Marion, R., & McKelvey, B. Complexity Leadership Theory: Shifting leadership from the industrial age to the knowledge era // The Leadership Quarterly. – 2007. – Vol. 18. – № 4. – P. 298–318.

132 Weick, K. E. Sensemaking in organizations. – SAGE, 1995.

133 Barile, S., & Saviano, M. Complexity and sustainability in management: Insights from a systems perspective. – In S. Barile, M. Pellicano, & F. Polese (Eds.), Social dynamics in a systems perspective Springer, 2018. – DOI: 10.1007/978-3-319-61967-5_3.

134 Jamali, D., & Carroll, A. Capturing advances in CSR: Developed versus developing country perspectives // Business Ethics: A European Review. – 2017. – Vol. 26. – № 4. – P. 321–325.

135 Stål, H. I. Inertia and change related to sustainability - An institutional approach // Journal of Cleaner Production. – 2015. – Vol. 99. – P. 354–365.

136 Ukko, J., Nasiri, M., Saunila, M., & Rantala, T. Sustainability strategy as a moderator in the relationship between digital business strategy and financial performance // Journal of Cleaner Production. – 2019. – Vol. 236. – P. 117626.

137 Hernes, T., & Bakken, T. Implications of self-reference: Niklas Luhmann's autopoiesis and organization theory // Organization Studies. – 2003. – Vol. 24. – № 9. – P. 1511–1535.

138 Marquis, C., & Qian, C. Corporate social responsibility reporting in China: Symbol or substance? // Organization Science. – 2014. – Vol. 25. – № 1. – P. 127–148.

139 Struben, J., & Kapmeier, F. From low-hanging fruit to high-impact sustainability transformations: unpacking dynamics of intra- and interorganizational capability traps // System Dynamics Review. – 2023. – Vol. 39. – № 4. – P. 404–431.

140 Bratt, C., Sroufe, R., & Broman, G. Implementing Strategic Sustainable Supply Chain Management // Sustainability. – 2021. – Vol. 13. – № 15. – P. 8132.

141 Campbell, J. L. Why would corporations behave in socially responsible ways? An institutional theory of corporate social responsibility // Academy of Management Review. – 2007. – Vol. 32. – № 3. – P. 946–967.

142 Christensen, L. T., Morsing, M., & Thyssen, O. CSR as aspirational talk // Organization. – 2013. – Vol. 20. – № 3. – P. 372–393.

143 Lyon, T. P., & Montgomery, A. W. The means and end of greenwash // Organization & Environment. – 2015. – Vol. 28. – № 2. – P. 223–249.

144 Gregor, S., & Hevner, A. R. Positioning and presenting design science research for maximum impact // MIS Quarterly. – 2013. – Vol. 37. – № 2. – P. 337–355.

145 Hevner, A. R., March, S. T., Park, J., & Ram, S. Design science in information systems research // MIS Quarterly. – 2004. – Vol. 28. – № 1. – P. 75–105.

146 Pawson, R., & Tilley, N. Realistic evaluation. – SAGE Publications Ltd, 1997.

147 Denyer, D., Tranfield, D., & van Aken, J. E. Developing design propositions through research synthesis // Organization Studies. – 2008. – Vol. 29. – № 3. – P. 393–413.

148 Wong, G., Greenhalgh, T., Westhorp, G., Buckingham, J., & Pawson, R. RAMESES publication standards: Realist syntheses // BMC Medicine. – 2013. – Vol. 11. – P. 21.

149 Baraldi, C., Corsi, G., & Esposito, E. Unlocking Luhmann: A keyword introduction to systems theory. – Bielefeld University Press, 2021.

150 Neely, A., Gregory, M., & Platts, K. Performance measurement system design: A literature review and research agenda // International Journal of Operations & Production Management. – 2005. – Vol. 25. – № 12. – P. 1228–1263.

151 van Aken, J. E. Management research based on the paradigm of the design sciences: The quest for field-tested and grounded technological rules // Journal of Management Studies. – 2004. – Vol. 41. – № 2. – P. 219–246.

152 O'Reilly, C. A., & Tushman, M. L. Organizational Ambidexterity: Past, Present, and Future // Academy of Management Perspectives. – 2013. – Vol. 27. – № 4. – P. 324–338.

153 Kolk, A. Trends in sustainability reporting by the Fortune Global 250 // Business Strategy and the Environment. – 2003. – Vol. 12. – № 5. – P. 279–291. – DOI: 10.1002/bse.370.

154 Hahn, R., & Kühnen, M. Determinants of sustainability reporting: A review of results, trends, theory, and opportunities in an expanding field of research // Journal of Cleaner Production. – 2013. – Vol. 59. – P. 5–21.

155 European Commission. Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU as regards sustainability reporting standards // Official Journal of the European Union. – 2023. – L, 2023/2772, 22.12.2023. – URL: http://data.europa.eu/eli/reg_del/2023/2772/oj (accessed: 31.07.2026).

156 IFRS Foundation. SASB Standards. [Electronic resource]. – London : IFRS Foundation, 2023. – URL: https://www.ifrs.org/issued-standards/sasb-standards/ (accessed: 31.07.2026).

157 Global Sustainability Standards Board. GRI 1: Foundation 2021. – Amsterdam : Global Reporting Initiative, 2021. – ISBN 978-90-8866-133-4. – URL: https://www.globalreporting.org/publications/documents/english/gri-1-foundation-2021/ (accessed: 31.07.2026).

158 Global Sustainability Standards Board. GRI 2: General Disclosures 2021. – Amsterdam : Global Reporting Initiative, 2021. – ISBN 978-90-8866-134-1. – URL: https://www.globalreporting.org/publications/documents/english/gri-2-general-disclosures-2021/ (accessed: 31.07.2026).

159 Global Sustainability Standards Board. GRI 3: Material Topics 2021. – Amsterdam : Global Reporting Initiative, 2021. – ISBN 978-90-8866-135-8. – URL:

https://www.globalreporting.org/publications/documents/english/gri-3-material-topics-2021/ (accessed: 31.07.2026).

160 Hassini, E., Surti, C., & Searcy, C. A literature review and a case study of sustainable supply chains with a focus on metrics // International Journal of Production Economics. – 2012. – Vol. 140. – № 1. – P. 69–82.

161 Neske, A. A Social Systems Theory Approach to Managing Sustainability Complexity in Multi-Tier Supply Chains // Perspectives of Sustainability Management in Europe and Asia: Challenges, Socio-Economic Transformations and Innovations / eds. B. Zirkler, H.-C. Brauweiler, I. Bordiyanu, A. Yerimpasheva. – Berlin: Peter Lang, 2026. – P. 27–55. – ISBN 978-3-631-94563-6. – DOI: 10.3726/b23959.

162 Kayikci, Y., Kazancoglu, Y., Gozacan-Chase, N., & Lafci, C. Analyzing the drivers of smart sustainable circular supply chain for sustainable development goals through stakeholder theory // Business Strategy and the Environment. – 2022. – Vol. 31. – № 7. – P. 3335–3353.

163 Beske, P., Land, A., & Seuring, S. Sustainable supply chain management practices and dynamic capabilities in the food industry: A critical analysis of the literature // International Journal of Production Economics. – 2014. – Vol. 152. – P. 131–143.

164 Kaplan, R. S., & Norton, D. P. Linking the balanced scorecard to strategy // California Management Review. – 1996. – Vol. 39. – № 1. – P. 53–79.

165 Lincoln, Y. S., & Guba, E. G. Naturalistic Inquiry. – SAGE, 1985.

166 Tracy, S. J. Qualitative Quality: Eight "Big-Tent" Criteria for Excellent Qualitative Research // Qualitative Inquiry. – 2010. – Vol. 16. – № 10. – P. 837–851.

167 Carter, C. R., & Easton, P. L. Sustainable supply chain management: Evolution and future directions // International Journal of Physical Distribution & Logistics Management. – 2011. – Vol. 41. – № 1. – P. 46–62.

168 Crane, A. Are You Ethical? Please Tick Yes or No: On Researching Ethics in Business Organizations // Journal of Business Ethics. – 1999. – Vol. 20. – P. 237–248.

169 Carlowitz, H. C. von. Sylvicultura oeconomica, oder haußwirthliche Nachricht und naturmäßige Anweisung zur wilden Baum-Zucht. – Leipzig : J. Fr. Braun, 1713. – 432 p.

170 Caradonna, J. L. Sustainability: A history. – Oxford University Press, 2014.

171 Warde, P. The Invention of Sustainability // Modern Intellectual History. – 2011. – Vol. 8. – P. 153 – 170.

172 Basiago, A. Methods of defining ‘sustainability’ // Sustainable Development. – 1995. – Vol. 3. – P. 109–119.

173 Kidd, C. The evolution of sustainability // Journal of Agricultural and Environmental Ethics. – 1992. – Vol. 5. – P. 1–26.

174 Emas, R. The Concept of Sustainable Development: Definition and Defining Principles. – Brief for GSDR 2015. – 2015.

175 McKenzie, S. Social sustainability: towards some definitions // Hawke Research Institute Working Paper Series. – Magill : University of South Australia, 2004. – No. 27.

176 Hajian, M., & Kashani, S. J. Evolution of the concept of sustainability: From Brundtland Report to sustainable development goals // Sustainable Development. – 2021. – Vol. 29. – № 4. – P. 737–747.

177 Orr, D. Four Challenges of Sustainability. – Conservation Biology, 16, 2002.

178 Guide, V. D. R., & Van Wassenhove, L. N. The evolution of closed-loop supply chain research // Operations Research. – 2009. – Vol. 57. – № 1. – P. 10–18.

179 Neske, A., Brauweiler, C., & Bordiyanu, I. A Systematic Literature Review on Theories Utilized Investigating Third Parties in Sustainable Supply Chain Management // Eurasian Journal of Economic and Business Studies. – 2023. – Vol. 67. – № 1. – P. 5–26.

180 Ivanov, D. Supply chain viability and the COVID-19 pandemic: a conceptual and formal generalisation of four major adaptation strategies // International Journal of Production Research. – 2021. – Vol. 59. – № 12. – P. 3535–3552.

181 Winter, M., & Knemeyer, A. M. Exploring the integration of sustainability and supply chain management // International Journal of Physical Distribution & Logistics Management. – 2013. – Vol. 43. – № 1. – P. 18–38.

182 Schneider, A., & Scherer, A. G. State governance beyond the ‘shadow of hierarchy’: a social mechanisms perspective on governmental CSR policies // Organization Studies. – 2019. – Vol. 40. – № 8. – P. 1147–1168.

183 Adler, P., Du Gay, P., Morgan, G., Reed, M., Seidl, D., & Mormann, H. Niklas Luhmann as Organization Theorist. – In P. Adler, P. Du Gay, G. Morgan, & M. Reed (Eds.), The Oxford Handbook of Sociology, Social Theory, and Organization Studies Oxford University Press, 2014.

184 Wright, S. The roles of mutation, inbreeding, crossbreeding, and selection in evolution // VI International Congress on Genetics / ed. by D. F. Jones. – 1932. – P. 356–366.

185 Kauffman, S. A. The Sciences of Complexity and "Origins of Order" // Philosophy of Science Association. – 1991. – Vol. 2. – P. 239–247.

186 Abazov, R., Zhuparova, A., Molchanovskaya, A., & Yeleussizova, B. Kazakhstan: Challenges and strategies towards green transformation and sustainable development (Project Paper No. 21). United Nations Conference on Trade and Development. [Electronic resource]. – 2025. – URL: https://unctad.org/system/files/information-document/unda2030d21-kazakhstan-green-transformation_en.pdf (accessed: 31.07.2026).

187 United Nations Green Climate Fund. GCF-EBRD Kazakhstan renewables framework [Project information]. Green Climate Fund. [Electronic resource]. – 2017. – URL: https://www.greenclimate.fund/project/fp047 (accessed: 31.07.2026).

188 European Bank for Reconstruction and Development. Supporting energy transition and role of RE financing framework in Kazakhstan [Conference presentation]. CAREC Program. [Electronic resource]. – 2024. – URL: https://www.carecprogram.org/uploads/S2.5_EBRD-1st-WGCC-ENG.pdf (accessed: 31.07.2026).

189 Akhmetkali, A. Kazakhstan’s renewable energy sees steady growth in 2024, energy storage challenges persist. The Astana Times. [Electronic resource]. – 2024. –

URL: https://astanatimes.com/2024/12/kazakhstans-renewable-energy-sees-steady-growth-in-2024-energy-storage-challenges-persist/ (accessed: 31.07.2026).

190 World Bank. Kazakhstan: Flaring and venting regulations. [Electronic resource]. – 2023. – URL: https://flaringventingregulations.worldbank.org/kazakhstan (accessed: 31.07.2026).

191 Reuters. Oil-rich regions in Kazakhstan brace for floods, Siberian rivers burst in Russia. [Electronic resource]. – 2024. – URL: https://www.reuters.com/world/europe/oil-rich-regions-kazakhstan-brace-floods-siberian-rivers-burst-russia-2024-04-19/ (accessed: 31.07.2026).

192 Electronic Government of the Republic of Kazakhstan. Information on waste reduction, recycling and reuse. [Electronic resource]. – 2023. – URL: https://egov.kz/cms/en/articles/ecology/waste_reduction_recycling_and_reuse (accessed: 31.07.2026).

193 Nurmukhametov, N. N., Islyam, G. I., Zhamieva, A. E., Bordiyanu, I. V., & Suieubayeva, S. N. The influence of fiscal factors on the sustainability of the regional economy development // Rivista di Studi sulla Sostenibilità. – 2023. – Vol. 13. – № 1 suppl. – P. 249–265. – DOI: 10.3280/riss2023-001-s1016.

194 OpenAI. ChatGPT, large language model, version GPT-6 Astra. [Electronic resource]. – San Francisco: OpenAI, 2026. – URL: https://chatgpt.com (accessed: 09.09.2026; period of use: 09.09.2026 to 05.10.2026). – Use: chapter-by-chapter review of the Introduction, Chapters 1 to 3 and the Conclusion. – Queries: "Review this chapter for unclear wording, gaps in the line of argument and inconsistencies between the text, the tables and the figures, and indicate the sections in which changes might be needed."

195 International Green Technologies and Investment Projects Center. Best Available Techniques Reference Documents: A Key Instrument in Kazakhstan’s Industrial Environmental Transformation. [Electronic resource]. – Astana: IGTIPC, 2025. – URL: https://igtipc.org/en/2025/05/21/8897/ (accessed: 31.07.2026).

196 International Green Technologies and Investment Projects Center. BAT reference documents. [Electronic resource]. – Astana: IGTIPC. – URL: https://igtipc.org/en/ndt-reference-books/ (accessed: 31.07.2026).

197 World Bank. Mining Sector Diagnostic Report – Kazakhstan. – Washington, D.C.: The World Bank, 2023. – Report No. 099081823001539573. – URL: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099081823001539573 (accessed: 31.07.2026).

198 United Nations Development Programme. Climate Risk Assessment Methodology of the Republic of Kazakhstan. [Electronic resource]. – Astana: UNDP Kazakhstan, 2025. – URL: https://www.undp.org/kazakhstan/publications/climate-risk-assessment-methodology-republic-kazakhstan (accessed: 31.07.2026).

199 Birbayeva, A. Kazakhstan accelerates industrial modernization and diversification. The Astana Times. [Electronic resource]. – 2025. – URL: https://astanatimes.com/2025/09/kazakhstan-accelerates-industrial-modernization-and-diversification/ (accessed: 31.07.2026).

200 U.S. Department of Commerce. Kazakhstan – Environmental Technologies. International Trade Administration. [Electronic resource]. – 2022. – URL: https://www.trade.gov/country-commercial-guides/kazakhstan-environmental-technologies (accessed: 31.07.2026).

201 Barro, A., & Cornell, S. E. Tokayev's economic reforms. CACI Analyst: Analytical Articles Central Asia-Caucasus Institute & Silk Road Studies Program. [Electronic resource]. – 2021. – URL: https://www.cacianalyst.org/publications/analytical-articles/item/13696-tokayev%E2%80%99s-economic-reforms.html (accessed: 31.07.2026).

202 "Baiterek" National Investment Holding JSC. Baiterek Holding strategy. [Electronic resource]. – Astana: Baiterek. – URL: https://baiterek.gov.kz/en/about-holding/baiterek-holding-strategy/ (accessed: 31.07.2026).

203 United Nations Economic Commission for Europe. Third Environmental Performance Review of Kazakhstan (Environmental Performance Reviews Series No. 50; ECE/CEP/185). United Nations. [Electronic resource]. – 2019. – URL: https://digitallibrary.un.org/record/3829193/files/ECE_CEP_185_Eng.pdf (accessed: 31.07.2026).

204 Bigazin, A., Abdulov, M., Abubakirov, O., & Sadykov, D. Environmental Law 2024 - Kazakhstan: Trends and Developments. In Global Practice Guides Chambers and Partners. [Electronic resource]. – 2024. – URL: https://practiceguides.chambers.com/practice-guides/environmental-law-2024/kazakstan/trends-and-developments/O19160 (accessed: 31.07.2026).

205 Kelsall, T., Steadman, S., & Gilmour, A. Financing Kazakhstan's energy transition: Possibilities and prospects for a country platform (ODI Global Working Paper). [Electronic resource]. – 2024. – URL: https://media.odi.org/documents/Financing_Kazakhstans_energy_transition_Possibilities_and_prospects_for_a_coun_ChiGp6U.pdf (accessed: 31.07.2026).

206 Siggelkow, N. Persuasion with Case Studies // The Academy of Management Journal. – 2007. – Vol. 50. – № 1. – P. 20–24.

207 Offerman, T., Stettina, C. J., & Plaat, A. Business capabilities: A systematic literature review and a research ambition. – In 2017 International Conference on Engineering, Technology and Innovation (ICE/ITMC) (pp. 1392–1400) IEEE, 2017.

208 Homann, U. A Business-Oriented Foundation for Service Orientation. [Electronic resource]. – 2006. – URL: https://cdn.ymaws.com/www.businessarchitectureguild.org/resource/resmgr/homann_article_on_capabiliti.pdf (accessed: 31.07.2026).

209 Sutton, R. I., & Callahan, A. L. The stigma of bankruptcy: Spoiled organizational image and its management // Academy of Management Journal. – 1987. – Vol. 30. – № 3. – P. 405–436.

210 Orazalin, N., & Mahmood, M. Determinants of GRI-based sustainability reporting: evidence from an emerging economy // Journal of Accounting in Emerging Economies. – 2020. – Vol. 10. – № 1. – P. 140–164.

211 Orazalin, N. Corporate governance and corporate social responsibility (CSR) disclosure in an emerging economy: evidence from commercial banks of Kazakhstan // Corporate Governance: The International Journal of Business in Society. – 2019. – Vol. 19. – № 3. – P. 490–507.

212 Kuur, O. V., Varavin, Ye. V., & Kozlova, M. V. ESG transformation factors of Kazakhstan's economy in the context of sustainable development // Economy: Strategy and Practice. – 2024. – Vol. 19. – № 2. – P. 20–40.

213 Uralova, A., Shakulikova, G., Yesturlieva, A., Syrlybayeva, N., & Amaniyazova, G. ESG approach to financial sustainability of Kazakhstan's oil and gas companies // Eurasian Journal of Economic and Business Studies. – 2025. – Vol. 69. – № 3. – P. 95–109.

214 Neafie, J., Sagymbayeva, A., Kenzhetayev, K., Duprey, B., Karazhan, Y., & Bayramov, E. What firms disclose versus what employees perceive: ESG–SDG alignment in Kazakhstan // Sustainability. – 2026. – Vol. 18. – № 16. – Art. 8222.

215 Akhmet, A., Nurekenova, E., Nurmukhametov, N., Vasa, L., & Rakhimberdinova, M. The impact of transport routes on Kazakhstan's agro-industrial complex considering ESG approaches // Problems and Perspectives in Management. – 2025. – Vol. 23. – № 1. – P. 656–672.

216 Neske, A., Brauweiler, H.-C., Bordianu, I., Anashkina, N., & Yerimpasheva, A. The Role of Third-parties in Sustainable Supply Chain Management: A Systematic Literature Review // Proceedings of the 1st International Scientific and Practical Conference on Transport: Logistics, Construction, Maintenance, Management (TLC2M 2022), Ekaterinburg, Ural State University of Railway Transport. – SciTePress, 2022. – P. 215–223. – ISBN 978-989-758-606-4. – DOI: 10.5220/0011581900003527.

217 Mukhiyayeva, D., Sembiyeva, L., & Zhagyparova, A. Evaluating ESG frameworks: A comparative analysis of global standards and their application in Kazakhstan // Economic Series of the Bulletin of L.N. Gumilyov ENU. – 2024. – № 3. – P. 245–261. – DOI: 10.32523/2789-4320-2024-3-245-261.

218 Zarubina, V. R., Zarubin, M. Yu., Yesenkulova, Zh. Zh., & Pritula, R. A. Promoting the ESG agenda for small and medium-sized businesses in the Republic of Kazakhstan in the context of sustainable development // Bulletin of "Turan" University. – 2024. – № 3. – P. 84–97. – DOI: 10.46914/1562-2959-2024-1-3-35-84-97.

219 Mazbayeva, K. O., Aripova, M. R., & Tokbergenova, Zh. G. International approaches to non-financial reporting and ESG practices: bibliometric and content analysis // Central Asian Economic Review. – 2025. – № 4. – P. 205–222. – DOI: 10.52821/2789-4401-2025-4-205-222.

220 Nizamdinova, A., Yang, Zhuoshan, & Aktureeva, E. Environmental management accounting within the ESG indicator system of sustainable business development in Kazakhstan // Economic Series of the Bulletin of L.N. Gumilyov ENU. – 2026. – Vol. 1. – № 1. – P. 260–276. – DOI: 10.32523/2789-4320-2026-1-260-276.

221 Kalibayev, M. K., & Erkaboev, A. The relationship between ESG indicators and financial performance in the context of integrated reporting: ERG company (2013–2024) // Bulletin of "Turan" University. – 2026. – № 1. – P. 128–140. – DOI: 10.46914/1562-2959-2026-1-1-128-140.

222 Gimranova, L. R., Pritvorova, T. P., & Gimranova, G. I. Analysis of project management "supplier development project" in the Republic of Kazakhstan // Journal of Economic Research & Business Administration. – 2022. – Vol. 141. – № 3. – P. 128–137. – DOI: 10.26577/be.2022.v141.i3.12.

223 Raimbekov, Zh. S., Syzdykbayeva, B. U., Rakhmetulina, A. A., & Abylaykhanova, T. A. The impact of risk factors on the sustainability of food distribution chain functioning in Kazakhstan // Bulletin of "Turan" University. – 2024. – № 2. – P. 395–411. – DOI: 10.46914/1562-2959-2024-1-2-395-411.

224 Ebesova, A. B., Imanbekova, M. A., & Pencheva, V. I. Sustainable development management in logistics based on ESG principles: international and domestic experience // Bulletin of "Turan" University. – 2025. – № 4. – P. 457–474. – DOI: 10.46914/1562-2959-2025-1-4-457-474.

225 Alexander, A., Walker, H., & Naim, M. Decision theory in sustainable supply chain management: A literature review // Supply Chain Management: An International Journal. – 2014. – Vol. 19. – P. 504–522.

226 Dubois, A., & Gadde, L.-E. Systematic combining: An abductive approach to case research // Journal of Business Research. – 2002. – Vol. 55. – P. 553–560.

227 Dubois, A., & Salmi, A. A call for broadening the range of approaches to purchasing and supply management case studies // Journal of Purchasing and Supply Management. – 2016. – Vol. 22. – № 4. – P. 247–249.

228 Locke, K., Golden-Biddle, K., & Feldman, M. S. Perspective – Making doubt generative: Rethinking the role of doubt in the research process // Organization Science. – 2008. – Vol. 19. – № 6. – P. 907–918.

229 Gong, Y., Jia, F., Brown, S., & Koh, L. Supply chain learning of sustainability in multi-tier supply chains // International Journal of Operations & Production Management. – 2018. – Vol. 38. – № 4. – P. 1061–1090.

230 Mena, C., Humphries, A., & Choi, T. Y. Toward a theory of multi-tier supply chain management // Journal of Supply Chain Management. – 2013. – Vol. 49. – № 2. – P. 58–77.

231 Meqdadi, O., Johnsen, T. E., & Johnsen, R. E. The role of power and trust in spreading sustainability initiatives across supply networks: A case study in the biochemical industry // Industrial Marketing Management. – 2017. – Vol. 62. – P. 61–76.

232 Morali, O., & Searcy, C. A review of sustainable supply chain management practices in Canada // Journal of Business Ethics. – 2013. – Vol. 117. – DOI: 10.1007/s10551-012-1539-4.

233 Wolf, J. Sustainable supply chain management integration: A qualitative analysis of the German manufacturing industry // Journal of Business Ethics. – 2011. – Vol. 102. – № 2. – DOI: 10.1007/s10551-011-0806-0.

234 Zhang, M., Pawar, K. S., & Bhardwaj, S. Improving supply chain social responsibility through supplier development // Production Planning & Control. – 2017. – Vol. 28. – № 6-8. – P. 500–511.

235 Lee, K.-H., & Kim, J.-W. Current status of CSR in the realm of supply management: The case of the Korean electronics industry // Supply Chain Management: An International Journal. – 2009. – Vol. 14. – № 2. – P. 138–148.

236 Maloni, M. J., & Brown, M. E. Corporate social responsibility in the supply chain: An application in the food industry // Journal of Business Ethics. – 2006. – Vol. 68. – № 1. – P. 35–52.

237 van Tulder, R., & Kolk, A. Multinationality and corporate ethics: Codes of conduct in the sporting goods industry // Journal of International Business Studies. – 2001. – Vol. 32. – № 2. – P. 267–283.

238 Yu, X. Impacts of corporate code of conduct on labor standards: A case study of Reebok's athletic footwear supplier factory in China // Journal of Business Ethics. – 2008. – Vol. 81. – № 3. – P. 513–529.

239 The Guardian. Stop eating Nutella and save the forests, urges French ecology minister. [Electronic resource]. – 2015. – URL: https://www.theguardian.com/environment/2015/jun/17/stop-eating-nutella-and-save-the-forests-urges-french-ecology-minister (accessed: 28.09.2026).

240 Hofmann, H., Busse, C., Bode, C., & Henke, M. Sustainability-related supply chain risks: Conceptualization and management // Business Strategy and the Environment. – 2014. – Vol. 23. – № 3. – P. 160–172.

241 Wilhelm, M., Blome, C., Wieck, E., & Xiao, C. Y. Implementing sustainability in multi-tier supply chains: Strategies and contingencies in managing sub-suppliers // International Journal of Production Economics. – 2016. – Vol. 182. – P. 196–212.

242 Paulk, M. C., Curtis, B., Chrissis, M. B., & Weber, C. V. Capability Maturity Model for Software, Version 1.1. Technical Report CMU/SEI-93-TR-24. – Pittsburgh: Software Engineering Institute, Carnegie Mellon University, 1993. – URL: https://www.sei.cmu.edu/documents/1092/1993_005_001_16211.pdf (accessed: 30.09.2026).

243 Oliver, C. Strategic responses to institutional processes // Academy of Management Review. – 1991. – Vol. 16. – № 1. – P. 145–179. – DOI: 10.2307/258610.

APPENDIX A – HISTORICAL EVOLUTION OF SUSTAINABILITY DEFINITIONS

Sustainability has roots in debates about maintaining resources over time. Carlowitz's Sylvicultura Oeconomica of 1713 connected forest use with regeneration and future availability [169]. The Brundtland Commission later linked present needs with the ability of future generations to meet their needs [28]. The triple-bottom-line perspective brought environmental, social, and economic dimensions into corporate discussion [29]. Table 43 summarizes this development. These definitions provide background to the dissertation's focus on organizational responses to sustainability requirements across supply chains.

Table 43 – Overview roots of definition of sustainability

Year	**Event / Source**	**Contribution to definition**	**Reference**
1713	Carlowitz, Sylvicultura Oeconomica	First use of "Nachhaltigkeit" (sustainability) in forestry	Caradonna, J. [170] Warde, P. [171]
1972	A Blueprint for Survival	Early use of sustainability in environmental context	Basiago, A. [172] Kidd, C. [173]
1987	Brundtland Report	Widely adopted modern definition	McKenzie, S. [175] World Commission on Environment and Development [28] Emas, R. [174] Basiago, A. [172] Hajian, M., & Kashani, S. [176] Orr, D. [177]
Note – Compiled by the author based on [28; 170; 171; 172; 173; 174; 175; 176; 177].			

APPENDIX B – EXTENDED SSCM THEORY AND PRACTICE OVERVIEW

From GSCM to SSCM + related concepts

Early research used Green Supply Chain Management (GSCM) to describe the integration of environmental concerns into supply chain operations. GSCM focuses on reducing waste and emissions and recycling materials. Srivastava [31] includes environmental thinking in product design, material sourcing, manufacturing, distribution, and end-of-life management. Practices can include eco-friendly raw materials, fuel-efficient transport, and reverse logistics for remanufacturing and recycling. These initiatives showed that environmental improvements could often support supply chain efficiency. Their main focus was the "planet" dimension of the triple bottom line. Social issues and long-term economic trade-offs were usually less explicit.

Related concepts include responsible supply chain, closed-loop supply chain, and circular supply chain. A closed-loop supply chain returns products or materials from consumers to producers for repair, refurbishing, recycling, or safe disposal. It overlaps with GSCM and SSCM by reducing waste and recovering value from end-of-life products [178]. The circular economy extends this approach. It designs supply chains and business models around repeated reuse and recycling, reducing demand for virgin materials. Circular supply chains consider the next use of a product at the design stage. Collaboration then helps keep materials in circulation. Closed-loop and circular supply chains extend SSCM's focus on long-term resource efficiency and environmental stewardship. They reflect continuing efforts to apply sustainability principles in global supply networks.

The Carter and Rogers definition in Section 1.1 makes three points. First, SSCM is strategic and transparent. Sustainability forms part of the core business strategy, and firms communicate their goals and performance openly. Second, it combines social, environmental, and economic goals, consistent with the triple bottom line. Third, it requires coordination across key business processes and companies. This involves suppliers, distributors, and partners, as well as functions such as procurement, operations, and logistics. One firm cannot achieve sustainability across the supply chain on its own.

Seuring and Müller [36], discussed in Section 1.1, also include the three sustainability dimensions. They add the management of material, information, and capital flows and cooperation between companies under sustainability criteria. Participation in the supply chain is conditional on meeting environmental and social standards. A manufacturer may require compliance with labor laws, pollution limits, or environmental certification. Suppliers that fail to comply may be removed. This transmits stakeholder and customer expectations through the chain. Seuring and Müller also connect customer requirements and economic criteria with competitiveness. Sustainability efforts should deliver customer value while maintaining the chain's economic viability. SSCM therefore combines minimum sustainability standards with performance goals such as quality, cost, and speed.

Dominant theories in SSCM

SSCM research has been explained through several established perspectives, especially stakeholder theory, institutional theory, RBV/NRBV, dynamic capabilities, and related governance perspectives [26; 27]. Here, these theories are not reviewed exhaustively in the main chapter because their general role in SSCM is already well established. Instead, they are treated selectively as complementary resources for specific explanatory tasks: stakeholder theory for issue salience, institutional theory for pressure transmission and legitimacy environments, and capability-based perspectives for organizational adaptation and execution. The dissertation's distinctive contribution does not lie in re-reviewing these theories one by one, and in explaining how organizations translate sustainability pressure into manageable response portfolios under differing institutional conditions. The following table summarizes the theoretical perspectives used in this appendix.

Table 44 – Dominant theories applied in SSCM

Theory	**Core mechanism**	**Typical SSCM implications / examples**
Stakeholder Theory	Firms must consider the interests of all parties affected by their operations; external stakeholder pressure is a key driver for adopting green and ethical practices; highlights the importance of stakeholder engagement and communication.	Codes of conduct for suppliers, sustainability reporting and transparency initiatives, community engagement; inter-organizational collaboration and involvement of third-parties to overcome sustainability challenges.
Institutional Theory	Organizations respond to coercive, normative, and mimetic pressures from the institutional environment (laws, norms, cultural expectations), leading to isomorphic behavior to maintain legitimacy.	Adoption of practices due to regulations (e.g., hazardous substances, due diligence), industry standards, and prevailing norms; embedding sustainability into routines and culture to build reputational capital.
Resource-Based View (RBV) / Natural RBV	Competitive advantage from valuable, rare, inimitable capabilities; proactive environmental strategies (pollution prevention, product stewardship) can yield advantage.	Eco-design capability, low-carbon/energy-efficient supply chains, strong supplier relationships for sustainability, advanced traceability, circular economy logistics; view sustainability as an opportunity to build unique competencies.

Triple Bottom Line / Contingency	Used to assess and guide how firms measure and balance economic, environmental, and social outcomes; effectiveness depends on contextual factors (industry type, complexity, stakeholder context).	Balanced scorecard approaches adapted for sustainability; tailoring SSCM strategies to fit context (e.g., fast-fashion vs. pharmaceuticals).
Note – Compiled by the author based on [26; 27].		

Literature reviews have found that, to date, SSCM research has predominantly borrowed these existing theories. Touboulic and Walker [27] observed a paucity of original theory-building in SSCM, noting that researchers rely mostly on imported theories like RBV, stakeholder, and institutional theory to frame studies. However, this is beginning to change as the field matures. Neske et al. [179; 216] and Govindan et al. [26] identify the prevailing theories used in recent SSCM research and encourage scholars to combine theories or use new interdisciplinary approaches to better capture the complexity of sustainable supply chains. For example, combining stakeholder and institutional theory can illuminate how stakeholder pressures become institutionalized norms. Together, these theoretical perspectives explain motivations (why firms engage in SSCM), mechanisms (how practices are implemented and diffused), and performance outcomes (what benefits are achieved and under what conditions) in sustainable supply chain management.

SSCM practice catalogue

Translating the concept of SSCM into practice involves a range of principles and concrete actions throughout the supply chain. While the specific initiatives can vary by industry and company, several key components and best practices have been identified in the literature.

Prior SSCM research documents a broad repertoire of sustainability practices, including sustainable sourcing, supplier management, eco-design, traceability, reverse logistics, collaboration procedures, and sustainability performance measurement [26; 36]. The dissertation treats these practices only as a repertoire of possible interventions. Its contribution is to explain how organizations select, sequence, combine, and govern them as Packed Business Capabilities under different routing conditions and institutional environments. The practice catalogue is summarized in Table 2 in sub-chapter 1.1. The following table repeats it for reference.

Table 45 – Key Principles and Practices in SSCM

Practice area	Summary
Sustainable Sourcing & Supplier Management	Integrating sustainability criteria into procurement; "supplier management for risks and performance" via

	audits, scorecards, codes of conduct and long-term collaborative relationships.
Product Design & Innovation for Sustainability (DfE/LCA)	Eco-design to minimize life-cycle impacts; using LCA to identify hotspots; reconfiguring supply chain activities; product-service models that reduce physical throughput.
Operational Sustainability & Lean Practices	Reducing waste aligns environmental impact and cost; energy/water efficiency, EMS, and worker health & safety improvements across operations and key suppliers.
Closed-Loop Supply Chain & Reverse Logistics	Managing reverse flows for reuse, remanufacturing, recycling; take-back systems; recovering secondary raw materials; regulatory drivers (e.g., WEEE).
Collaboration & Transparency	Joint initiatives with suppliers/NGOs; traceability (e.g., blockchain), supplier databases and audits; disclosure incl. scope 3 emissions to manage risk and build resilience.
Performance Measurement & Continuous Improvement	KPIs across the triple bottom line; balanced scorecards; applying PDCA to supply chain sustainability and aligning incentives/information systems.
Note – Compiled by the author based on [26; 36].	

Implementation challenges & future directions

From a research perspective, future directions in SSCM suggested by recent studies include the need for models and theories that capture how multiple factors interact in sustainable supply chains. Neske et al. [179] call for integrating multiple theories to better understand complexities (e.g., how do stakeholder pressures, internal capabilities, and institutional contexts jointly affect SSCM outcomes). Another emerging focus is supply chain sustainability in the context of climate change and resilience. The concepts of sustainability and resilience are increasingly intertwined: a supply chain that is environmentally and socially responsible is often more resilient to shocks like natural disasters or political upheavals, and vice versa. Scholars like Ivanov [180] have started examining how to design supply chains that are both sustainable and resilient to disruptions, sometimes using advanced modeling. The COVID-19 pandemic offered real-world tests of supply chain resilience, and it also highlighted social issues (such as the health and safety of essential workers in supply chains). This is likely to spur more research on how sustainability initiatives (for example, local sourcing, fair labor practices, safety protocols) can enhance the resilience of supply chains in times of crisis [26; 139; 81].

The conceptual development of SSCM has also revealed a gap between theory and practice. While the literature offers frameworks, the operationalization and empirical validation remain fragmented. This is partly due to the heterogeneity of supply chains and the varying definitions and metrics of sustainability across sectors [181]. Consequently, the field calls for more theoretical foundations and methodological pluralism. Carter and Easton [167] emphasize the need for theory-driven research to understand how and why firms adopt SSCM practices and how these practices affect performance outcomes.

As more companies commit to ambitious sustainability targets (like science-based targets for carbon reduction or zero-deforestation supply chains), supply chain innovation will be central to meeting them. Decarbonizing supply chains to meet climate goals is a massive task that will drive changes in sourcing (e.g., sourcing low-carbon materials), transportation (e.g., electrified vehicle fleets, alternative fuels), and production (e.g., renewable energy use, energy efficiency). Collaboration across industries may create new norms - for instance, firms might collectively push logistics providers to offer greener shipping options. The concept of circular supply chains will likely gain more traction, supported by policy initiatives in the EU and elsewhere promoting circular economy principles. New business models may emerge in which manufacturers take greater responsibility for the entire lifecycle of their products, effectively blurring the line between producers and recyclers.

While significant progress has been made in establishing the fundamentals of sustainable supply chain management over the past 10-15 years, the field continues to evolve. Companies and researchers are moving from understanding "why" sustainability is important to tackling "how" to implement it effectively at scale. The coming years are expected to bring deeper integration of digital technology with sustainability (digital sustainability), more stringent requirements from governments and society, and further evidence on the effects of SSCM on business performance and global sustainability outcomes.

APPENDIX C – OVERVIEW OF CASES & INTERVIEWS

Table 46 – Overview of Cases & Interviews

Case/ Supply Chain	**Organization**	**Head-count**	**Branch**	**Respondent position**	**Duration in minutes**	**Interview type**
Production/ retail textiles	For-profit 2	1,000 to 4,999	Textiles	Manager Supplier Management & Sustainability	40	Call
	For-profit 2	1,000 to 4,999	Textiles	Manager Supplier Management & Sustainability	90	Face-to-face
	For-profit 3	1,000 to 4,999	Textiles	Head of Sustainability	25	Call
	For-profit 3	1,000 to 4,999	Textiles	Head of Sustainability	75	Face-to-face
	For-profit 4	10,000 to 49,999	Textiles	Director Global Sustainability	35	Call
	For-profit 4	10,000 to 49,999	Textiles	Director Global Sustainability	45	Call
	For-profit 6	50 to 249	Textiles	General Manager	90	Face-to-face
	For-profit 6	50 to 249	Textiles	General Manager	35	Call
	For-profit 9	1,000 to 4,999	Textiles	Team Leader Corporate Responsibility	80	Video-Call
Production beverages	For-profit 8	50 to 249	Beverages	Manager Sustainability	90	Call
	For-profit 16	250 to 999	Beverages	Manager CSR	75	Face-to-face

	For-profit 18	1,000 to 4,999	Beverages	Head of Sustainability & Safety	50	Call
Retail food/ non-food	For-profit 5	fewer than 50	Coffee	General Manager	20	Call
	For-profit 5	fewer than 50	Coffee	General Manager	85	Face-to-face
	For-profit 10	10,000 to 49,999	Food	Head of CSR	60	Face-to-face
	For-profit 15	10,000 to 49,999	Food/ Non-food	Lead Manager Sustainability	80	Call
	For-profit 23	5,000 to 9,999	Food/ Non-food	Director Sustainability Strategy	100	Face-to-face
	For-profit 24	50,000 or more	Food	Head of Corporate Responsibility	50	Face-to-face
Production/ retail cosmetics	For-profit 22	10,000 to 49,999	Cosmetics	Creative Buyer (Buyer sustainability)	110	Face-to-face
Production food	For-profit 11	1,000 to 4,999	Food	Manager Work Safety & Sustainability Management	60	Call
	For-profit 13	5,000 to 9,999	Ingredients	Manager Corporate Sustainability	30	Call
	For-profit 13	5,000 to 9,999	Ingredients	Manager Corporate Sustainability	20	Call
Production cleansing	For-profit 17	1,000 to 4,999	Chemistry	Head of Sustainability and Organizations Management	40	Call

Note – Compiled by the author based on [53].

APPENDIX D – ADDITIONAL INTERVIEWS FOR BACKGROUND INFORMATION

Table 47 – Additional interviews for background information

Case/ Supply Chain	**Organization**	**Head-count**	**Branch**	**Respondent position**	**Duration in minutes**	**Interview type**
Retail food/ non-food	For-profit 1	fewer than 50	Coffee	General Manager	35	Call
Non-specific	Non-profit 1	1,000 to 4,999	Services	Manager Public Affairs	35	Call
Production/Retail Timber	Non-profit 2	fewer than 50	Timber	Manager Market Services	35	Call

Note – Compiled by the author based on [53].

APPENDIX E – EXTENDED SOCIAL SYSTEMS THEORY PRIMER (THEORETICAL DEPTH)

The application of social systems theory to SSCM opens up a range of opportunities and benefits.

First, the systemic approach treats the supply chain as one system. Sustainability is treated as an integral part of the system and its environmental relationships. This allows interactions between different areas (environmental, social, economic) to be better recognized. For example, a change in the environment such as new legal requirements can have a simultaneous effect on various elements (suppliers, internal processes, customer perception). The systemic view helps to recognize such interrelationships at an early stage [50].

Second, focusing on the essentials as the theory forces us to ask: What is really relevant for a system? This focus can help to set priorities in practice. By defining their relevant complexity companies can allocate resources in a targeted manner. Studies suggest that companies are more successful in their sustainability initiatives if they set clearly defined priorities and do not try to solve everything at once [182].

Third, systems theory improves complexity management: with concepts such as internal vs. collaborative complexity, it provides a strategic framework for designing sustainability management. Companies can systematically examine whether a problem is more likely to be solved by expanding internal capabilities or through external cooperation or through a mix. This approach promotes efficient solution strategies. For example, companies may realize that certain problems (such as energy savings in their own plants) are best solved internally, while others (such as compliance with human rights at sub-suppliers) can only be tackled through industry-wide cooperation. The theoretical model helps to structure such decisions [55].

Fourth, a systems theory-oriented company develops mechanisms for self-observation and adaptation, which strengthens its adaptability and resilience. It learns to continuously scan changes in its environment and to readjust internal processes accordingly. This increases the resilience of the supply chain in the face of new challenges. The COVID-19 pandemic, for example, confronted many supply chains with unprecedented social (health protection) and ecological (local vs. global production) issues, where companies with flexible, learning-capable systems were able to respond more quickly [81]. Systems theory provides the mindset to perceive changes not as disruptions but as opportunities to redefine relevant complexity and remain agile.

Fifth, this perspective advances scientific knowledge, as it offers the opportunity to expand existing SSCM concepts. Many classical theories in SCM (e.g., principal-agent theory, transaction cost theory) fall short when addressing multifactorial sustainability issues. Systems theory, by contrast, enables the inclusion of social dynamics, communication, and self-regulation in the analysis [183]. Initial research [53; 56] shows that this allows for the description of new phenomena or the life-cycle dependency of CSR outcomes [56]. This opens up new research fields and leads to deeper understanding.

A complementary heuristic is the notion of 'fitness landscapes' [184], which help illustrate the fragmented and dynamic nature of sustainability challenges in supply chains. The NK “rugged landscape” is borrowed here as a heuristic. In this mapping, fitness denotes the continued reproduction of decision communications, while N and K refer to the number of expectation domains and their couplings that make selection rugged. In Kauffman’s [185] analogy to complexity, the context may be rugged, depending on the distribution of fitness values and interdependencies between the system's components.

The systems theory thus promotes a proactive, reflective, and interconnected approach to sustainability management, one that incorporates complexity and makes it a central focus. This enables companies to act in a more structured yet flexible manner.

From a business practice perspective, the key insights emerge. First, sustainability in the supply chain must be viewed as part of a complex system where not everything can be controlled, but where targeted selection and prioritization can steer outcomes. Second, the right partners and networks must be mobilized to collaboratively solve shared problems. Isolated approaches quickly reach their limits. Third, companies should cultivate a learning culture, as sustainability challenges evolve. What is seen as relevant today may be outdated tomorrow, and new issues will arise. Systems theory teaches that rigid, non-learning systems cannot survive in complex environments.

Of course, transferring systems theory into practice brings challenges: it requires a shift away from simplified cause-effect models toward embracing uncertainty and multi-layered dynamics. Yet, in light of the “wicked problems” faced in global supply chains (e.g., climate change, exploitation, volatility), such an approach seems highly relevant. It helps companies build resilience, a quality that increasingly becomes a competitive advantage in a complex world.

Social Systems Theory does not offer a ready-made solution catalog for SSCM, but it does provide a compass for managing the challenges. It sharpens awareness of the right questions to ask (Where is the complexity? What are we ignoring? Where do we need help?), and offers conceptual tools to structure responses. In this way, it makes a significant contribution to the further development of sustainable supply chain management both in theory and practice.

APPENDIX F – METHODOLOGY (WESTERN FIRMS RESPONSES TO SUSTAINABILITY-RELATED COMPLEXITY)

To stay competitive and fulfill legal requirements, organizations need to manage sustainability in their supply chains. However, this increases the complexity they have to deal with. So far, it is unclear how organizations design business capabilities to manage sustainability-related complexity. Given the limited research on managing sustainability-related complexity internally, and because the research question is a how-question, the study abductively explores how organizations design business capabilities to manage this complexity by conducting a multiple-case study.

This approach allows us, first, to study the phenomenon in its context and, second, to understand the nature and complexity of the research objective itself. Case studies are particularly suitable for exploring complex, context-dependent phenomena such as sustainability management in supply chains. Unlike other qualitative methods, case studies provide detailed insights into internal processes and mechanisms that organizations use to manage complexity, enabling a rich understanding of dynamic interactions and the practical implications of theoretical constructs [24; 206]. Third, in comparison to large-scale-theory-testing methods, this approach additionally enables getting closer to a theoretical construct while uncovering intrinsic relationships [53; 206].

However, to ensure rigour, quality measures for validity and reliability, as proposed by Yin [24], are applied. The detailed overview of the quality measures is presented in the Table 48. The paragraphs below explain the course of research. The methodological design of Study I, with the account of case selection, data collection and data analysis presented in this appendix, was first published by the author in [53]. It is reproduced here in condensed and partly revised form in order to document the empirical basis of the present dissertation.

Table 48 – Quality measures for qualitative research

Quality criterion	Design	Case selection	Data gathering	Data analysis
Reliability (shows operations of the study and if replicated leading to same results)	Develop a case protocol and use a case database.	Document selection criteria in the protocol and database.	Use a semi-structured guide and share it with interviewees beforehand.	Code transcripts systematically with qualitative analysis software. Involve researchers who did not gather the data.

Internal validity (establish a causal relationship, which are believed to lead to other outcomes/ conditions)	Build the research model on literature and theoretical reasoning.	Use expert interviews to refine the reasoning. Record sampling criteria.	Interview knowledgeable informants and use multiple sources.	Compare patterns with prior research and triangulate sources.
Construct validity (identification of suitable operational measures for the study)	Adapt research questions from earlier SSCM studies.	Not applicable.	Use interviews, sustainability reports, press articles and other reports.	Have key informants or interviewees review transcripts.
External validity (showcase generalizability of findings)	Use a comparative multiple-case design.	Use theoretical sampling.	Collect information about case context.	Consider contextual detail when interpreting transferability.
Note – Compiled by the author based on [24; 118].				

Research design

To study how sustainability-related complexity is managed internally and to understand the underlying theoretical constructs, the study relies on an abductive multiple-case study approach [24; 206; 225; 226; 227; 228], following the design developed in [53]. This approach is best suited for the following reasons. First, qualitative research on how sustainability-related complexity is managed internally remains scarce and fuzzy, which makes it impossible to validate existing theoretical considerations. Therefore, the abductive approach, on the one hand, guides the research process prior to the data analysis by relying on theoretical considerations. The abductive approach was chosen for its iterative interaction between theory and data. Compared to purely deductive methods, it allows for greater flexibility in refining theoretical considerations based on empirical findings [140]. At the same time, it builds on existing theoretical frameworks, offering more depth than inductive methods. This approach is particularly suited for examining complex and dynamic phenomena such as sustainability-related complexity, as it both refines existing theories and generates new theoretical insights. On the other hand, it supports the data analysis after the data collection and aids understanding. Second, the case study approach is best suited to investigating the phenome-

non in its context. Contrary to a quantitative approach, it allows for interactions between the researcher and the informant. In parallel, it draws on multiple data sources, which leads to higher information richness [24]. Moreover, studying the phenomena in its context and drawing on statements of informants, this dissertation is able to develop and modify a theoretical contribution of very high practical relevance [118]. And third, as the topic of sustainability is still developing due to regulatory and customer pressure worldwide, the fuzziness of the term sustainability is clarified through the interviewing process and subsequently through the internal validity of the study. Fourth, using and triangulating multiple sources of data reduces the social-desirability bias that organizations often introduce through window-dressing or greenwashing. Accordingly, the research is guided by theoretical considerations based on Social Systems Theory, which assumes that, dealing with external complexity, systems increase their internal complexity and build up collaborative complexity with others. To the author's knowledge, no prior research addresses this research objective; a priori hypotheses therefore cannot be derived, which justifies this approach. However, to guide the research, the author pre-selected interview-questions related to the preliminary considerations in the field of mostly SCM and SSCM [75; 229; 230; 231; 232; 233; 234]. This methodology enables us to examine theoretical concepts empirically and generate new insights into the management of sustainability-related complexity in supply chains.

Methodological reflection on the case selection

Before describing the operational sampling steps, the underlying case selection approach is made explicit. Case selection in Study I follows theoretical and purposive sampling principles in the tradition of Eisenhardt [108], Eisenhardt and Graebner [109], Patton [110], and Yin [24], and not convenience sampling driven by access alone. Three implications follow from this commitment.

First, the cases were selected to inform the analysis of internal capability building under sustainability-related complexity. The sampling supports analytic generalization to the proposed mechanisms [111; 24]. It does not provide a statistically representative picture of firms. Case evidence shows how the phenomenon operates in selected settings. It also allows the analysis to examine whether patterns recur across those settings [112; 110].

Second, sampling maximizes variation in industry sustainability salience, supply-chain position, size, and customer proximity. The literature and pre-study expert interviews identified these dimensions as theoretically relevant [110]. Maximum-variation sampling deliberately seeks cases that differ on these dimensions in order to strengthen the robustness of any cross-case pattern: a pattern that survives across heterogeneous cases is more likely to reflect the focal mechanism than the specific context of any single case. The geographic concentration on Germany was a deliberate hold-constant decision (controlling for the institutional environment).

Third, the sample comprises six embedded supply-chain cases covering 17 for-profit organizations and 23 interviews. The six cases fall within Eisenhardt's [108] recommended range of four to ten for theory-building case studies. The 17 embedded organizations add replication breadth and stabilize the PBC architecture. This retains the depth needed for abductive within-case analysis. Theoretical saturation in the sense

of Eisenhardt and Graebner [109] was indicated by the recurrence of capability patterns across heterogeneous cases and by the absence of substantively new sub-business capabilities in the final cases analyzed. This saturation rationale anchors the claim that the sample is adequate for the dissertation's theory-building purpose.

Theoretical sampling and case selection

The sampling for this study was twofold, first looking for industries and second selecting respective organizations. The selection of industries such as textiles, food, and cosmetics was based on their high relevance to sustainability issues due to regulatory requirements, societal expectations, and ecological impacts. These industries were selected because they exemplify sustainability challenges faced by organizations with complex and global supply chains. Textiles combine fragmented supply chains with visible ethical concerns. This makes the industry suitable for studying internal sustainability strategies. Food and beverages depend on agricultural raw materials. These face close scrutiny of environmental and social impacts, which informed sector selection. By focusing on these industries, the study ensures relevance and provides insights into managing sustainability-related complexity in sectors that serve as benchmarks for other industries. The cosmetics industry was selected due to its focus on raw material sourcing and public sensitivity to ingredient transparency. These industries provide an ideal setting to analyze internal sustainability capabilities. The case size, aligned with Eisenhardt's [108] recommendation of 4-10 cases, was chosen to balance in-depth analysis with the generalizability of findings. This approach captures both industry-specific nuances and recurring patterns in the development of business capabilities.

The following outlines this theoretical sampling and the reasons for case selection. The selection criteria for cases were carefully designed to capture a diverse range of perspectives. Organizations were chosen based on three factors: first, their reliance on natural raw materials, second, varying organizational sizes and structures, and third, regional consistency, focusing on companies headquartered and operating in Germany to ensure comparability of regulatory and market conditions. This diversity enhances the study's ability to generalize findings while providing an understanding of how different organizational contexts influence the management of sustainability-related complexity.

First, especially industries relying on natural raw materials or ingredients and produce or source agricultural products face high expectations and pressures e.g. from customers, governments and NGOs to implement a sustainability ambition in their supply chains [48; 53; 235; 236; 237; 238].

Because of this pressure and awareness, it is assumed that these organizations are more likely to improve their sustainability ambitions, enabling higher generalizability of the empirical findings. Sustainability ambitions are understood as part of internal complexity. Although the selected industries provide valuable insights, the study acknowledges that the specific challenges and strategies observed may not be entirely generalizable to industries with less complex supply chains or lower sustainability pressures, such as local service-based businesses. Nevertheless, the findings can offer transferable frameworks for analyzing stainability-related complexity in other contexts [53].

Second, organizations processing and sourcing agricultural products are criticized for their own and their suppliers' harm to the environment (e.g., deforestation or waste water), and for their impact on humans both related to processing and sourcing (e.g., child labor or working conditions) as well as living in the natural environment nearby [239; 240]. Climate change has raised these expectations further, with more customers and other stakeholders holding organizations accountable for their impacts. In addition, organizations operating in supply chains with focus on agricultural products face a high vertical and horizontal supply chain complexity [53; 241].

Third, because such heterogeneous actors (e.g., customers, NGOs, governments) expect organizations and their suppliers to raise their sustainability ambitions, the sampling focused on a diverse set of organizations from the agricultural industry, varying in size (number of employees) and purchasing categories. This suits the qualitative approach building on variance and looking for differences between organizations and their respective purchasing categories. Organizations of varying sizes were included to ensure the results capture a broad spectrum of internal sustainability-related complexity. Larger organizations often have more resources and established complexity-management frameworks. Smaller firms may rely on innovative or ad-hoc approaches because resources are limited. This variation allows the study to identify both commonalities and size-specific strategies for managing sustainability-related complexity. Including large and small organizations also shows how size affects the scale and scope of sustainability initiatives. For example, larger firms may focus on global supplier management systems. Smaller firms may prioritize local strategies. These differences help the study draw conclusions about internal capability development. The selected cases support the research objective of understanding how organizations manage sustainability-related complexity internally. They cover different industries and purchasing categories. This allows the study to examine a wide range of strategies and capabilities. It also shows how different external pressures shape internal capability development [53].

Fourth, to increase the comparability of external factors like governmental regulations, the focus is on organizations headquartered in and operating from Germany. The focus on Germany reflects its stringent sustainability regulations and strong public demand for corporate accountability. Germany's role in setting international sustainability standards encourages organizations to adopt advanced practices. The geographic focus may reflect Germany's particular regulatory and cultural conditions. Applying the findings elsewhere may require adaptation to different priorities and enforcement levels. To refine the sampling and the semi-structured interview guide, expert interviews with for-profit and non-profit organizations were conducted prior to the data-collection phase. To this end, a set of organizations was contacted [53].

The interviewed for- and non-profit organizations are diverse in size and purchasing categories. The sampling approach and the selection criteria are documented in [53]. Prior to the interviews, one or two purchasing categories (e.g., cacao, palm oil, cotton) from each organization's sourcing portfolio were selected and agreed upon with the respective interviewee. A general criterion was that the selected purchasing category was significant for the company's revenues and typical of what the company is

publicly known for. In total, 20 organizations were interviewed across 26 interviews. However, this dissertation sampled six supply-chain cases, which lies within the range of four to ten cases suggested by Eisenhardt [108]. A detailed overview of all cases and interviews included in the analysis is provided in **APPENDIX C – OVERVIEW OF CASES & INTERVIEWS**. The background/expert interviews used to refine the interview guide are summarized separately in Appendix D. The selection of cases ensured that the results provide both in-depth and generalizable insights into the internal management of sustainability-related complexity [140].

Sampling and informant bias: reflection and mitigation

Sampling and informant bias are not treated as residual concerns but as design parameters that the case selection approach and the data collection procedure were built to address [113; 108; 109; 110; 24]. Four potential bias sources are made explicit and matched to concrete mitigation steps.

Self-selection bias. Organizations that agree to participate in sustainability-focused interviews may be systematically more engaged with sustainability than non-participants. Three mitigation steps were taken. First, the industry-level sampling step (textiles, food, beverages, cosmetics/cleansing, chemicals, retail) was anchored in literature- and pressure-based criteria, not in self-reported sustainability claims of candidate firms. Second, selection within each industry covered size, supply-chain position, and customer proximity. It included organizations not publicly identified as sustainability frontrunners. Third, every interview-based account was triangulated against publicly available material (sustainability reports, supplier and supply-chain codes of conduct, press articles, corporate websites), so the empirical record for each case combines interview self-report with additional sources [167; 168; 118; 24].

Informant-availability and elite-bias effects. Sustainability discourse inside organizations is unevenly distributed across roles and hierarchical levels. The risk is that only the most senior or most publicly visible informant speaks for the organization, which would skew the reconstructed capability set. This risk was mitigated by a multi-role informant strategy combining CEO, sustainability-manager, and purchasing-manager perspectives across the case set. Where multiple informants per case were available, their accounts were used for within-case triangulation. Where only one informant was available, the reduced internal triangulation is documented case by case in the case database.

Gatekeeping effects. Access to sustainability-relevant informants is frequently mediated by communications or legal departments, which may filter who is reachable and what is sayable. Three mitigation steps were taken. First, contact was sought directly with the substantively responsible role (e.g., head of sustainability, head of purchasing). Second, all interviews were conducted under anonymity, and no organization was granted veto rights over the analysis or the dissertation text. Third, transcripts were returned to informants for verification of factual accuracy and for the opportunity to flag misrepresentations, but not for editorial control. No informant requested substantive changes.

Social-desirability and window-dressing risks. Sustainability is a domain in which informants have an incentive to present an organization in a favorable light. This

risk was mitigated by the triangulation approach described above, by the multi-role design that exposes inconsistencies between strategic and operational accounts, and by the explicit comparison of interview claims with publicly disclosed material. Documented inconsistencies were analyzed as signs of internal tension between strategic ambition and operational implementation.

A residual transferability limitation arises from the geographic concentration of cases on Germany. This concentration is a deliberate hold-constant decision, and its consequences for transfer to other institutional environments are explicitly addressed in the limitations discussion.

Data collection

The multi-disciplinary and cross-functional management of sustainability internally led to varying informants (CEO, sustainability manager, purchasing manager). The roles of the interviewees were selected based on their direct involvement in sustainability decision-making and implementation. CEOs provide insights into organizational priorities. Sustainability managers explain operational challenges and how they are addressed. Purchasing managers contribute insights into supplier engagement and supply chain complexity. Together, these perspectives support a comprehensive understanding of sustainability-related complexity. They show how it is managed at both strategic and operational levels. The cases were sampled between August 2019 and March 2020 using a semi-structured interview guide (see APPENDIX I – INTERVIEW GUIDE on page 254). Prior to the interview, a shortened version of the semi-structured interview guide was sent to the interviewees. The semi-structured interview guide covered four themes: (1) the organization's understanding of sustainability and its goals, (2) environmental and social challenges in the upstream supply chain, (3) internal management and adaptation to these challenges, and (4) the use of third parties such as labels and cooperation with NGOs [53].

This approach was expected to improve the quality of interviewees' answers, since notes, drafts, and first ideas were developed upfront. Based on these notes, the understanding of the study objective and the associated questions were deepened. During the course of research the semi-structured interview-questions were refined and adjusted to ensure that new and interesting facets were included [24]. In addition, interview questions from previous research in the field were revised and adopted [53]. This step further increased the quality of the research, and particularly of the semi-structured interview guide. The interviews were conducted in German language and treated anonymously. The interviews were conducted in three formats: face-to-face, phone, and virtual. Phone and virtual interviews were used to overcome geographic constraints, while face-to-face interviews allowed for capturing non-verbal cues. The interviews lasted an average of 60 minutes and were carried out by one researcher. Prior to the interviews, further information was gathered to support the sampling of purchasing categories, drawing on publicly available sources such as corporate websites, sustainability reports, and supplier/supply-chain codes of conduct. The audiotaped interviews were transcribed afterwards. In total, 26 interviews with 20 organizations were conducted. Owing to the unstructured information and partially missing

audio material, the pre-tests are not included in the study. They are nonetheless reported in this method section for completeness and, more importantly, treated as background interviews providing further context (see Table 47).

This reduces the number of interviews included in the analysis section to 23 interviews with 17 different for-profit organizations. During the interviews, notes were taken and added to a protocol (e.g., date of interview, information of interviewee, interview setting (face-to-face or phone call) and other comments). This accounts for reliability and supports the data analysis [24; 118]. To ensure validity, information from multiple sources was additionally collected (sustainability reports, firm websites, supplier/supply-chain codes of conduct, press articles, and other freely accessible reports) for later triangulation [118]. In addition to triangulation, validity was strengthened through feedback loops with interviewees. Transcripts were shared with participants for verification, ensuring that their statements were accurately represented. External data sources such as sustainability reports, press articles, and publicly available documents were integrated to corroborate findings. No interviewee intervened or asked for changes to the transcripts. Lastly, a case database was established consisting of the transcripts, notes and other sources of data for triangulation [24]. The case study protocol and the database follow the procedure reported in [53]. Reliability was ensured through the creation of a detailed case study protocol, which documented a step of the research process, enabling replication by other researchers. Combining different data sources and verifying the transcripts with respondents increased the reliability and informative value of the data.

Reflection on the nature of interview evidence

Study I treats interview responses as accounts of how people make sense of their organizations. They are not treated as independently verifiable descriptions of operational practice [105; 106; 14; 15; 16; 107]. This reflects the dissertation's interpretive-constructivist stance. During the interview, informants and the researcher jointly develop these accounts. Informants describe, reconstruct, and explain their organization's capability architecture. The data show how informants understand the organization's response logic. They also show which capabilities informants consider essential, how they connect strategy to execution, and how they explain tensions and trade-offs. The value of these accounts does not depend on independently verifying every procedural detail.

Three design features reduce the risk of treating one informant's account as a definitive description of an organization. First, CEOs, sustainability managers, and purchasing managers provide different organizational perspectives on the same capability set. Convergence across roles supports the capability construction, while divergence is treated as analytically informative about intra-organizational tensions. Second, the triangulation of interview data with publicly available material (sustainability reports, corporate websites, supplier and supply-chain codes of conduct, press articles) tests whether capability articulations hold across sources. It does not test the truth of individual claims [167; 168; 118; 24]. Third, transcripts were returned to informants for verification of factual accuracy and for the opportunity to flag misrepresentations. No informant requested substantive changes, which strengthens reliability without

turning the interview into a managed organizational message. Study I claims that the Packed Business Capabilities architecture captures a recurring pattern of capability construction. The pattern appears across heterogeneous cases and holds across the data sources outlined above. The boundaries of this claim, particularly with respect to inferences from articulation to operational practice, are made explicit in the limitations discussion in the Conclusion.

Data analysis

After the data collection, the data was coded and analyzed. The data analysis was twofold. First, the within-case analysis based on Miles, Huberman, and Saldaña [117] allows understanding case-specific constructs, whereas secondly the cross-case analysis helps to understand patterns and comparison across the cases. The qualitative data analysis was conducted using NVivo to ensure systematic and traceable coding of transcripts. The coding process followed a deductive-inductive approach: data were initially coded based on predefined categories derived from social systems theory, followed by emergent categories developed to capture new insights.

Eisenhardt and Graebner [109] suggest that qualitative research builds new theory or elaborates existing theory. The study is positioned in between, since a prior framework is already in place, one that builds on Social Systems Theory with its overarching constructs. However, this study focuses on construct development and elaboration, with theory testing outside its scope. Instead, the overarching constructs of social systems theory (i.e. internal complexity with structure and process) were used to first structure the interview data. Despite relying on these initially, the analysis rapidly reached the stage of crafting constructs, termed Packed Business Capabilities, together with their respective sub-constructs (each an individual business capability) of internal complexity. These sub-constructs of internal complexity are viewed as business capabilities. The sub-construct of a business capability can be understood as a firm's ability to reach a certain goal. This goal could be of strategic importance or very operational. This aligns with the definitions in the literature e.g. from Offerman et al. [207] literature review on capabilities where they cited Homann [208], who defines a business capability as follows: "A business capability is a particular ability or capacity that a business may possess or exchange to achieve a specific purpose or outcome. A capability describes what the business does (outcomes and service levels) that creates value for customers. For example, pay employee or ship product. A business capability abstracts and encapsulates the people, process/procedures, technology, and information into the essential building blocks needed to facilitate performance improvement and redesign analysis." [208] On the one hand, the present analysis further developed and crafted sub-constructs as business capabilities. On the other hand, the analysis derived new constructs of which internal complexity consists. Besides the original constructs of process and structure, strategy and technology were also crafted as novel constructs, each with respective sub-constructs (i.e. business capabilities). The overview of the constructs is provided in the following table.

Table 49 – Business Capabilities for complexity reduction

Construct (Packed Business Capability)	**Sub-Construct (Business Capability)**	**Description**
Strategy	Strategic Management	Set sustainability priorities and goals, align them with strategy and secure top management support. Treat sustainability as a potential competitive advantage.
People	Organizational Structure & Staff	Assign sustainability roles and staff. Use dedicated departments, decentralized management, international representation, advisory boards or committees as appropriate.
	Employee Empowerment	Build employee awareness and engagement through training and incentives.
	Communication	Communicate sustainability internally and with customers and stakeholders. Use credibility to support competitiveness and collaboration. Consider willingness to pay along the value chain.
Process	Process Innovation & Adaptation	Adapt processes to improve sustainability.
	Supply Chain Sustainability	Integrate sustainability into sourcing, audits, supplier collaboration and transparency.
	Risk Management	Develop and apply policies for managing sustainability challenges.
	Product Innovation & Adaptation	Develop projects and labels. Integrate sustainability into product and process management. Adapt products or find alternative products and raw materials.
	Social Responsibility	Use community engagement, corporate giving and stakeholder involvement to support social responsibility.
	Continuous Improvement	Use feedback and performance measures to improve sustainability continuously.
	Innovation for Sustainability	Develop solutions that address environmental and social challenges.
Technology	Data Management and Reporting	Collect, analyze and report sustainability data.
	Technology Adoption	Develop tools, adapt ERP systems and manage IT for sustainability.
Note – Compiled by the author based on the coding of Study I.		

However, the first step is to provide the within-case descriptions, aiming for internally consistent accounts of the cases. For this purpose, all information relevant to understanding internal sustainability-related complexity is captured as business capabilities. This is then followed by the cross-case analysis. The cross-case analysis identifies patterns in different settings and increases the external validity. While the study focuses on industries and organizations with significant sustainability challenges, the patterns identified may also be relevant to other sectors. The emphasis on internal capability development, for example, provides a transferable framework for organizations in service or technology industries, where complexity management also plays a critical role. However, the findings should be interpreted with caution when applied to contexts with significantly different supply chain structures or sustainability pressures. The cross-case results were discussed iteratively to enhance the objectivity in the study [209].

However, to reach an understanding, the whole process is iterative, moving back and forth between data and literature. Finally, the whole research was assessed against Yin's [24] four tests as shown in Table 48.

Construct validity was ensured by triangulating interview data with field notes and publicly available documents and by corroborating the findings through the perspectives of different informant roles across the cases, as highlighted in Table 46.

Internal validity was ensured by matching the pattern with the predicted one developed from literature. Using multiple cases enabled replication of the findings, providing external validity. Reliability was ensured by rigorous use of the case study protocol and developing a case study database. The coding scheme is provided in Table 49. The results of Study I are reported in Section 2.1.

APPENDIX G – METHODOLOGY (KAZAKH FIRMS RESPONSES TO SUSTAINABILITY-RELATED COMPLEXITY)

Research design & rationale for using sustainability reports

This study employs Qualitative Content Analysis as a systematic method for interpreting textual data through coding and categorization, allowing researchers to uncover meaningful patterns and insights from documents [25; 102]. As defined by Krippendorff [102], content analysis is a research technique that derives information from texts by situating them within their context of use. The process involves carefully reading the text, assigning segments to relevant categories, and drawing conclusions about the communication and its contextual significance. The method's flexibility accommodates both quantitative elements such as the frequency of themes and qualitative interpretation of latent meanings.

In this study, the emphasis is on qualitative interpretation to understand how organizations in Kazakhstan develop and use business capabilities to address sustainability-related complexity. To this end, a multiple-case qualitative design is adopted, with corporate sustainability reports serving as the primary data source. These reports are formal disclosures in which companies publicly outline their environmental, social, and governance (ESG) performance and initiatives. As central tools for corporate transparency, sustainability reports have become critical for demonstrating accountability and building stakeholder trust [126]. By disclosing ESG-related information, companies signal their commitment to sustainable practices and enable stakeholders to assess their impact and progress. These reports are thus a central medium through which companies present their sustainability efforts and respond to stakeholder information needs.

From a theoretical standpoint, the rationale for focusing on sustainability reports is underpinned by Social Systems Theory. First, Niklas Luhmann's theory conceptualizes organizations as self-referential social systems that operate through communication. In this view, any interaction between an organization and its external environment occurs via communicative processes (e.g. reports, statements, media). Luhmann emphasizes that society can address issues such as ecological challenges only through communication [127]. A sustainability report exemplifies this as it is a *communication* tool through which a company observes itself and projects a self-description to society regarding sustainability. By publishing sustainability reports, organizations engage in what Luhmann terms ecological communication: the organization responds to environmental and social expectations using the language of transparency and accountability. This theoretical grounding suggests that analyzing these reports can reveal how companies (as social systems) adapt and respond to societal sustainability norms and pressures through their communications.

Second, sustainability reports are particularly well-suited to qualitative content analysis because they are rich, text-heavy documents that often follow established frameworks (such as the Global Reporting Initiative standards). They typically contain narratives, data, and reflections that provide insights into corporate values and strategies. Unlike financial filings, sustainability reports tend to include descriptive discussion of policies, goals, and stakeholder engagement efforts, making them fertile ground

for qualitative analysis. They also represent a relatively standardized genre of corporate communication, which aids comparability across companies. By focusing on reports from multiple companies, the research can discern patterns in how sustainability is communicated and identify differences that may relate to organizational context.

Methodological reflection on the case selection

Case selection in Study II follows the same theoretical and purposive sampling rationale as Study I, adapted for a content-analytic design [108; 110; 24]. Three points should be made explicit before the operational selection criteria are described.

First, the Study II sample supports analytic generalization [111; 24]. The selected companies provide variation in how large Kazakhstani firms report sustainability-related capabilities. The findings concern patterns within this sampling frame. Estimating how common these patterns are across Kazakhstani companies would require a different sampling design.

Second, sampling is structured by a maximum-variation approach [110] along four dimensions identified as theoretically relevant: sector exposure, ESG maturity, ownership structure, and disclosure transparency. Each dimension reflects a published source of variation in capability articulation in emerging-market and resource-intensive contexts. Deliberately spanning these dimensions strengthens any cross-case pattern that survives such heterogeneity [112], while deliberately contrasting cases enable theoretical replication in the sense of Yin [24].

Third, the sampling frame was anchored externally. Candidates came from PwC Kazakhstan's Top 50 ESG Disclosure Companies in Kazakhstan rating. It independently assesses ESG strategy, corporate governance, society, environmental impact, and reporting practices. This external anchoring reduces researcher discretion and makes the sampling frame more transparent. The four selection criteria below were then applied within that frame to select the final 11 cases.

Case selection and sampling strategy

The study uses a multiple-case qualitative design to examine sustainability communication in Kazakhstan. It selects 11 companies through purposive sampling aligned with theoretical sampling principles [108]. Cases were chosen to vary in characteristics relevant to sustainability reporting and to support useful comparisons. This increases the opportunity to observe different practices and identify underlying patterns for theory building [108]. Following Yin, the cases support literal and theoretical replication [24; 108]. Literal replication expects similar outcomes in similar contexts. Theoretical replication expects contrasting outcomes in different contexts. The selection criteria are described below.

To define the sampling frame, large Kazakhstani companies with publicly available sustainability or ESG reports were first screened. Selection consulted PwC Kazakhstan's Top 50 ESG Disclosure Companies in Kazakhstan rating [82]. It independently reviews the completeness, quality, and accessibility of ESG information in annual and sustainability reports. It identifies leading reporters in oil and gas, energy, mining, finance, transport, and telecommunications. PwC assesses Kazakhstan-based companies across ESG strategy, corporate governance, society, environmental impact,

and reporting practices. The latest edition applies stricter criteria. These reflect developing expectations for governance and strategic sustainability integration. This external benchmark was used to identify candidates with active sustainability communication, and the criteria below were then applied to narrow the list to 11 focal cases.

First, sector. The sample spans energy, mining, finance, transportation, and other industries. This covers different sustainability issues and stakeholder expectations. Extractive and service industries face different challenges and reporting norms. Including both high-impact and less intensive sectors helps examine how sector context shapes sustainability management.

Second, the ESG Maturity. The sample includes companies at different levels of ESG maturity. Some firms are reporting leaders or early adopters with several years of reports and possible international recognition. Others are new to formal sustainability disclosure. This variation allows examination of how maturity (or experience) with ESG practices might reflect in the depth and quality of reporting. Less mature reporters may provide more basic or symbolic disclosures, whereas mature reporters might offer more extensive data and analysis.

Third, the ownership structure. The sample included a mix of state-owned enterprises, privately owned local companies, and subsidiaries of multinational corporations. Ownership structure in Kazakhstan can influence the management of sustainability due to factors like government expectations, investor pressure, or corporate governance practices. For example, state-owned companies might face public-sector transparency mandates, while multinational subsidiaries might adopt global parent company standards. Theoretical sampling of different ownership types enables analysis of whether and how ownership and governance context shape sustainability communication.

Fourth, report transparency. An initial review of available reports informed the assessment of transparency and quality. The sample covers detailed disclosures using GRI standards, quantitative data, and candid discussion, as well as more limited, compliance-oriented reports. This variation supports comparison between high-transparency and low-transparency sustainability communication.

Using these criteria, 11 companies were theoretically sampled to provide rich contrasts. According to the detailed company profiles provided in the following table, the final sample includes major Kazakh enterprises in oil & gas, mining/metals, banking, transportation, and construction, among others. They range from large state-owned corporations to publicly-listed firms and joint ventures.

Table 50 – Overview firms used for content analysis

Firm	**Sector**	**Short description of rationale for integrating in research**
JSC National Company KazMunayGas (KMG)	Oil & Gas	Leading energy supplier with comprehensive ESG reports; benchmark for resource-intensive industries.

Karachaganak Petroleum Operating B.V. (KPO)	Oil & Gas	International partnership with a focus on sustainable development
National Atomic Company Kazatomprom JSC	Uranium Mining	Leader in uranium production; documented ESG framework, risk-intensive - similar to "risk governance" focus in Western industries.
KAZ Minerals Limited	Copper Mining	Mining with ESG ambitions; comparable to international commodity companies.
Eurasian Resources Group S.à r.l. (ERG)	Mining	Large mining company with ESG reporting.
Samruk-Energy JSC	Energy Provider	Representative for strategic green restructuring in state-related structures.
Kaspi.kz JSC (Kaspi)	FinTech / E-Commerce	Innovative, capital market-oriented company with a modern ESG approach comparable to the digital business models of Western companies.
Halyk Bank of Kazakhstan JSC (Halyk Bank)	Banking	Largest bank in Kazakhstan, ESG framework and sustainable finance products. Comparable to western banks.
Bank CenterCredit JSC (BCC)	Banking	Bank with a focus on ESG integration.
BI Group (parent company BI Group Ltd.), report issued by BI Development Ltd.	Construction	Large property developer with growing interest in sustainable construction focusing on "product innovation" and "process capabilities".
Air Astana JSC	Airline	ESG initiatives in the emissions-intensive transportation sector, well documented and comparable to Western airlines.
Note – Compiled by the author.		

Each firm represents a particular combination of these criteria. Examples include an established mining ESG reporter and a newly listed firm with emerging reporting practices. Such heterogeneity is intentional and methodologically beneficial for following reasons.

First, according Eisenhardt's guidelines, diverse cases can help uncover patterns and insights that are not specific to one type of company [108]. Comparing cases identifies consistent sustainability content across contexts. It also reveals systematic variation by sector, maturity, or ownership. This strategy thus balances depth (within each case) with breadth (across cases) to enhance the study's analytical generalizability.

Sampling and disclosure bias: reflection and mitigation

Three potential bias sources specific to a content-analytic design with corporate sustainability and annual reports as data are made explicit and matched to concrete

mitigation steps. A fourth concern, disclosure bias in the substantive reports, is treated separately as part of the research object.

Sampling-frame bias. The frame from which cases are drawn can itself favor visible or sophisticated reporters. To reduce researcher discretion in constructing the frame, candidates were drawn from PwC Kazakhstan's "Top 50 ESG Disclosure Companies in Kazakhstan" rating, an externally produced and methodologically transparent assessment that scores ESG disclosures along five blocks (ESG strategy, corporate governance, society, environmental impact, reporting practices). Within this externally anchored frame, four selection criteria were applied (sector exposure, ESG maturity, ownership structure, disclosure transparency) to span variation. Both early-stage and mature reporters are deliberately included, which strengthens the maximum-variation rationale underlying the sample [108; 110; 24].

Industry-concentration bias. Kazakhstan's corporate sector is shaped by extractive industries, which would over-represent extractive logics if industry inclusion followed economic weight alone. To mitigate this, the sample deliberately includes banking (Halyk Bank, Bank CenterCredit), fintech and e-commerce (Kaspi), transportation, and construction alongside oil & gas (KazMunayGas, KPO), uranium (Kazatomprom), and copper mining (KAZ Minerals, Eurasian Resources Group). The cross-sector heterogeneity is a constitutive design feature.

Language-availability bias. The analytic protocol focused on publicly available reports in English. This restriction is a frame-defining decision that supports comparability across cases and across studies, and that is consistent with the reach of major Kazakh firms whose stakeholder communication is internationally oriented. The restriction is acknowledged transparently, and its transferability consequences for smaller, domestic-only Kazakh firms are addressed in the limitations discussion.

A common concern with corporate sustainability reports is that organizations disclose what looks favorable and omit what does not. Within the present design, selective disclosure forms part of the research object. Study II analyzes how Kazakh organizations *publicly articulate* sustainability capabilities; the level of inference is the organizational self-description, not the underlying practice [102; 14; 15; 16; 25]. The analysis and limitations discussion make the interpretive consequences explicit. Reports alone cannot confirm practice. Report-based patterns must be read as patterns of articulation. The dissertation therefore neither treats reports as transparent windows on practice nor dismisses them as window-dressing. It treats them as the empirical surface of organizational self-description, which is precisely what an analytic generalization to capability articulation requires.

Analytical framework

According established methodologies [25; 101], a deductive-inductive coding approach was implemented. The hybrid approach applies predetermined codes from theory or prior research. It also allows new codes to emerge inductively from the data [101]. The analysis began with a coding frame organized around the Packed Business Capabilities architecture, developed from the interview-based study and refined through prior empirical work. Social Systems Theory guided attention to selective articulation, routinization, and organizational self-description. The operational codes

were capability-based. They were not taken directly from SST [101; 102; 14; 15; 16; 25]. This provided theoretical guidance and content expectations for the coding process, where existing theory and knowledge shape the coding scheme [101]. In Mayring's terms, a coding frame was formulated a priori (deductive category assignment), including definitions and examples for each category, to ensure consistency in how text segments would be interpreted. At the same time, the coding process was open to novel insights: new themes were inductively identified to expand or refine the categories accordingly. This flexible refinement aligns with the idea that analytical constructs in content analysis can stem from multiple sources such as existing theory, expert knowledge, and emergent data patterns [102]. Iterating between the theoretical framework and the empirical content of the reports ensured that the final coding scheme was both conceptually grounded and empirically sensitive.

A custom coding scheme was developed to operationalize the analysis. It covers the key dimensions of sustainability content to be evaluated and consists of several main categories, each broken down into more specific subcategories with an associated coding scale or assessment criteria. The categories were derived from the theories and the research questions on how companies construct their sustainability narratives and were refined based on initial readings of the reports. The self-developed coding scheme was documented in an Excel file, which served as a codebook and data collection guide. Appendix H – Coding Scheme Overview summarizes each category, its subcomponents, and the coding scale used.

Each category in the actual codebook included a definition and detailed coding instructions. For instance, Strategy with its sub-category "Strategic Management" was coded 3 (detailed, strategic, and integrated) only if the report clearly described a sustainability strategy integrated into business goals or mentioned board-level responsibility, 2 if the strategy was described with examples, 1 if it was only mentioned, and 0 if it was not mentioned (Table 52). This coding scheme captured systematically which topics are covered and in how much detail. Its categories are capability-based and derived from the interview-based study, with Social Systems Theory as interpretive orientation, and are therefore grounded in real-world observations and not solely in abstract concepts.

Coding Process and reliability

All sustainability reports were coded manually by the researcher using Microsoft Excel as the coding platform. Excel was chosen for its flexibility in organizing qualitative data in a tabular format. For each company report, a coding worksheet was created with rows corresponding to text segments or sections of the report and columns for each category in the coding scheme. The coder would read the report in detail, segment it (for example, by paragraph or section) and then assign codes in the Excel sheet by marking the presence of relevant content, rating the level, and noting illustrative evidence or excerpts. Using Excel's filtering and sorting functions, it was easy to aggregate coded data for analysis (e.g. to compare all companies on a particular subcategory). To maintain methodological rigour, the coding followed a clear procedure, and several measures were taken to ensure reliability and validity.

First, a coding protocol was established in advance, outlining each step of the process and the rules for applying codes. The importance of a rule-bound, systematic approach as advocated in content analysis literature was observed throughout [25]. For example, the "unit of coding" was defined in advance (here, a meaningful text passage, often a paragraph or section dealing with a single theme). This unitizing was kept consistent so that codes would be applied to comparable chunks of text across all reports. The sequence of coding was also standardized as first an initial read-through for familiarization was done, then a second pass for applying the deductive codes, then subsequent passes to refine codes or add inductive insights.

Second, before full-scale coding, a pilot test was conducted. Two sustainability reports (from companies outside the main sample) were coded to trial the scheme. This pilot helped clarify category definitions and revealed any ambiguities or overlap between codes. Adjustments were made to the codebook (Excel) for instance, refining the wording of what constitutes "detailed" vs. "basic" disclosure in certain categories. This step increased the *face validity* of the coding scheme, ensuring that codes would consistently capture the intended phenomena. It also familiarized the researcher with using the scheme, effectively serving as training to improve consistency.

Third, although a single coder performed the coding for all reports due to resource constraints, reliability was addressed through repeated coding and peer debriefing. The researcher performed an initial coding of all documents and then, after some time, re-coded a subset of reports to check for consistency (intra-coder reliability). Discrepancies were examined to identify whether any coding rules needed further clarification. In addition, portions of coded data were reviewed by an academic peer familiar with qualitative methods. The peer was given the codebook and asked to independently code a small sample of passages, whose coding was then compared to the researcher's. Where differences arose, the interpretation was discussed until consensus was reached, which led to minor refinements of the code definitions. This peer exercise preceded the formal reliability check reported below, which was conducted with the same second coder on the stratified 29-passage subsample.

An intercoder reliability check was conducted to assess whether the final coding scheme could be applied consistently beyond the primary coder. A subsample of 29 coded text passages, representing approximately 15 percent of the Study II coding material, was selected for independent recoding. The subsample was constructed as a stratified sample across five companies (KAZ Minerals, KazMunayGas, Air Astana, Samruk-Energy, and BI Group) and all four Packed Business Capability domains, Strategy, People, Process, and Technology, and it included both deductively and inductively derived passages. The second coder received the final codebook, domain definitions, sub-capability definitions, coding examples, and decision rules.

The second coder assigned codes independently and without access to the primary coder's coding decisions. After both coding sets were completed, intercoder reliability was calculated using Krippendorff's alpha for nominal data. This coefficient was selected because it is suitable for content-analysis reliability assessment and can be applied to categorical coding data. The calculation was based on the unreconciled coding decisions in order to avoid overstating reliability.

The resulting reliability coefficient for Krippendorff's alpha was 0.818.

The simple percentage agreement was 86.2 percent, with 25 of the 29 passages coded identically by both coders. The result is interpreted as satisfactory, since the coefficient exceeds the 0.800 threshold conventionally applied in content-analysis research. The four disagreements were subsequently reviewed. Three of the four concentrated at the Technology domain boundary, specifically in passages where a technological system supported an operational process, such as automated emission monitoring at combined cycle gas turbine projects, or expressed a strategic investment decision, such as investment in more fuel-efficient aircraft. The remaining disagreement concerned the boundary between Strategy and Process. These disagreements did not reflect random inconsistency, and the interpretive question of whether a passage should be coded according to its technological form or according to the process or strategic function that it serves. In response, the decision rules governing the Technology boundary were clarified, in particular the rule that a passage is coded as Technology only where a digital or automated system, data platform, or monitoring technology is the central object of the statement, and the rule that passages naming both a process and an enabling technology are coded according to their primary emphasis. The reconciled coding was then used for the final analysis. This procedure strengthens the transparency and reliability of Study II. It also remains consistent with the dissertation's interpretive and abductive research design.

Table 51 – Intercoder Reliability Check Overview Results

Element	**Description**
Material checked	29 coded text passages from Study II
Share of coded material	Approximately 15 percent
Companies covered	Five (KAZ Minerals, KazMunayGas, Air Astana, Samruk-Energy, BI Group)
Coding level	PBC domain level
Coding categories	Strategy, People, Process, Technology
Reliability coefficient	Krippendorff's alpha (nominal, two coders)
Simple percentage agreement	86.2 percent (25 of 29 passages)
Result	alpha = 0.818
Interpretation	Satisfactory, exceeds the 0.800 threshold
Reconciliation procedure	Disagreements reviewed after coefficient calculation, concentrated at the Technology domain boundary, decision rules clarified
Note – Compiled by the author.	

Fourth, to ensure the analysis remained valid (credible and representative of the data), reflexive practices were employed during coding. The coder kept analytic

memos in Excel alongside the codes, noting context or uncertainties (for example, “Company X mentions a target but in a vague way. Coded as 1 not 2”). This helped maintain transparency in how difficult judgment calls were made. Moreover, the coding scheme itself was grounded in existing theory and prior empirical insights, which supports content validity (the categories cover the relevant facets of sustainability communication as suggested by literature and expert input). Where possible, results from the coding (e.g. emerging patterns) were compared with external information or expectations; for instance, if a company known for poor environmental incidents had a very upbeat report, this was noted as a form of triangulation to guard against taking the report content at face value. This reflective stance helped ensure that the qualitative inferences truly stemmed from the data and not from preconceptions.

After completion of coding for all reports, the coded data were analyzed by looking across cases and categories to identify prominent themes, differences, and similarities. The structured Excel data allowed us to sort or group information (for example, to see all instances of stakeholder engagement practices, or to compile the transparency scores for each company). These were then synthesized into the findings. The coding and analysis process is summarized in the following scheme below, which outlines the step-by-step flow from data collection to interpretation.

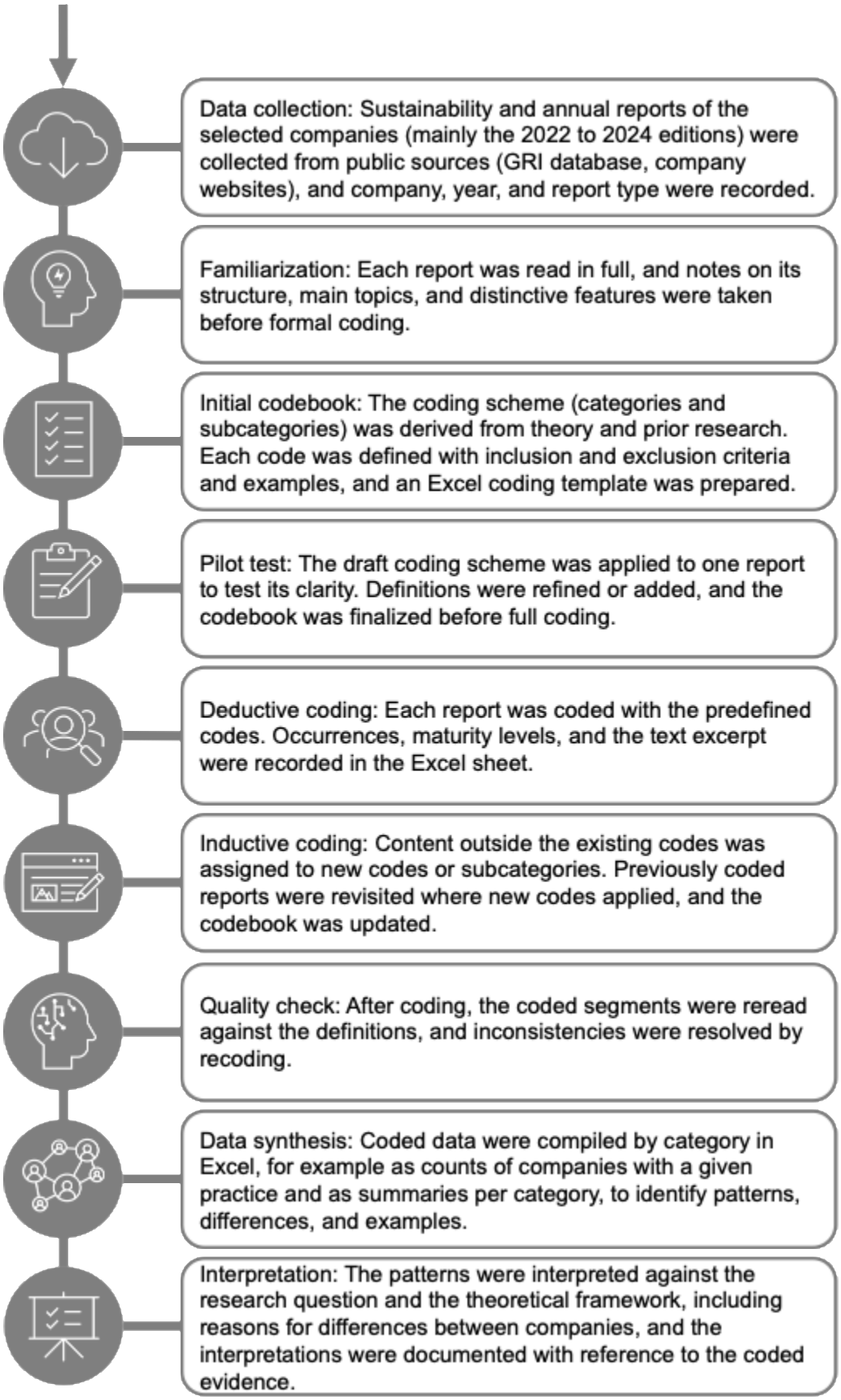


Figure 8 – Coding and analysis process

Note – Compiled by the author.

Through this process, qualitative content analysis enabled a methodical and transparent examination of the sustainability reports. The combination of deductive structure and inductive openness ensured that the analysis was guided by prior knowledge yet able to discover new insights from the data. Careful coding and comparison of the reports made it possible to draw conclusions about the management of sustainability in Kazakh companies, with the confidence that these conclusions are supported by a systematic analysis of the text. Due to the length of the analysis and its results, the detailed information can be retrieved from Appendix P – Within-case analysis: Capability-Building within Kazakh Firms. Only the consolidated results are therefore presented in the discussion and cross-case analysis section of sub-chapter 2.2.

Data sources and evaluation period

The sustainability reports analyzed in this study were collected from publicly accessible sources. All reports used were the official publications released by the companies, in English language only. Using public reports ensured that the data reflects what stakeholders and regulators see, aligning with the interest in external communication. It also means no confidential internal data was involved, meaning the analysis deals solely with information companies have willingly put into the public domain. The analysis focused on reports published in the period 2022-2025. This range was chosen to capture the most recent reporting practices and developments in sustainability disclosure, while covering multiple years for trend observation. The start point of 2022 ensures that the data includes reports influenced by the latest global sustainability frameworks and post-2020 sustainability priorities (e.g. pandemic recovery, renewed climate goals), making the findings up-to-date. The end point covers fiscal year 2024 (inclusive): if a company released a 2024 report (for the 2024 fiscal year, for example), it was included at the time of analysis. In practical terms, most of the collected reports correspond to fiscal or calendar years from 2021 to 2024, and were subsequently published between 2022 and 2025. The historical range was limited to avoid older reports that might reflect now-outdated practices or substantially different business contexts (given the rapidly developing ESG landscape). By using a four-year window, the study balances recency with enough documentary spread to identify whether certain shifts in reporting emphasis or evidence orientation are visible across the available reports, without turning the design into a longitudinal analysis of reporting trajectories.

Each of the 11 companies is represented by at least one report from the evaluation period, and 20 reports were analyzed in total (Table 53). Seven companies contributed two reports, KazMunayGas contributed three, and BI Group, Bank CenterCredit and Samruk-Energy contributed one each. Three companies (Air Astana, KazMunayGas and Kazatomprom) are represented with reports from both 2023 and 2024. Nine reports date from 2023, five from 2024, five from 2022 and one from 2021. This distribution ensured that for each company at least one full report was available and, in many cases, that more than one recent report could be consulted to contextualize the company's public articulation. However, these repeated documents are used primarily to enrich cross-company interpretation. The analysis primarily treats each company as a unit (pooling information from its reports in the period) since the main objective is cross-company comparison and qualitative patterns.

Sustainability reporting in Kazakhstan is a relatively nascent but quickly developing practice, and the 2022-2024 period captures that dynamic. Many companies in emerging markets have been ramping up disclosures in response to global investor expectations and local policy encouragement. By collecting data from this specific timeframe, the study taps into the current state of practice for instance, reflecting any alignment with the latest GRI Standards (updated in 2021), references to the UN Sustainable Development Goals (common in recent reports), or the influence of any new national guidelines on ESG reporting. Focusing on recent reports also means that the information is more comparable across companies. All were reporting under similar global conditions and sustainability discourse (as opposed to comparing one company's 2015 report to another's 2023 report, which would introduce generational differences in reporting norms). The data source strategy and time frame were designed to yield a coherent and contemporaneous set of documents. All data was collected ethically from open sources, and the defined period ensures relevance. The number of reports and their distribution across companies provided a set for analysis, with enough material to perform in-depth qualitative coding while remaining manageable for a deep read of each document.

This appendix documents the research design of Study II, the case selection, the content-analysis procedure with its reliability checks, and the data sources, so that the findings can be traced to the underlying material. The approach combines established methods (e.g. qualitative content analysis techniques from Mayring and Krippendorff) with the specific context of the research (Kazakh companies and Social Systems Theory as a lens) [25; 102]. The availability of more than one report for several firms provides limited temporal contextualization, and not a full basis for longitudinal inference.

APPENDIX H – CODING SCHEME OVERVIEW

The coding scheme operationalizes the dissertation's empirical analysis through capability-based categories. It is therefore the primary coding architecture for cross-case comparison, while Social Systems Theory remains a supporting interpretive lens.

Table 52 – Coding Scheme Overview

Packed Business Capability	**Sub-Capability**	**Guiding Questions (based on RQ)**	**Coding Scale Description (0-3)**
Strategy	Strategic Management	To what extent does the company articulate and integrate a sustainability strategy in its corporate agenda?	0 = Not mentioned, 1 = Mentioned, 2 = Described with examples, 3 = Detailed, strategic and integrated
People	Organizational Structure & Staff	How is sustainability embedded structurally (e.g., units, roles, responsibilities) within the organization?	0 = No structural evidence, 1 = Partial mention, 2 = Clear structure, 3 = Fully embedded organization-wide
People	Employee Empowerment	How are employees enabled and motivated to support sustainability efforts?	0 = No activities, 1 = Basic awareness, 2 = Training and incentives, 3 = Systematic empowerment programs
People	Communication	How is sustainability communicated internally and externally, and how are stakeholders engaged?	0 = No communication, 1 = Internal only, 2 = Internal + external, 3 = Strategic stakeholder engagement
Process	Process Innovation & Adaptation	How has the organization modified its core processes to address sustainability-related complexity?	0 = No process change, 1 = Ad hoc initiatives, 2 = Ongoing improvements, 3 = Systematic transformation
Process	Supply Chain Sustainability	What practices are implemented to ensure sustainability along the supply chain?	0 = Not addressed, 1 = Vague mentions, 2 = Practices described, 3 = Audits and standards implemented
Process	Risk Management	How does the organization identify, assess,	0 = No mention, 1 = Acknowledged, 2 =

		and mitigate sustainability-related risks?	Procedures in place, 3 = Systematic enterprise risk management
Process	Product Innovation & Adaptation	To what extent are products or services adapted to address sustainability needs or reduce impact?	0 = No mention, 1 = Conceptual only, 2 = Products adapted, 3 = Marketed innovations for sustainability
Process	Social Responsibility	What role does social engagement play in the organization's sustainability efforts?	0 = Not covered, 1 = Basic donations, 2 = CSR programs, 3 = Strategic community partnerships
Process	Continuous Improvement	What procedures exist for iterative sustainability improvement (e.g., reviews, KPIs)?	0 = No review, 1 = Informal learning, 2 = Regular KPIs, 3 = Embedded continuous improvement loop
Process	Innovation for Sustainability	How is innovation specifically directed toward addressing sustainability-related complexity?	0 = Not addressed, 1 = Sporadic projects, 2 = Sustainability-driven innovation, 3 = Dedicated innovation strategy
Technology	Data Management and Reporting	How is sustainability data managed, reported, and aligned with global standards (e.g., GRI)?	0 = No reporting, 1 = Unstructured, 2 = Structured & standard-aligned, 3 = Verified, detailed disclosures
Technology	Technology Adoption	What technologies are adopted to facilitate sustainability transformations?	0 = Not used, 1 = General tools, 2 = Sustainability-specific tools, 3 = Integrated digital solutions
Note – Compiled by the author.			

APPENDIX I – INTERVIEW GUIDE

Introduction

1. Introduce interviewer and project
2. Introduce interviewee
    a. Position & role in the company
3. Introduce interviewee company
    a. How does the interviewee's company understand sustainability?
        i. On the basis of your definition - how would you assign 100 points to the respective pillars of your definition?
    b. What are the company's overarching sustainability goals?
    c. How long has the company been dealing with sustainability?
        i. Who initiated the topic?
        ii. Who, apart from interviewee, is dealing with the topic?

Environmental and social challenges in the upstream supply chain

1. What are the environmental challenges for the company in the upstream supply chain?
2. What are the social challenges for the company in the upstream supply chain?

Internal management & adaptation

1. How does your company manage the environmental/social challenges internally? What adjustments to internal management have these challenges prompted?
2. What are the challenges of managing environmental/social challenges in the supply chain? Are there differences in the management?

Use of third party (e.g. label usage or cooperation with NGO)

1. Tell me about the most successful/most unsuccessful third party use/collaboration.
    a. When did you decide to use/collaborate with the third party? What was the reason for using the third party?
    b. Can you describe how the use/collaboration has developed and what the current use/collaboration looks like?
    c. What importance does the third party have for the company?

Acknowledgment and ending of the interview

APPENDIX J – CASE PRODUCTION/ RETAIL TEXTILES

Case description

The textile industry has a long history of sustainability-related complexity, as evidenced by major incidents such as the collapse of Rana Plaza. As a result, the industry has gained significant public interest worldwide. In order to address these sustainability challenges, the industry has established sustainability goals that apply to all stakeholders in its supply chain. Given the length and fragmentation of the supply chain, research was conducted with a diverse range of organizations, including small, medium and large businesses, as well as multinational corporations. Furthermore, the organizations vary in their position within the supply chain. Some have a direct connection to end customers, while others operate as producers and retailers in a business-to-business context. Due to their customer-facing operations and size, some of these organizations are well-known internationally for their premium products. Smaller organizations, however, are at least well-known in the German textile market. A total of nine interviews were conducted with five different organizations [53].

Packed business capability & business capabilities elaboration

On the strategy level of the packed business capability, the evidence indicates that organizations build the business capability of "Strategy Capability" with very low levels of maturity. This may be because for "Retail" companies, the issue might not be as strategically relevant, given that their primary role is selling products. In contrast, "Production" companies need to address sustainability more strategically due to its direct impact on their responsibilities and market expectations, and this strategic relevance can also be influenced by the motivation and size of the organizations, such as the family-owned nature of "Production/retail textiles" companies. The General Manager of For-profit 6 describes this as:

> *It's also a strategic decision that we make on the basis of our strategy meetings, which we have, ok we`ll do it properly. We don't do it halfway. That's not for us.*

At the level of People as packed business capability, the evidence indicates that organizations build various capabilities. First, organizations build the business capability of "Organizational Structure & Staff" with a pronounced development of this capability. For instance, "Retail textile" tends to rely on a dedicated Sustainability Department, while "Production/retail textile" employs a decentralized Sustainability Function. This approach can be explained by the size of the organizations. Larger companies often require more central control. Conversely, the "Production/retail textile" case is smaller and has sustainability deeply embedded in its company history and philosophy. Nevertheless, "Production/retail textile" uses a variety of business capabilities to adapt organizational structure and staff to sustainability needs. The Director Global Sustainability of For-profit 4 puts it as follows:

> *And I believe that the two together were the driving forces that led to the gradual systematization of the topic, the creation of a separate organizational unit, and so on. […] Yes, today we have an overall sustainability division that is*

almost 30 people strong, including all the teams. If you go back 10 years, the division didn't even exist then.

Second, organizations build the business capability of "Employee Empowerment," although at a low level of maturity. The interviews mention first training measures and management support to enhance employee skills and confidence, empowering them to contribute more effectively. The Team Leader Corporate Responsibility of For-profit 9 describes this as:

Much more in terms of social standards. This means that training will also take place here. We have already started with fiber training. But that's still a long way to go in order to impart this knowledge at all. And to get people on the same level.

Third, organizations build the business capability of "Communication," but it is often relatively low in maturity. A possible reason for this is that with high integration of functions, the exchange between them tends to increase. Especially when functions work closely together, exchanges often occur with minimal coordination effort, leading to less emphasis on formal communication as a distinct capability.

The Head of Sustainability of For-profit 3 explains:

And of course that always means that employees here in the company have to be trained, have to know how to use these tools and so on, we have talked about sustainability at staff meetings, that always takes up a lot of space, we have talked about sustainability in our staff magazine and do so regularly when there are things that are important for the company that need to be communicated.

At the level of the packed business capability Process, different capabilities are built up. The organizations build the business capability of "supply chain sustainability" by focusing on developing suppliers and building strong relationships with them. The focus is clearly on establishing relationships with suppliers, whether through relationship-building or by "controlling" interactions via a Supplier Management System, which includes development and onboarding processes. The Manager Supplier Management & Sustainability of For-profit 2 puts it as follows:

In our company, we have organized it in such a way that we have the production sites disclosed to us via a supplier management system. This means that we are one step further along the supply chain than we actually negotiate, let's say. And, of course, these production facilities must first of all be scrutinized on the basis of their regionality, particularly because they are in Asian countries, to see to what extent they meet sustainability requirements.

Additionally, organizations build the business capability of "Risk Management", which they use intensively across their operations. They focus on integrating a supplier management system and an internal management system, both supported by detailed guidelines to effectively manage and mitigate risks. The General Manager of For-profit 6 describes this as:

And we have actually included these five or six points that (...) from the, I think it's the International Organization for Human Rights or something like

that, and we have presented them to each of our suppliers, each of our manufacturers, so that they have to sign them. This means that at least once they have seen in English what we demand and what we consider important and that they comply with it.

This can also be highlighted by the Head of Sustainability of For-profit 3 who explains:

Yes, we have always carried out risk analyses of all business partners who supply us.

But organizations also build the business capability of "Process Innovation & Adaptation" through significant process adjustments. This is particularly evident in their business capability within the sourcing process, where they implement high levels of adaptation. Additionally, the integration and merging of functions (cross-functions) are visible, highlighting their commitment to innovation. Especially the exchange (networking) between functions emerges as a key driver of process innovation, facilitating more dynamic and adaptive processes. The Manager Supplier Management & Sustainability of For-profit 2 describes this as:

> But of course, the prominence of the topic itself has increased the variety of tasks somewhat in any case. I would now give a qualified yes to the networking with other departments, or rather the stronger networking. Because in the end, it was designed from the outset in such a way that a high proportion of networking with other departments was necessary for this position. It was simply a matter of responding to enquiries from whatever angle. Still, Purchasing is always the main player, let's say. Because they have the most direct access to the customer., and, in customer management or in sales, which of course also have queries. Of course, if they have a campaign in-house or a customer approaches them and asks questions, or we sometimes create a handout or an info letter to give the sales staff something to ask questions about. Of course, the dialogue has become a bit bigger in general.

However, organizations build the business capability of "Technology Adoption" by responding with tool adjustments to meet sustainability challenges. These adaptations help integrate new technologies and processes into their existing systems, enhancing their capability. The Team Leader Corporate Responsibility of For-profit 9 puts it as follows:

> *When I look at the business process management side now, there have been massive changes. Especially in product development, of course. And in purchasing. So, if you look at Design for Secularity. That's definitely something we're aiming for in the future. Because, of course, it could make our entire supply chain cleaner in environmental terms. Creating transparency alone was also a very big change in business process management.*

On the level of technology as the packed business capability, the evidence indicates that organizations are focusing on the two business capabilities “Data Management and Reporting” and “Technology Adoption”. Organizations build the business capability of "Data Management and Reporting," although it often shows a low level of maturity. This low maturity is also evident in the limited adoption of technology,

which hinders the capability's development. However, reporting as a business capability is becoming more pronounced, potentially due to historical events such as the Rana Plaza incident, which emphasized the need for improved reporting practices. The Director Global Sustainability of For-profit 4 explains:

> *And so there are many, many examples of how operational business processes have changed as a result of For-profit 4 growing commitment to sustainability. Right up to the corresponding reports in the company, for example on the fulfilment status of the social audits that we carry out, reports in the operating units, on the status of activities with our suppliers in terms of chemicals management and so on and so forth. […] Until then, for example, new systems will have to be introduced in order to manage and report on the key figures and KPIs in the area of CR.*

The business capability of "Technology Adoption" reappears at this level: organizations again respond with tool adjustments that integrate new technologies into their existing systems. The Team Leader Corporate Responsibility of For-profit 9 describes this as:

> *There was-. Our ERP system had to be adapted. It is still being adapted because we have to enter more information, of course. The purchasers have to write other information on their purchasing orders. They have to continuously check the supply chain to see whether production is actually taking place somewhere. Whether a certain dyeing unit is actually being used. So there are a lot of operational processes that have to be handled differently here.*

APPENDIX K – CASE RETAIL FOOD/ NON-FOOD

Case description

The retail food and non-food sectors are among the largest and most significant industries in Germany. In addition to sourcing and selling German-grown food, the German market is reliant on a significant volume of imported food and non-food items. This characteristic has been maintained in this case. Two of the organizations are among the large food and non-food retailers in Germany, selling a wide range of products including fruits, wheat products, textiles and household items. The remaining organizations include a small coffee retailer and further food and non-food retailers. The industry has a direct relationship with end customers, which makes sustainability, complexity and awareness a significant issue. Customers increasingly not just rate retailers on their sustainability activities but also specifically buy sustainable products. To gain a complete overview of the industry, a set of interviews with organizations ranging from small to large were conducted. In total, six interviews with five different organizations were conducted, which provides a high level of contrast for analysis [53].

Packed business capability & business capabilities elaboration

On the strategy level of the packed business capability, the research showed that, due to their size, many companies have built up sub-business capabilities in the area of strategy in order to better achieve their sustainability goals. However, the 'Trade Coffee' case is too small to develop specific strategic business capabilities, especially as sustainability is already intrinsically anchored in the business model. This explains why the strategic characteristics of smaller companies such as 'Trade Coffee' are less formally developed. The Lead Manager Sustainability of For-profit 15 describes this as:

> *At the same time, we continue to push the issue forward and say: OK, if we are serious about climate change, if we are serious about becoming a sustainable destination, then the next step would be to turn 20% recycled plastic into 50% plastic. And then there are internal CEO meetings about the next quarter, where sustainability targets are set and so on. In other words, there is always this strategic component, which is more target-driven. We have to do that by the end of the year. Then there is the day-to-day component, i.e. a part of the business where we are more of a kind of supervisory body. And as a specialist department, we have the on-the-ground component, i.e. we also have people who set up on-the-ground projects. And what's really nice now is that sustainability is also a core component of the overall For-profit 15 strategy, which means that the management also deals with the topic itself and uses us more as a kind of sparring partner and discusses topics with us. Of course, they still make their own decisions.*

On the People level of the packed business capability the research showed that the 'Trade Coffee' sub-case lacks the organizational size to have its own department, which limits the development of the 'Organizational Structure & Staff' business capability. In contrast, 'Retail Food' companies use various sub-business capabilities to spread adaptation and react more flexibly to changes. The reason for this could be that

these companies have a broader portfolio and therefore require a more versatile organizational structure. The Head of Corporate Responsibility of For-profit 24 describes this as:

> *Of course, from our side we offer a framework for what this should look like in the best case scenario. But countries also work differently. So, in some countries it's more the quality assurance department. And in some other countries, it is more the purchasing department that is in charge. In other countries, it's done completely differently.*

The Head of CSR of For-profit 10 puts it as follows:

> *We have also set up an advisory board, which consists of the managing director, [an environmental NGO], [a representative of a consumer initiative] and another scientist on the subject of permaculture, who will bring the topic into their circles and advise us on how to bring it to the customer.*

In addition, in the research, it was found that employee empowerment is also highly relevant as a business capability in managing sustainability-related complexity. The organizations focus on training and management support to ensure that employees are well-equipped to contribute to sustainability initiatives. However, it seems that firms are more relying on spreading on different sub-business capabilities, potentially because they are quite large with very different employees, requiring a more decentralized approach to empowerment. The Lead Manager Sustainability of For-profit 15 explains:

> *And we are now gradually expanding the capacities of the individual departments so that they are able to act accordingly themselves. And what we have now started this year is to train all employees to become sustainability ambassadors. We have trained [several hundred] employees, because we believe that the topic must be everywhere and be present everywhere, because only then will it be carried out with full force and incorporated into decisions.*

The Head of CSR of For-profit 10 puts it as follows:

> *So when I started and then came round the corner with the topic of sustainability, many departments were more like: Well, what kind of topic is that? And do we need it now? And, oh, it's certainly a trendy topic. And we already had the goal, I've already said that - to take these departments with us. So even if the secretary orders pencils, she should think about it: which is the sustainable option? For example, I would say that she then orders the FSC pencil. And that's how it should get into everyone's heads, and processes have already been set up that are now part of everyday working life.*

By contrast, the research showed that communication is relatively underdeveloped, which may reflect limited recognition of communication as a capability. However, it can also be found in the integration of functions, as the closer the functions work together, the more intensive the exchange. Where functions work together closely, exchange often takes place without much formal coordination, which may be why communication is mentioned less explicitly for a formally developed communication capability. The Head of CSR of For-profit 10 describes this as:

But it was already clear that it was an important topic, that they had thought about it, that they called me and said: I've got something, have a look at it. Is that sustainable at all or is it just greenwashing? […] I: Perhaps another question: is it the location process that you tend to approach the departments? Or is it the other way round, that the departments tend to approach you? Head of CSR: I would say both. So maybe 60:40, me 60, the 40,

On the Process level of the packed business capability, the organizations showed a relatively low level of sub-business capabilities in supply chain sustainability. Presumably, 'trade/retail' is more of an intermediary and less in direct contact with suppliers, which makes direct control over sustainable practices in the supply chain more difficult. This could explain why the development of specific capabilities in this area is less pronounced. The Head of Corporate Responsibility of For-profit 24 describes this as:

What is much more difficult is to work into the inventory, so to speak. In other words, the suppliers that have always delivered or the products that have always been running. In other words, changeover phases are always necessary. Yes, but basically, so to speak, when we talk about the supply chain or products and, yes, commodities at this point, this tool, Requirement Profile, is actually one of the main tools we can work with.

The organizations in the research showed that risk management is a heavily used business capability, particularly as a supplier management system and internal management system with policies in place. Coffee companies, however, do not use this, which could indicate that these companies have a local presence and are therefore less reliant on formal risk management systems. This direct contact could enable them to manage risks differently. The Head of CSR of For-profit 10 explains:

No. So when an issue comes up, whether it's ecological or social, it's managed in the same way.

The research also showed that the organizations exhibit a high degree of process adaptation, particularly regarding sub-business capabilities in the sourcing process. However, the integration of functions (cross-functions) can also be observed, which enables flexible and agile adaptation of processes. Particularly in the case of 'Retail Food & Retail Food/Non-Food', a high level of integration appears to be necessary, which is driven by market and customer requirements and then works 'backwards' through the organization. The Head of CSR of For-profit 10 explains:

Yes, so when I have a topic, I approach the departments and present it to them. Then I also have suggestions on how to tackle it and then I look at how it can be implemented and then I bring it to the management and say: 'So and so, this is what we want to do. […] I would say both. So maybe 60:40, I'd say 60, the 40, because they are also required to achieve this 100% at some point, i.e. by 2030. And so they already have this goal and this task of establishing sustainable product ranges or topics, i.e. packaging, as it is now - you don't make any sales with that, but each area has its own tasks, yes. Exactly.

The Lead Manager Sustainability of For-profit 15 describes this as:

However, we have now reached the point at For-profit 15 where we have extremely close working groups in the individual product development departments, such as product procurement. So although we are a centralized/ we are a kind of central staff unit, it is integrated everywhere in the relevant interfaces and we are now gradually expanding the capacities of the individual departments so that they are able to act accordingly themselves.

On the Technology level of the packed business capability, the research showed that the organizations in the area of data management and reporting had a low level of sub-business capability. This is also reflected in the Technology Adaptation, which is low to non-existent and therefore limits the ability to effectively manage and report data. This low level could hinder the development of data management systems. The Head of CSR of For-profit 10 puts it as follows:

And there are monthly reports where we look at where we stand with our sustainable product range.

APPENDIX L – CASE PRODUCTION FOOD

Case description

In comparison to the retail food and non-food industry, there is a relatively small number of German-owned food businesses in terms of revenue volume. However, the German market includes a number of internationally operating and selling organizations. As a result, these organizations are of interest to businesses operating internationally and in Germany alike. In this case study, the sampling attempted to mirror the market structure and interest in sustainability-related complexity. Three interviews were conducted with two different organizations. One of these organizations is a food producer with international sales, while the other is one of a small group of ingredient providers. In this case, the focus was on the publicly known organizations and their position in the supply chain [53].

Packed business capability & business capabilities elaboration

In the research, it was found that organizations have built Sub-Business Capabilities to develop their Strategy Capability. This approach follows the argument that sustainability and securing raw materials are essential for the business and its survival, necessitating a strategic focus on these areas. By embedding these capabilities, organizations aim to ensure long-term resilience and competitiveness in their operations. The Manager Corporate Sustainability of For-profit 13 describes this as:

> *What we have done recently is to define what we consider to be strategic raw materials, strategically relevant raw materials, on which we are focusing our commitment. We have selected these in recent years and because you can't get a grip on all supply chains by simply encouraging suppliers to operate more sustainably, we are pursuing this strategic goal of backward integration, i.e. we want strategically important raw materials wherever possible, we want to have more power in the supply chain, which simply means shortening the distances to the growers. […] And what we are doing there, by showing them, people, in your forest, there are some really great species growing there, different types of nuts that can be used wonderfully in the cosmetics industry, we have tried, together with our local partners, and that is not just [a development agency] and [a large natural-cosmetics manufacturer], we are simply trying to give the forest or the Nontimber Forest Products in the forest an economic value and are doing this quite successfully, so that the farmers realise that leaving trees standing is more economically profitable than cutting them down. Yes? So it's more or less about valorizing ecosystems. Again, in order to be able to obtain these raw materials in the long term.*

On the People level of the packed business capability, the research shows that communication is relatively underdeveloped as a distinct business capability within organizations. Therefore, no fitting quote could be provided. However, it can be found within the integration of functions, as closer functions tend to facilitate more frequent exchanges. Particularly when functions work closely together, frequent exchanges occur with less need for formal coordination, which can result in the lower prominence of communication as a separate capability.

On the Process level of the packed business capability, it was found that Supply Chain Sustainability has relatively dispersed sub-business capabilities, indicating that specific sustainability practices are not always widely implemented. For "Production Food," this can be attributed to having their own plantations, resulting in a self-contained supply chain that facilitates internal sustainability measures. In contrast, "Production Ingredients" can source substitutes globally and thus engage in "multi-sourcing," which requires a broader and more diverse approach to supply chain security and sustainability. The Manager Work Safety & Sustainability Management of For-profit 11 puts it as follows:

> *This means that we already purchase more or less almost [several thousand] tons of cocoa from [a Central American country] from cooperatives. That's around [several thousand] farmers who are organized in cooperatives. We will receive [a substantial share] of the cocoa beans from [our own sourcing project] when it is at full capacity. […] And the remaining [share] will come from [another region], where we work with cooperatives. I think we now have five cooperatives where we basically generate direct procurement. In other words, to keep the supply chain as short as possible. To cut out the middlemen. In principle, to cut out the stock exchange. And to say that we still pay the farmers good money, not too much money for the cocoa. So that works extremely well. We currently have [about half] direct procurement and will increase this to [full direct procurement] through these partnerships. So we can say that we know what is happening in the supply chain. There are minor exceptions, such as shipping.*

Additionally, the Manager Corporate Sustainability of For-profit 13 describes this as:

> *Let me put it this way, of course there are differences, but ultimately it is managed within the same framework. We have a sustainability agenda that supports and complements our sustainability strategy. Derived from this, we have various policies and processes and so on, which are also processed and managed as part of our integrated management system. And that sounds a bit tautological now. So, when I come to the management of environmental challenges - or no, it's actually the same thing in both cases. Where we need to focus and place an emphasis is on the supply chain, supplier management, yes. […] That is why we have various tools and processes that we use to evaluate, measure and analyze the sustainability performance or sustainability aspects of suppliers and then, if necessary, initiate follow-up measures if we find that things are not working as we would like them to.*

Risk Management is frequently identified in the interview material. Respondents describe supplier assessment procedures, internal management systems and guidelines intended to address sustainability-related risks. These accounts document reported procedures, but do not measure their effectiveness in reducing uncertainty or mitigating risks. The Manager Work Safety & Sustainability Management of For-profit 11 describes these procedures as follows:

That's not many, it's four or five. And with the smallest quantities, i.e. seasonal quantities, where they can't analyze for so long, because by the time the analysis is done, the product is already off the market. And seasonal products have-. We have now developed a checklist for the suppliers and say hey supplier you have to take care of it. Please answer the checklist. Give us some feedback on the status of the raw material. […] Yes, actually yes, but the fact is that when we look at these main raw materials, we naturally have clear guidelines. But otherwise, of course, we have corresponding papers where we say we want to procure certain things somehow. It ranges from raw materials to technical aids.

APPENDIX M – CASE PRODUCTION BEVERAGES

Case description

The beverage industry is of significant interest in Germany, where the beer market is both diverse and high-volume. Furthermore, the German market is home to several prominent non-alcoholic beverage companies. These German market specifics are reflected in the present case. The beverages industry is of particular interest as the sourced ingredients are either sourced internationally or even pre-produced at their source of origin. This places sustainability-related complexity both internationally and in Germany on the public agenda. Furthermore, the subsequent processing is highly energy-intensive (for example, in relation to cooling and heating processes) and the logistics of the goods represent a significant sustainability challenge. To gain further insight, three interviews were conducted with representatives of three prominent German organizations [53].

Packed business capability & business capabilities elaboration

On the Strategy level of the packed business capability, it was observed that the Strategy Capability has a lower degree of development within organizations. However, it is evident that there is a strategic focus, particularly on raw materials, securing sustainable sourcing. This strategic focus also extends to production, emphasizing the importance of aligning production processes with sustainability goals. The Manager Sustainability of For-profit 8 explains:

> *Yes, it's true, it's often said that what you do that goes beyond your core business would simply be a huge financial burden. We see it differently. We have created a product that is positioned in an area, in the organic sector, with a rather high sales price. That has to be said quite clearly. So our products are higher priced. But they are still bought. So we are [among the leading companies in our market segment]. […] But we are actually bought, even though we have a rather high sales price. And this is due to the work of departments such as sustainability management. Customers are quite prepared to pay this price, which is ultimately our only real source of income, if we do what we do authentically. And* For-profit 8 *has been doing that for many years. When the producer organization was founded [several decades ago], there was no sustainability management. These were actually decisions made by the top management, the boss, who actively and independently approached the farmers and created this connection. Once he realized that there was actually a lot of work behind it, it developed bit by bit with personnel development. But I have to say that what we do is often already covered by our salary. So this co-operation with the association.*

On the People level of the packed business capability, the research shows that organizations tend to rely on a Sustainability Department as a central unit for managing sustainability-related complexity. This approach is likely because the business has historically addressed these challenges, reducing the need for further adjustments. On the other hand, given the sensitivity of the topic, it is often managed centrally to ensure

effective oversight. For the "Production/Retail Beverages" case, however, sustainability is still relatively new, leading to a starting point with a "central focus" to establish and integrate this capability. The Head of Sustainability & Safety of For-profit 18 describes this as:

> *Yes, of course. Of course. Firstly, we have created a position, or the company has created a position, to deal with this topic, there is a sustainability team, which is relatively large, that didn't exist before. We have 16 people in the company who have been trained and educated externally as sustainability managers to lay a foundation so that colleagues know, okay, what does sustainability actually mean, what are the challenges to be solved?*

In parallel, the Manager CSR of For-profit 16 puts it as follows:

> *Exactly, so I approach the individual colleagues as required, meetings only took place as part of the / these workshops, but that's not weekly either, it was maybe once a quarter or once every six months and no, otherwise / I had just presented the stakeholder survey in the individual plants, because we also wanted to survey employees, of course, and I explained again in principle what I'm doing here and yes, why we would now like to have the opinion of the employees, what the aim of the whole thing is et cetera, but otherwise I just approach my colleagues if necessary.*

Additionally, it was found that employee empowerment is also highly relevant as a business capability within organizations. The primary focus is on training and management support, which are essential for effectively empowering employees. In the case of "Production/Retail Beverages," however, this capability is notably absent, which may be attributed to the novelty of the topic and its central integration, reflecting its relatively new status within the organization's sustainability framework. The Head of Sustainability & Safety of For-profit 18 describes this as:

> *We have 16 people in the company who have been trained and educated externally as sustainability managers in order to lay a foundation so that colleagues know, okay, what does sustainability actually mean, what are the challenges that need to be solved. Because I can tell everyone in the company how sustainability works and I can also train them and help them move forward, but what I can't do is say, 'I-, how does sustainability work in purchasing? What are these specific and special processes in purchasing, how does it work in marketing or sponsoring? And that is precisely why we have trained and educated colleagues there who do not now have one hundred per cent of their working time available on the subject of sustainability,*

Communication was found as relatively underdeveloped as a distinct business capability within organizations. However, it can be found within the integration of functions, where closer functions facilitate more frequent exchanges. Especially when functions work closely together, exchanges often occur with minimal coordination effort, which can lead to the reduced emphasis on communication as a separate capability. The Manager Sustainability of For-profit 8 describes this as:

And we then communicate the whole thing externally via the Brand and Communication department. Some of them then approach the association independently if they have specific questions. So of course I inform the organization about what's going on, where we are, where we might be able to go public or whether we're still a long way off. And if our employees in this area think, yes, that's something we can play, that's something for our social media channels or that interests our customers at trade fairs, then they approach the association independently and ask: What can we do, what are we allowed to do? Or we would like to publicize it in this way, is that okay?

This was also concluded by the Manager CSR of For-profit 16, who explains:

Not anymore, so a few years ago it was different and no, we also have a very good response rate in the survey, so we did an employee satisfaction survey about a year ago and the response rate was lower than in my survey now, but I think the difference is also simply because I went to every plant, stood there and presented it to everyone and the other survey was just a slip of paper with the pay slip and then that's always a different motivation, whether you fill something like that out or not.

On the Process level of the packed business capability, in developing the business capability "Supply Chain Sustainability," organizations focus on developing and building relationships with suppliers. The emphasis is clearly on establishing connections with suppliers, either through direct relationship management or by implementing a Supplier Management System that includes development and onboarding processes. However, the case "Production/Retail Beverages" has significantly fewer sub-business capabilities compared to the "Production Beverages" case. This difference can be attributed to the maturity level of sustainability management. While "Production/Retail Beverages" focuses primarily on internal sub-business capabilities, "Production Beverages" has reached a level of maturity that allows for external expansion and more supply chain sustainability efforts. The Manager Sustainability of For-profit 8 puts it as follows:

Of course, we are very, very spoilt in this respect, as the organic approach has been in place in the beer industry for 30 years. It already existed before management systems for continuous improvement were even implemented here. In other words, direct contact with the farmer, fair and ecological procurement was already established before management systems for continuous improvement in environmental performance and quality had even been implemented. This is of course an excellent starting point for management to develop further.

The Head of Sustainability & Safety of For-profit 18 comes to the same conclusion:

And our philosophy is that if we have suppliers who can't fulfil certain requirements that we have or that other customers of ours have, then my first priority is to say, or my recommendation is to say, because I'm not the buyer, how can we develop you, yes. I don't think it's any good if I have a trusting, good relationship, and have perhaps had one for 20, 25, 30 years, to then put a gun to someone's head and say: 'Okay, if you can't do that, then you're out', I think

it's more about developing the supply chain. That's also more conducive to the topic than if I say: 'Okay, eat or die.'

In the research, it was found that risk management is a highly used business capability within organizations. This is particularly evident in its role as both a supplier management system and an internal management system with guidelines, which helps address and mitigate various risks. The structured approach to risk management ensures oversight and effective risk control across different operational areas. The Head of Sustainability & Safety of For-profit 18 explains:

Internally, of course, we have adapted our feasibility analyses, there is no longer a feasibility analysis in which the issue of sustainability is not integrated, meaning that the issue of sustainability must be considered and evaluated in the same way as the financial aspect and the quality aspect. That doesn't always mean that I take the more sustainable route, because I always have conflicting goals, but I have to analyze it. I need to know what solutions are available in terms of sustainability, and then I can assess whether I want to go down that route or not.

Also, it was found that organizations have implemented significant process adaptations, particularly in Sub-Business Capabilities related to the sourcing of raw materials. This involves optimizing sourcing processes, and integrating and aligning cross-functional teams to enhance overall efficiency. The strong focus on the Sustainability Department in "Production Beverages" indicates its leading role in driving these process innovations and adaptations, positioning it as a central force in the organization's sustainability efforts. The Manager CSR of For-profit 16 explains:

So, my goal is also, once we have decided what we want to report on, which standards from the GRI reporting standards, then of course there has to be a team, then there have to be responsibilities for all the KPIs: Who has to find the information about them? Then a sustainability team will also be formed, and we will also be holding a workshop at the end of November as part of a program, where we want to go through case studies with people: How could you report on this or how can you integrate sustainability into your day-to-day business? Et cetera. So, all I'm going to tell you now is: We're just getting started, we're not doing anything yet. […] So definitely someone from the energy management team, I'm also in this team, but I don't know so much about the technical details that there's someone there, that will probably be the energy manager we have for all three locations, HR is very important, then procurement, sales, marketing, we have here that we have differences between brand business and private label business, so there must also be different people there, production, controlling, because of course there's a lot of data there.

On the Technology level of the packed business capability, the research shows that there is a low development of the business capability "Data Management and Reporting" within organizations. This is also evident in the business capability "Technology Adaptation," where the organization shows only minimal adjustments to tools and systems. The limited adaptation in technology further reflects the challenges in fully

developing solid data management and reporting capabilities. The Manager CSR of For-profit 16 describes this as:

> *So my job is actually to develop the CSR strategy, then later also the sustainability reporting and topics such as, for example, I oversee the organic audits here at the site, the Rainforest Alliance audits and so on, so the position is now a staff position, I am assigned to the Head of Production / Product Development, Purchasing, Quality Management et cetera, as a staff position, it is directly under the management and yes, that is the area that I am in charge of, of course with the support of my colleagues, because I don't know anything about energy consumption at the plant in 2017 or anything like that.*

On the Technology level, the business capability "Data Management and Reporting" remains weakly developed, as does "Technology Adaptation", where the organization shows only minimal adjustments to tools and systems. This bounded adaptation also reflects the difficulty of fully developing robust data management and reporting capabilities. The Manager CSR of For-profit 16 describes this as:

> *The challenge is to implement this in the ERP system, i.e. in the ERP system and IT-technically and yes, to be honest we are not that far advanced because we do not yet have everything electronically mappable or not in such a way that we can now press a button for traceability, but there is still a lot of paper, especially here at the site, there is still a lot of searching in folders and in Excel tables and in records and that is actually the basic prerequisite for all these technologies that this is already there.*

APPENDIX N – CASE PRODUCTION/ RETAIL COSMETICS

Case description

In recent years, the cosmetics industry has become increasingly aware of the need to source ingredients responsibly. Furthermore, customers are becoming increasingly aware of the ingredients used in cosmetics and their effects on the skin, as well as the environmental impact of microplastics and other pollutants. However, given the highly fragmented nature of the market and its vast product portfolio, the interviews focused on large organizations only. It was possible to interview one of the most prominent cosmetics and personal care organizations in the global market. Furthermore, this company is renowned globally for its commitment to sustainability, with a particular focus on the natural ingredients in its products, which benefit consumers, and protect the environment.

Packed business capability & business capabilities elaboration

On the People level of the packed business capability, the organizations built up the business capability 'Organizational Structure & Staff' by making only very minor adjustments to the sub-business capabilities. This can presumably be explained by the fact that the business has already responded to the challenges historically and therefore no longer requires any significant adjustments. The existing structure was already well aligned with the complexities of sustainability, meaning that further changes were hardly necessary. The Creative Buyer (Buyer sustainability) of For-profit 22 puts it as follows:

> *Yes, they work together a lot, of course, but they also work a lot with other departments. We in purchasing work with them a lot because we often have to provide them with data. Conversely, we can also say, how does this and that compare? I always pull examples out of thin air when I say, okay, we could save a few euros if we fly something in from the Far East, but how would the costs be calculated if we say transport from southern Germany versus China or Korea? So you also say, "Okay, can we perhaps include other data?" That the data that is collected there is also made available to other departments. And they then, of course, communicate this to all departments. […] It also depends on what the local markets want. [One country] has the biggest team and the biggest capacity. North America usually has its own team because they are so big. And then there are... We have people here who are very familiar with environmental regulations. [Another country], on the other hand, has other people who specialize in this topic. There is exchange and the local focus is set. Yes, but in principle [the first country] is also responsible for us in Germany, yes.*

In parallel, the organizations built up the business capability 'Employee Empowerment' by focusing more on awareness in order to create an awareness of sustainable practices. This is presumably done so that employees can approach the topics themselves and their own initiative is encouraged. This enables them to continuously develop and actively contribute to the company's sustainability. The Creative Buyer (Buyer sustainability) of For-profit 22 describes this as:

Based on knowledge from other organizations, based on experts that we brought in. And who advised us on it, some of whom joined us, so it's like that, I would say, we accumulated knowledge. And when we then said, okay A, it really is a critical issue and B, we see the possibility that we can really do something about it. That we should focus on it, we then said, okay, let's really put this into an official form, but exactly when and who that was... There are rarely these concrete moments and the name that is then on it, so it is usually really very... there is really a lot going on in our process.

The organizations also built up the business capability 'Communication', although communication was relatively low. However, this can be reflected in the integration of functions, as the closer the functions are to each other, the more intensive the exchange becomes. Particularly when functions work together a lot, exchanges often take place without a great deal of coordination, which means that communication is mentioned less explicitly. The Creative Buyer (Buyer sustainability) of For-profit 22 describes this as:

Oh, there are lots of things, there are newsletters, there are Slack channels, anyone who is interested in the topic can sign up. The shops get all the updates on such topics. There are-. We often have global meetings where the different departments also have presentations. And we say this is important, you should do this and that. There are lots of things, so just like the rest of the company, there are a variety of channels. And you try to reach as many people as possible with this variety of channels, and in such a way that everyone feels addressed. Because then again, oh yes, I don't read emails. I would like it to be snappy in a Slack channel or oh I would like a video presentation. Yes, then go to the website, there you have a video, so yes, the variety of communication in the company is sometimes one of the biggest challenges. Actually for us, but yes, it is there. No, but so concrete that you say: "X, Y." And then there and there and then you find this and that, which-. No, not. Anyone who can contribute something can contribute something. They can... They have channels where everyone can reach everyone, so it's very pluralistic.

On the Process level of the packed business capability, the organization built the business capability "Supply Chain Sustainability" by drawing on very diverse sub-business capabilities, including supplier engagement, sustainable sourcing, lifecycle assessment, and advanced logistics management, to address environmental and social challenges across the supply chain. The Creative Buyer (Buyer sustainability) of For-profit 22 explains:

That's what long-term relationships are for. So that you can really say: "We know what's going on there." And unless you get a concrete risk situation where you say: "Okay, that's fishy, I need to follow up on that." You can really say, okay, it'll stay at that level, but that's easier said for European suppliers. Internationally, in Indonesia, Africa, and South America, we have colleagues who visit suppliers there on a regular basis. Simply because it's project collaboration, which requires more investment, more commitment, and close collaboration. Like with buying investments, for example, long-term suppliers who are

really very important in the regions. They are then regularly visited by colleagues, yes.

The organization also built the business capability "Risk Management", which it uses heavily to manage sustainability-related complexity. It is particularly used as a supplier management system, ensuring that suppliers meet sustainability standards, and as an internal management system with clear guidelines to mitigate risks related to environmental and social issues. These systems help the organization proactively identify and address potential risks, strengthening their sustainability efforts. The Creative Buyer (Buyer sustainability) of For-profit 22 explains:

How often, how much, in what concentration, which of these are critical? And that we can then say specifically, okay, risk, risk, high risk. Let's focus on what we can do better, can we work with the supplier? Can we replace the raw material if that is not possible? So, if there is a lack of transparency, five corners wide open. And we know that these are high-risk pesticides and poor working conditions, we can replace the raw material. So that we really go through all the issues in order to reduce or remove such high-risk areas, problems, yes.

Additionally, the organization built up the business capability 'Process Innovation & Adaptation' by making only very minor adjustments to the sub-business capabilities. This can presumably be explained by the fact that the organization has already responded to the relevant challenges historically and therefore no further significant adjustments are required. The existing processes were already well geared towards innovation and adaptation, meaning that further changes were hardly necessary. The Creative Buyer (Buyer sustainability) of For-profit 22 explains:

Yes, specifically the animal testing policy. In the past, all suppliers were told that we don't want you to do animal testing. And then it happened and then there was the-. At some point they simply said that this is actually-. That's nothing, you can wipe your ass with that, to put it vulgarly. And then they just said straight away that from now on every new supplier has to fill out a declaration that their company is not involved in animal testing, which we specify. So we then have a specific questionnaire, we do not accept the companies' own declarations. The questionnaire is developed further every year, with external auditors who say, dear people, this is a new risk, you have to be careful. And then we say, okay, then add this question or okay, the question. We have also already removed questions because everyone simply said that it is not a problem in this industrial sector, you can just remove it. I have to-. You don't have to, yes, keep a record of it 100 times. So this questionnaire itself is developing further, together with an external organization that advises us and also monitors us, so they do audits for us and our suppliers. That's true, but this onboarding process has changed so that from now on, before a new supplier can deliver anything to us, they have to fill it out and we have to approve it, yes, because it's a very specific request. So we ask the whole company and the standard, especially in the cosmetics sector, is that only the raw material is confirmed as not being tested on animals for cosmetic purposes. And that's why we had to introduce our own independent process, because that was just... This was our understanding,

this was the understanding of the suppliers and the industry. And then you have to say no, okay, we have to get you over here now. Yes, and that was actually specific, that we said I don't know exactly in which year this was introduced. But that was clear before I moved to purchasing and that concerns new and all existing suppliers, they have to complete the questionnaire every year. And then the audit takes place. […] Natural products are subject to this too, and so is our packaging. The pesticide policy is now being introduced, and it will undergo a similar process. That means there will be an annual questionnaire, although it will not be as radically exclusive as the animal testing one. Animal testing, as I said, is an absolute no-go for us. A company really has to commit immediately to never conducting any animal testing again if they want to do business with us without any harm. And with pesticides it is more then that, the questionnaire will analyze the risks and what is it? And then, based on that, minimize risks or see what we can improve, but it will not say, okay, you are now using glyphosate. You will be pilloried and then burned at the stake, you would have to test on animals. I am making bad jokes, that is part of the program.

Besides this, the organization built up the business capability ‘Product Innovation & Adaptation’ by making significant adaptations in only one case. This indicates that it is potentially difficult to find alternatives for existing products that meet sustainability requirements. The limited adaptation shows that product innovations can pose a particular challenge in this context. The Creative Buyer (Buyer sustainability) of For-profit 22 describes this as:

Although I know that this is second hand, especially my colleagues from [another country], including [a member of the founding family], it is very difficult to justify this in any way. And in [year] it was decided that we no longer wanted to use palm oil. Then we stopped ordering palm oil, that was the easy step. And no more palm kernel oil, but I think we still have up to two dozen synthetic raw materials from the chemical industry. Where the suppliers only tell us that these are fatty acids, fatty esters, bases that they buy in bulk from somewhere, which were also bought in bulk on the world market by the manufacturer of the fatty acids, fatty esters, fatty alcohols. Of course you could say that mass balance would be the first way, but for us internally it is really the case that there is the... So the [group] requirement is simply us, for us it is greenwashing and why should we spend more money when all we see at the other end is environmental destruction? That's a bit like the reason we decided to say we want to take it out. We want to find suppliers who work with other fatty acids, fatty esters, fatty alcohols. In other words, we have new raw materials in our range that are based on olive oil in Italy, for example. Coconut is always mentioned very often as an alternative. Are there also options for doing it purely using coconuts? And when you get to that point, you get to a point where you say: "We use a large amount of synthetic raw materials that are based on vegetable fats." And palm oil is simply the most efficient form of oil per hectare. And you are left with the fact that even if you go into the chemical industry and say: "Well, from now on we want it with coconut or we want it with rapeseed." Here in Europe we have

a lot of rapeseed production, why don't we use rapeseed? I mean, sometimes it doesn't fit, the profile doesn't fit. Well, why don't we use oils that don't come from areas where there is active destruction? And then you reach the point where you say: "These oils don't exist, or they come from these regions, or you replace one monoculture with another monoculture." And then I don't know what the solution is. Well, that really is such a challenge, well, globally speaking, it would be easiest if we reduced our global fat requirements. But that's difficult when you see that more and more people are saying, oh, let's increase biodiesel again. Well, Indonesia wants that, I don't know, I'd have to google it. I read once that they want to increase it further, it's a kind of palm... I'm going to be vulgar for a moment, it's a mindfuck, it's-, it's-.

On the Technology level of the packed business capability, the research shows that there is a low development of the business capability "Data Management and Reporting" within organizations. This is also evident in the business capability "Technology Adaptation," where the organization shows only minimal adjustments to tools and systems. The limited adaptation in technology indicates that solid data management and reporting capabilities have not yet been developed. Therefore, no quote for this business capability can be provided.

APPENDIX O – CASE PRODUCTION CLEANSING

Case description

The cleansing industry is also a key focus area, like the cosmetics industry, given the significant environmental impact and potential risks to user health associated with certain ingredients in their products. As a result, it was possible to conduct an interview with a German producer of environmentally friendly cleaning products.

Packed business capability & business capabilities elaboration

On the Strategy level of the packed business capability, organizations did not place a strong focus on developing the "Strategy Capability" within this sub-business capability. This may be due to a lesser emphasis on integrating sustainability into the upstream supply chain, as the focus tends to be more on internal processes and downstream activities. As a result, strategic efforts in this area are more aligned with internal and downstream sustainability goals. Therefore, no quote for this business capability can be provided.

On the People level of the packed business capability, the organizations developed the business capability "Organizational Structure & Staff" with very minimal adjustments to the sub-business capabilities. This is likely explained by the fact that the business had historically already addressed these challenges, making further adjustments unnecessary. The existing organizational structure and staff configurations were already well-aligned with the demands of sustainability, requiring little to no change. The Head of Sustainability and Organizations Management of For-profit 17 puts it as follows:

> *Our department essentially has two different branches that are nevertheless very closely linked. Firstly, everything that has to do with sustainability management, except sustainability communication, is done by corporate communications. All certifications in the field of environmental and energy management are handled by us, [for all our sites]. And the other branch, organizational management, is primarily concerned with organizational development in relation to process and project management. Process management is logical in some ways, because these ISO standards always rely on this process-oriented approach, so it is obvious that we also take the lead in this area in the company.*

The organizations built up the business capability ‘Employee Empowerment’, as employee empowerment is also highly relevant. The focus here is on training and management support in order to strengthen employees in their skills. It appears that companies are increasingly focusing on spreading and promoting this empowerment through various sub-business capabilities. The Head of Sustainability and Organizations Management of For-profit 17 explains:

> *So through various measures and methods, we do a mandatory training course, an online training course for employees once a year on environmental and energy, sustainability topics, which everyone has to complete with control questions at the end. […] We regularly offer events on the topic of sustainability with different focuses. […] So we are very active in this area and we regularly*

have articles in the staff magazine about it, about information monitors. So yes, countless.

Additionally, the organizations developed the business capability "Communication," although it was somewhat underdeveloped. This can be observed in the integration of functions, where closer proximity between functions naturally enhances communication. Particularly when functions work closely together, exchanges often occur with minimal coordination effort, which may explain why communication is less frequently mentioned. Therefore, no quote for this business capability can be provided.

On the Process level of the packed business capability, the organizations developed the business capability "Risk Management," although it exhibited a rather low level of maturity. This, however, can be explained by the downstream-oriented business models and specific sustainability requirements. The lower maturity of risk management reflects the focus on downstream processes and sustainability criteria. The Head of Sustainability and Organizations Management of For-profit 17 puts it as follows:

> *Well, ultimately, we have an integrated management system that we work with. So we have the quality arm, of course, with which we work very closely, and the environment and energy. And we have all kinds of standards and norms and certificates here at the site, these are ISO, i.e. 14001, 9001, 50001 for energy, EMAS, we are proud of that, we have had it for [many] years now. Which is extremely helpful, especially in dealing with ecological challenges. Which is also just like the ISO standards, which means that we are of course constantly changing. […] When we carry out process optimization, we look at every process and see whether the guiding value is sustainability or one of the guiding values is sustainability. This means that the employees are forced to deal with the topic and see what risks the process they are currently working on has for the environment, for example, or for social components. They have to evaluate this.*

However, the organizations show a high level of the business capability "Process Innovation & Adaptation," built up over many years, so that recent adjustments to the sub-business capabilities were minimal. The limited need for change suggests that existing processes were already well-suited to address sustainability challenges. As a result, only minor adaptations were necessary to align with developing sustainability goals. The Head of Sustainability and Organizations Management of For-profit 17 explains:

> *Not specifically now, of course we have grown over time because the subject areas have simply expanded. But ultimately we also try to position the departments in such a way that they actually take a lot of things into account themselves, because we work, we have a sustainability team that consists of representatives from all departments in the company and they meet regularly and discuss certain topics, so that is also the goal, that ultimately the sustainability department does not do sustainability, but that the departments themselves understand how it works. And we just support them and give them content-related input. […] So we don't go directly to China and let them do our work or buy the*

raw materials there, but we mainly have dealers and they are all based in Europe. Our direct dealers are based in Europe, but of course they do get some of their raw materials from other countries, even outside the EU, depending on the raw material.

On the Technology level, this case matches the previous cases: the business capability "Data Management and Reporting" remains weakly developed. This is also evident in the business capability "Technology Adaptation," where the organization shows only minimal adjustments to tools and systems. This reflects the challenges in fully developing data management and reporting capabilities. Therefore no quote for this business capability can be provided.

APPENDIX P – WITHIN-CASE ANALYSIS: CAPABILITY-BUILDING WITHIN KAZAKH FIRMS

This analysis examines the sustainability-related capabilities of the Kazakh case firms, based on a deductive and inductive coding of the sustainability reports of the case firms. The results are organized by Packed Business Capabilities (PBCs), with each section presenting Deductive Sub-Capability Coding first, followed by Inductive Sub-Capability Coding, which emerged during the analysis.

Air Astana

Strategy PBC

Deductive sub-capability coding

The Strategy PBC captures the alignment between sustainability goals and corporate strategic intent. Deductively, the Sub-Capability **Strategic Management** is exemplified in phrases such as:

> *At Air Astana, we understand that our operations have a profound impact on the environment. We are committed to mitigating these impacts to ensure a sustainable and responsible future for the aviation*.

This suggests that sustainability is integrated into the firm's overarching strategic architecture, not as an afterthought but as a foundational principle.

Inductive sub-capability coding

However, inductive coding shows an additional strategic dimension through the Sub-Capability of **Stakeholder Engagement** and **Relationship Management**. This is captured in the passage:

Engaging with our stakeholders to grasp their needs and expectations more fully – regardless of whether they are affected by our operations or shape our long-term goals – is crucial for maintaining our license to operate and for the ongoing prosperity of our business.

This illustrates a deliberate effort to incorporate stakeholder perspectives into strategic decision-making. The underlying logic is relational: stakeholders are informed and actively consulted and mapped as partners in sustainability co-creation.

The interplay between deductive and inductive findings shows a two-tiered strategy model. Deductive coding affirms internal strategic alignment, while inductive coding illuminates external alignment with social and ecological constituencies. This duality supports the strategic value of stakeholder capital and suggests that Air Astana regards legitimacy, trust, and responsiveness as strategic assets in their own right.

People PBC

Deductive sub-capability coding

The People PBC encompasses capabilities related to human resources, internal communication, and organisational development. Deductively, the Sub-Capabilities of Communication, Employee Empowerment, and Organisational Structure & Staff emerge strongly.

Communication is foregrounded in excerpts such as:

[…] *on environmental stewardship, prioritising fuel efficiency […] management to raise awareness among all stakeholders*

The excerpt shows that the company communicates sustainability topics such as fuel efficiency and aims to raise awareness among all stakeholders. The communication is directed at internal and external audiences.

Employee Empowerment is similarly prominent, as shown in the text:

Additionally, Air Astana donated USD 2.7 million to support recovery efforts in the flood-affected regions. Furthermore, our employees initiated a fundraising campaign and collected essential supplies, which were then sent as humanitarian aid.

This excerpt reflects the firm's willingness to allocate discretionary resources toward social sustainability, and illustrates a decentralised empowerment structure in which employees are expected to act as proactive contributors. The encouragement of grassroots initiatives signals a distributed form of agency that is unusual in the traditionally hierarchical airline industry.

The third deductively coded Sub-Capability, **Organisational Structure & Staff**, is exemplified in statements such as:

A strong emphasis in 2023 has been on increasing the focus on our leadership programme, Leadership Essentials, widening our E-learning capabilities and offering bespoke skill development modules for the business. The aim of the Leadership Essentials programme is for current and newly promoted leaders to attend and gain job-relevant skills in people management and leadership.

Here, the institutionalization of training and leadership development indicates a more structural embedding of sustainability competencies. The integration of these themes into standard leadership tracks suggests that Air Astana does not isolate sustainability as a specialist function, but instead diffuses it across organisational levels.

Inductive sub-capability coding

Inductive analysis further refines the People PBC through the emergence of a new Sub-Capability: **In-house Training** and **Competency Development Infrastructure**. The excerpt:

Specific planned investments are focused on engineering and maintenance, pilot training, ground handling and catering, and spare engines.

demonstrates a shift from outsourced training provision to internally managed learning platforms. Moreover:

Continued improvements and expansion of in-house fleet maintenance and training facilities, plans to establish Air Astana Terminal Services

points to the physical localisation of skill development. This development evidences an internalisation of knowledge assets, aimed at increasing control over competency standards and alignment with sustainability objectives.

Process PBC

Deductive sub-capability coding

At Air Astana, the **Process** Packed Business Capability (PBC) reflects a growing effort to embed sustainability into core operations, product strategy, risk governance, and external relationships. The airline's disclosures surface a broad yet still maturing

array of process-oriented sub-business capabilities: process innovation and adaptation, product innovation and adaptation, continuous improvement, innovation for sustainability, risk management, social responsibility, and supply chain sustainability. Together, these form a framework through which the company is operationalising ESG objectives in a resource-intensive, high-regulation industry.

A major strength lies in **process innovation and adaptation**, where Air Astana is actively redesigning its internal procedures for environmental and operational effectiveness. The airline frames sustainability as part of its core growth strategy:

> *We are committed to mitigating these impacts to ensure a sustainable and responsible future for the aviation industry.*

Process digitisation is also a recurring theme:

> *We have digitised the way we handle passenger complaints, by offering passengers information sheets with a QR code, so they can…*

These measures show the airline using both digital and procedural redesigns to improve environmental stewardship, operational safety, and customer experience. The embeddedness of sustainability in compliance (e.g., inspections) as well as service redesign (e.g., QR-based complaints handling) signals a maturing capability that balances regulatory and reputational pressures.

Closely related is **product innovation and adaptation**, which reflects how Air Astana evolves its service portfolio to meet both customer expectations and sustainability goals. A foundational element here is the integration of sustainability in procurement:

> *Our procurement process follows international best practice, ensuring transparency and equal opportunity for all potential suppliers.*

This approach is increasingly aligned with sector-wide programs:

Participate in IATA's Integrated Sustainability Programme – Sustainable Procurement Pilot – to enhance procurement practices and ensure they also support environmental conservation and social responsibility

These examples illustrate how product design and sourcing decisions are being informed by ESG objectives. The linkage of procurement to sustainability through IATA-led frameworks also reflects alignment with industry best practices, which is a key requirement for maintaining competitive parity and future regulatory compliance.

Air Astana also exhibits a practical culture of **continuous improvement** that spans performance monitoring, training, and internal audits. Capacity-building supports this performance culture:

We organised B737, A330, and B777-type training to improve our capacity.

Improvement efforts are not limited to flight operations. The treasury function is also subject to review:

> *Verifying control mechanisms for the Company's treasury activities and ensuring the effectiveness and improvement of policies and procedures in the treasury function.*

This sub-capability demonstrates an approach to performance enhancement, reaching from frontline safety metrics to back-office financial processes. It reflects a systemic mindset of incremental improvement and accountability.

Air Astana's approach to **innovation for sustainability** reflects both compliance and ethics-driven innovation. The company builds awareness through ethics training and digital tools:

> *An online Code of Conduct training course was developed in 2021 and made available to employees during 2022.*

Its sustainability governance is also tied to innovation performance:

> *The Board of Directors holds ultimate responsibility for the Group's sustainable development and entrusts the ESG Committee with overseeing ESG-related risks and issues.*

This innovation extends beyond environmental concerns to include privacy:

> *Substantiated complaints concerning breaches of customer privacy and losses of customer data.*

Collectively, these initiatives suggest that sustainability-driven innovation is both procedural (ethics, digitalisation) and structural (governance). Although still developing, the alignment of values, oversight, and digital systems signals an intention to create lasting, innovation-based resilience.

A more formalised sub-capability is **risk management**, especially regarding climate-related exposure and governance. Air Astana also links risk oversight to corporate governance:

The Board of Directors holds ultimate responsibility for the Group's sustainable development and entrusts the ESG Committee with overseeing ESG-related risks and issues.

Safety risk is acknowledged as a top strategic priority:

> *Effective safety management is critical to minimise the potential for incidents or accidents.*

These examples show that the company treats risk as a multi-dimensional construct by e.g. combining regulatory exposure (e.g., climate), ethical scrutiny (e.g., data privacy), and operational safety. However, the disclosure lacks detail on scenario planning or stress testing. Still, the structure is in place for ongoing integration of ESG-related risk management into long-term planning.

The **social responsibility** sub-capability is embedded in Air Astana's stakeholder relationships, from government to local communities and shareholders. The company values coordination with national and municipal partners:

> *Our collaboration with government bodies, regulatory agencies, and local authorities is crucial for our operational mandate.*

Its shareholder engagement also includes strategic alignment:

Following engagement with our shareholders, we were able to secure their support for a range of strategic issues related to the Company's growth plans, financial and sustainable performance. […] There were 12 General Meetings of shareholders, which among other matters addressed: […] approval of the 5-year Business Plan and Annual Budget

Finally, social concerns are tied to product performance:

> *Substantiated complaints concerning breaches of customer privacy and losses of customer data.*

The social dimension is clearly framed through strategic partnerships, compliance, and customer satisfaction. Though not always differentiated from broader corporate communication, the company's ability to balance stakeholder expectations reflects a procedurally embedded social-responsibility capability.

The final sub-capability, **supply chain sustainability**, is emerging through procurement governance and environmental commitment. Air Astana's supply-chain approach is based on transparency and alignment with ESG priorities:

Our procurement process follows international best practice, ensuring transparency and equal opportunity for all potential suppliers. Our framework includes procurement procedures, management standards and strict compliance rules. […] We approved our Procurement Standard, incorporating sustainability criteria for suppliers.

The company also links supply chain management to climate mitigation:

Air Astana Group remains committed to addressing climate-related risks and fostering sustainable practices in every facet of our operations.

These activities suggest that the firm is beginning to treat its upstream relationships as part of its ESG ecosystem.

The **Process** PBC at Air Astana is actively evolving into a system of structured sustainability practices, governance mechanisms, and continuous performance enhancement. Process and product innovation reflect a commitment to operational modernisation and responsible sourcing. Continuous improvement supports efficiency and audit-readiness across multiple domains. Innovation for sustainability combines ethics, privacy, and digital enablement. Risk management offers a strong governance foundation, while social responsibility and supply chain sustainability link internal practices to broader systemic impact.

Inductive sub-capability coding

Inductive coding identifies Customer Experience Management as an additional sub-capability. The report describes service changes made in response to customer feedback:

We continue to review the customer experience regularly. Besides making in-flight and ground experience improvements based on customer feedback, we launched an upgraded website, providing a more intuitive experience for customers.

The excerpt links customer feedback to reported changes in inflight and ground services and to an upgraded website. It supports the coding of customer-centred process redesign. It does not describe back-end analytics, quantify changes in customer satisfaction or establish improvements in fuel efficiency. The inductive code adds a customer-feedback dimension to the Process PBC, while the sustainability effects of these changes remain unverified.

Technology PBC

Deductive sub-capability coding

The **Technology** Packed Business Capability (PBC) at Air Astana focuses on how the company uses technological infrastructure, tools, and practices to support sustainable operations, efficiency, and data integrity. The deductive coding reveals two core sub-business capabilities within this domain: data management and reporting and

technology adoption. Though still under development in certain areas, these capabilities suggest growing digital maturity in both sustainability governance and operational performance.

The **data management and reporting** sub-capability is foundational to Air Astana's efforts to track, disclose, and verify its sustainability-related activities. The airline provides clarity on the scope and boundaries of its disclosures:

> *Reporting scope and boundaries: the scope of this Annual Report encompasses Air Astana Group's operations for the period from 1 January to 31 December 2023.*

This precision in boundary-setting supports comparability and credibility in ESG disclosures. The company also demonstrates a commitment to anti-corruption governance through disclosure integrity:

> *Violations related to corruption, nor were there any public legal cases regarding corruption brought against the Group or its employees. Our steadfast commitment to combating corruption in all its forms is…*

Crucially, the company aligns with best practices in data verification:

> *Conducted limited substantive testing on a sample basis on a selected consolidated sustainability information to verify that the data have been properly calculated, recorded, compared, and disclosed.*

This emphasis on third-party assurance and methodological clarity strengthens stakeholder confidence. Though disclosures are mostly descriptive, the presence of detailed procedures and assurance procedures indicates that Air Astana is laying the foundation for solid ESG analytics and performance monitoring.

In parallel, the airline is advancing its **technology adoption** sub-capability to support sustainable growth and competitive positioning.

Technology is also linked to brand identity and strategic growth:

Aiming higher to create one of the finest airlines in the world. Building on its successful track record, Air Astana Group, the flagship carrier of Kazakhstan and one of the largest airlines in Central Asia and Caucasus, is well positioned for substantial growth opportunities in the region and beyond.

Sustainability targets are supported by sound financial foundations and operational efficiency, which are closely tied to digital innovation:

> *The Group maintains a robust balance sheet and liquidity position. Commitment to sustainability: with well-defined ESG targets, the Group aims to become the most…*

Finally, operational performance is directly tied to technological efficiencies:

> *The lowest unit-cost performances (measured by CASK) among both of our airlines' international competitors. This enables us to compete effectively on airfares, stimulating market demand and supporting growth.*

Here, cost-efficiency through digital systems supports both competitiveness and environmental responsibility. Though explicit technologies (e.g., fleet analytics, emissions monitoring software) are not detailed, the framing of technology as a pillar of ESG performance is clear.

Air Astana's **Technology** PBC reflects a purposeful alignment between digital tools, operational performance, and ESG disclosure integrity. **Data management and reporting** reveal a maturing ability to measure, verify, and communicate sustainability progress, supported by third-party assurance and structured reporting boundaries. Meanwhile, **technology adoption** is leveraged as a growth and differentiation strategy, enabling efficiency, environmental performance, and market expansion.

These sub-business capabilities show a company that treats technology as a strategic enabler of sustainable aviation. Further transparency in specific technological systems (e.g., digital emissions tracking, AI-enabled optimisation, customer data governance) would enhance the narrative. Nevertheless, the current integration of sustainability into both data and operational innovation marks meaningful progress toward long-term digital and ESG convergence.

Inductive sub-capability coding

Inductive findings expand this perspective by surfacing two further Sub-Capabilities: **Digital Logistics Integration Standards** and **Fuel-Efficient Fleet Modernisation**. The adoption of IATA's "ONE Record" standard, described as:

an open-source messaging standard that replaces legacy methods

illustrates a move toward digital interoperability. This enables real-time data exchange across the aviation logistics ecosystem, highlighting the shift from point solutions to integrative platforms.

Similarly, the excerpt:

Invest in more fuel-efficient and modern aircraft to support our sustainability objectives

The statement presents fleet renewal as an investment that supports the sustainability objectives. Technological assets are directly linked to long-term sustainability targets.

The deductive and inductive findings jointly demonstrate a two-layer technology strategy. On the one hand, digital infrastructures ensure data transparency and operational synchronisation. On the other hand, physical infrastructure upgrades, particularly in aviation hardware, constitute high-impact levers for emissions reduction. Together, they present a coherent technological capability stack that supports both operational efficiency and reputational legitimacy.

Cross-capability synthesis

The reports describe training, digital logistics systems and changes to fleet and service operations. These activities occur across the People, Process and Technology domains. Their co-occurrence suggests possible complementarities, but does not establish that training caused the reported technical or process changes.

The material also distinguishes internal initiatives from changes attributed to stakeholder input. It refers to a fatigue threshold used in crew rostering since 2024, a crew pairing optimizer planned for April 2025 and service changes made in response to customer feedback. The planned implementation date does not establish that the optimizer went live. The reports do not quantify coordination costs or demonstrate the effects of reliance on external standards.

Finally, several latent barriers are suggested by the fragmented and occasionally incomplete nature of reporting. While the capability set is broad and seemingly well-articulated, the lack of synthesis across domains may result in coordination costs. Furthermore, a reliance on global standards such as ONE Record, while strategically astute, could expose the firm to external dependencies if industry protocols shift.

Bank CenterCredit

Strategy PBC

Deductive sub-capability coding

Bank CenterCredit's strategy is both ambitious and structured, as seen in:

The main objective of the Bank's sustainable development activities is to integrate ESG aspects into the Bank's corporate long-term growth strategy […]. One of the tasks of the ESG transformation was to develop a roadmap to increase the Bank's maturity level in the area of sustainable development and identify key performance indicators for the Bank's management […]

This roadmap reflects **Strategic Management** with external frameworks. It demonstrates that ESG is embedded not just as a principle but as a measurable and phased plan.

Inductive sub-capability coding

Two additional capabilities emerged inductively, adding functional sophistication to the bank's strategic management.

One of the emergent sub-business capabilities is Scenario-Based ESG Planning, derived from the following statement:

Climate stress testing: development and gradual improvement of the climate stress testing procedure, which aims to assess the potential impact of climate change on the operating and investment activities of the Bank's clients. […] developing a comprehensive methodology that takes into account the impact of both transition and physical climate risks […]

This elevates the bank's ESG strategy to a **resilience-driven** function, using foresight tools to anticipate environmental shocks and integrate them into financial planning.

On the other hand, Strategic Data Capability could be derived from the following statement:

Creating an ESG database: setting up and launching the process of collecting and systematising qualitative and quantitative information on current and potential corporate clients of the Bank related to sustainable development factors and climate change issues.

This shows that strategy is operationalized through data infrastructure, which is bridging the gap between vision and implementation.

The Strategy PBC of Bank CenterCredit rests on a sustainable development strategy and a roadmap with key performance indicators. The two inductive Sub-Capabilities, climate stress testing and an ESG database, are still at the planning stage.

People PBC

Deductive sub-capability coding

The following Sub-Capabilities collectively reflect a human-centered sustainability strategy of Bank CenterCredit.

First, Organizational Structure & Staff illustrates the bank's internal integration of ESG by the following statement:

At the beginning of 2023, the Bank established a Sustainability (ESG) Directorate, which coordinates the process of ESG transformation of the Bank.

This indicates formalization of sustainability within the organizational hierarchy, suggesting both legitimacy and resource allocation for ESG efforts.

Second, *Employee Empowerment* is reflected in:

One of the key tasks of ESG training is to raise employees' awareness of the concept and aspects of sustainable development. In 2023, the Sustainability Directorate participated in the organisation, development and implementation of training programs: Online course on the basics of ESG, which was successfully completed by more than 60% of the Bank's employees

This demonstrates active empowerment procedures that go beyond awareness toward **agency and participation** of the employees. Employee empowerment here goes beyond structural provisions and shapes behavior: it encourages ideation and engagement.

Third, under *Communication*, the bank highlights:

Informing about the Bank's strategic goals, performance results, and the contribution of employees to achieving these goals […] Regular direct communication between managers, teams and individuals […] Research on the level of employee engagement and loyalty, as well as the socio-psychological climate in divisions

This can be read as a two-way communication model, enhancing information dissemination and internal responsiveness. It shows how sustainability is embedded in organizational culture.

Inductive sub-capability coding

The inductive coding for this PBC revealed no new Sub-Capabilities. The deductive categories therefore cover the People evidence in this report. It also illustrates how inductive coding can enrich interpretation even when no "new" categories emerge. To this end, additional deductive results are provided.

First, *Organizational Structure & Staff*:

The Managing Director is a member of the Sustainability Committee attached to the Board of Directors. As part of the implementation of the sustainable development strategy, the Managing Director oversees the work of the Sustainability (ESG) Directorate, and also provides communication with the heads of all structural divisions of the Bank for the successful implementation of the sustainable development strategy.

This confirms both the presence and the integration of ESG across traditionally siloed departments, enhancing organizational alignment.

Second, *Employee Empowerment*:

The Bank strives to ensure that the remuneration system promotes long-term development and sustainability, as well as reflects responsible management of the impact

on the economy, environment and society. This is achieved through the implementation of the ESG KPIs for senior management.

The bank links its remuneration system to ESG KPIs, and only for senior management. The report does not describe ESG-linked incentives for other employees, so this excerpt supports Employee Empowerment only indirectly.

Third, Communication is reinforced through:

The Bank develops communication programs to strengthen corporate values and creates a universal corporate portal for access to information and coordination of work. […] Development of the internal BCC space platform based on Web Soft, which includes the following blocks: internal news portal and employee training and development

This last sub-capability supports an emergent storytelling culture, where sustainability becomes a shared internal narrative, not just a top-down directive.

Overall, the People PBC at Bank CenterCredit is mature, with aligned incentives, formal roles, and cross-functional communication, which is both detected and elaborated through the combined coding approach.

Process PBC

Deductive sub-capability coding

At Bank CenterCredit, the **Process** Packed Business Capability (PBC) reflects how the bank integrates sustainability into operational routines, oversight structures, and stakeholder-facing systems. A deductive reading of the disclosures reveals a maturing architecture made up of four core sub-business capabilities: **risk management**, **supply-chain sustainability**, **social responsibility**, and **continuous improvement**. While some practices are still consolidating, the bank shows early-stage institutionalisation of ESG criteria into its core banking processes.

The most developed sub-capability is **risk management**, which at Bank CenterCredit is positioned as a foundation of the bank's corporate governance. It encompasses compliance, internal controls, and climate-related threats. The bank describes its system as both comprehensive and aligned with global practice:

> *The Bank has developed an effective risk management system that meets all the requirements of both the current legislation and generally accepted international practice.*

This structure extends beyond traditional financial risks to include reputational and sustainability risks:

> *The Bank's activities are based on a comprehensive approach to risk management, which includes identification, analysis and control of market, credit, operational and legal risks, risks of loss of business reputation and liquidity risks.*

The presence of this system indicates a maturing framework for evaluating both financial and non-financial threats. However, further details on how sustainability-specific risks (e.g., climate transition risk) are measured or mitigated would strengthen its interpretative weight. Nonetheless, the integration of ESG risk into a traditionally conservative control structure signals strong internal alignment.

Another evolving sub-capability is **supply-chain sustainability**, which is emerging through policy commitments, due diligence, and reporting practices. Although explicit mentions of supplier assessments are sparse, relevant disclosures point to ethical, environmental, and human rights considerations in procurement:

The Bank wants to be sure that it works with suppliers whose approach to doing business is based on the principles of compliance with national legislation and international recommendations in the area of procurement, business ethics and fair business conduct, who care about labour protection, the health of their employees, and the environment and respect human rights.

While Bank CenterCredit does not yet disclose procedures like ESG audits or supplier training, the policy architecture lays the foundation for future expansion. The focus on ethical procurement and alignment with national and international initiatives (e.g., UN SDGs) suggests a potential trajectory toward a more responsible sourcing program. For now, however, the capability appears nascent and reliant on broader governance instruments.

Bank CenterCredit's **social responsibility** sub-capability is most visible in its stakeholder engagement strategy. The bank has developed a multi-channel system for communicating with stakeholders including communities, customers, NGOs, and regulators. This system reflects both transparency and responsiveness:

> *Creating partnerships that contribute to the Bank's integrated sustainability activities… receiving information from experts, communities and non-governmental organisations on key areas of sustainable development.*

These interactions are facilitated through various tools:

> *Annual report, sustainability reporting… participation in public environmental events… charity events… social networks… mass media… external website.*

The bank also engages extensively with clients and the professional community:

Informing about the Bank's products and services, as well as the terms of their receipt […] Understanding customer expectations and needs to ensure a high level of service […] Satisfaction surveys, reviews, and complaints related to products, services, and interactions

This broad stakeholder framework indicates a deliberate effort to shape Bank CenterCredit's social licence to operate. The communication and reporting efforts follow the GRI Standards. They also include mechanisms for two-way interaction. The impact of these interactions is not always quantified. However, the systematic nature of the activities suggests a structured capability that is becoming more mature.

A more implicit but foundational sub-capability is **continuous improvement**, which underlies Bank CenterCredit's sustainability governance and reporting procedures. Sustainability is monitored across multiple governance levels, and improvements are expected through policy updates, learning cycles, and reporting practices. One excerpt shows this commitment to incremental progress:

Plans for the development of the sustainable development management system.

This commitment is reinforced by participation in international standard-setting processes and ratings:

Getting an ESG rating and improving it in the future.

Though not presented under a formal continuous-improvement framework (e.g., PDCA or KPI-driven assessments), these statements reflect a mindset of sustainability enhancement through self-assessment and alignment with global norms. The use of international disclosures (e.g., TCFD, GRI) indicates a maturing learning capability.

Bank CenterCredit's **Process** PBC reflects a growing system of sustainability routines embedded into the institution's routines. **Risk management** is well-established, covering both traditional financial threats and reputational risks. **Supply-chain sustainability** is emerging through ethical procurement frameworks, while **social responsibility** is expressed through a multi-stakeholder engagement architecture. A focus on continuous improvement is becoming more active across the organization. It supports learning and helps the organization adapt its practices.

Some parts of the structure are still taking shape. Bank CenterCredit nevertheless shows early signs of embedding ESG practices in its core operations. Policy frameworks, stakeholder engagement mechanisms, and alignment with global reporting standards support this development. Further work is needed to put supply chain oversight into practice, measure stakeholder impacts, and integrate climate risk models. The Process PBC provides a foundation for embedding sustainability capabilities more firmly in the organization.

Inductive sub-capability coding

The Inductive coding revealed innovation beyond risk assessment, including **digital efficiency** and **customer engagement**.

Under Digital Process Optimization, the coding revealed:

In 2023, the Bank made a significant step forward by implementing such projects as […] digital mortgage, which allows to apply for a mortgage loan for the purchase of housing in just one day and without visiting the bank's branch, which made it much easier and speed up the process of processing and receiving financial services.

This shows how sustainability and efficiency converge through digital transformation, aligning customer experience with environmental goals.

On the other hand, Client Sustainability Onboarding was evident in:

In 2023, the Bank developed and started applying the following additional tools and procedures to assess the compliance of potential and current borrowers with the ESG principles: […] Self-declaration: filling out a questionnaire addressed primarily to SME clients and aimed at determining the level of ESG risk depending on the industry and applied practices.

This shifts ESG responsibility outward and embeds sustainability in internal processes as well as in client engagement and education. It reflects a capability to extend sustainable behavior beyond organizational boundaries.

The combination of deductive and inductive evidence shows a dual-layered process capability: internal standardization and external alignment. This suggests that Bank CenterCredit is using sustainability as a lever for operational excellence and client ecosystem transformation.

Technology PBC

Deductive sub-capability coding

On the Technology PBC level, the coding identifies Data Management and Reporting as well as Technology Adoption. Both are coded in the bank's description of waste management:

Data collection and monitoring processes: Recyclables are transferred under a transfer acceptance certificate, and data collection is monitored through an app and web platform for recording and controlling waste disposal and recycling processes.

This suggests an automation of sustainability performance tracking, enhancing accuracy, transparency, and comparability.

Inductive sub-capability coding

The inductive data revealed a broader infrastructural initiative:

The growth dynamics in energy consumption stimulated the development of a targeted energy efficiency plan. The Bank implemented measures, including an initiative to modernise and replace air conditioning systems with more modern and energy-efficient ones. […] The new equipment not only helped reduce overall energy consumption, but also eliminated the use of freon, which is prohibited for use, starting in 2022.

This goes beyond reporting. It represents a shift in the bank's **digital foundation**, aligning technological modernization with environmental efficiency.

The deductive-inductive pairing here reflects a layered technology strategy: visible performance reporting (external) supported by sustainable infrastructure (internal).

Cross-capability synthesis

The report describes ESG-related responsibilities, scenario modelling, data warehousing, customer-facing initiatives and board-level arrangements. These disclosures are coded across the four PBC domains. They indicate formalization in the reported arrangements, but do not establish organization-wide integration, a mature capability profile or the effects of the initiatives.

BI Group

Strategy PBC

Deductive sub-capability coding

Strategic Management

The deductive analysis on the Strategic Management revealed that the BI Group embeds sustainability into long-term strategic planning:

> *BI Development implements a systemic approach to managing environmental impact, integrating ecological principles into operations and strategic planning.*

This shows that sustainability is core to the BI Group's business model.

Inductive sub-capability coding

The inductive coding highlighted **Community Lifestyle Infrastructure Integration** as an additional Business Capability. The company has implemented multifunctional public spaces such as a community center within its residential developments, which could be seen here:

> *Community center: a multifunctional public space combining sports, education, leisure, and social activities for local residents.*

This initiative embeds sustainability into the urban fabric, supporting social interaction, well-being, and long-term value creation for residents. It illustrates how strategic sustainability is realized at the level of urban design and community development.

Deductive themes focus on governance and planning, while inductive themes show how the strategy is implemented through infrastructure. At BI Group, the strategy is therefore visible both in policy and in built projects.

People PBC

Deductive sub-capability coding

First, the BI Group demonstrates a strong emphasis on **Employee Empowerment** through structured initiatives. The company introduces:

> *[…] non-material and financial motivation tools, performance reward systems, and mechanisms to recognize each employee's contribution to the company's success.*

Additionally, the investment in training through the BI University reflects a strategic effort to upskill the workforce:

> *BI University - an educational platform focused on practical cases and relevant competencies.*

These initiatives suggest that empowerment is embedded into BI Group's sustainability approach as a critical driver of employee engagement and long-term performance.

Second, **Communication** was coded deductively. The company employs a variety of internal communication tools:

> *An internal portal, an employee feedback network, team meetings, engagement surveys, and the regular publication of reports.*

The combination of portal, feedback network, meetings, and surveys supports top-down and bottom-up information flows. Feedback channels of this kind are a characteristic of a learning organization.

Third, regarding Organizational Structure & Staff, a forthcoming transformation in the company's risk management system includes:

> […] the creation of a dedicated functional area and the appointment of responsible individuals.

This move signals a shift from ad hoc sustainability actions to structural integration. It shows BI Group's intent to operationalize sustainability governance and build institutional capacity for long-term sustainability performance.

Inductive sub-capability coding

Resident Community Enablement inductively expands the people capabilities to include external stakeholders. BI Group emphasizes:

> *Creating sustainable residential communities through development of infrastructure, services, and programs for resident engagement.*

The statement extends the People PBC beyond employees. Residents are addressed as participants in community programs.

While deductive findings focus on internal human capital development, inductive results introduce an outward-facing social strategy. Together, they form a people capability that supports both employee engagement and community empowerment. BI

Group appears to view human capital not just as a means of production, but as a source of innovation, resilience, and legitimacy in its sustainability agenda.

Process PBC

Deductive sub-capability coding

On the Process PBC level, evidence emerged for all three sub-business capabilities. First, for **Process Innovation & Adaptation** the evidence indicates that the company adopts Lean management:

> *Lean at BI Development is a comprehensive lean manufacturing philosophy based on eliminating waste and developing quality standards.*

This indicates an organization-wide effort to eliminate waste, improve efficiency, and integrate continuous improvement into daily routines. By framing Lean in holistic terms, BI Group presents it as a strategic enabler of sustainability.

> The use of methods such as kaizen (continuous incremental improvement) supports the coding of Continuous Improvement. The following statement is an example:
>
> *In 2024, the Group continued implementing initiatives aimed at increasing environmental responsibility, including waste reduction and reuse.*

These initiatives address waste reduction and reuse. The report does not describe how improvements are reviewed.

Third, **Operationalization** is seen at the following statement:

> *BI Development implements a systemic approach to managing environmental impact, integrating ecological principles into operations and strategic planning.*

Sustainability appears to be embedded in the operational model through digital transformation and other initiatives. BI Group's process orientation reflects a capacity to translate sustainability strategies into actionable procedures and routines, which is ensuring alignment between vision and execution.

Inductive sub-capability coding

Inductive coding yielded two further sub-business capabilities. The first is Extended Warranty Management. The company extends the warranty period for its residential complexes, which indicates a longer responsibility for its products. BI Group states:

> *In 2024, we are increasing the warranty period for all BI Development residential complexes from 3 to 5 years.*

It shows BI Group's readiness to take ownership of its environmental and social impacts beyond the point of sale, which is a central principle of circular economy practices.

> The second is Integrated Equipment Fleet Telemetry, a GPS monitoring system connected to internal and external systems for tracking construction equipment. The report states:
>
> *The GPS monitoring system, integrated with internal projects and external services… ensures 100% transparency in supplier selection and equipment work tracking.*

It reflects a sophisticated operational capability that aligns digitalization with sustainability performance.

For BI Group, the Process PBC combines standardization and improvement (deductive) with data-based monitoring and responsibility after the sale (inductive).

Technology PBC

Deductive sub-capability coding

Deductive coding identifies Technology Adoption in two areas. The first concerns the apartments:

The 'Smart Home' system with modular contactors and motion/water leak sensors reduces energy and water use, enhancing residential energy efficiency.

And on the other hand:

The BIG App allows clients to manage their apartments, request assistance, engage in community life, and integrates tenant services to form a digital ecosystem.

Both statements show that BI Group draws on technological tools to improve its sustainability performance. Monitoring systems enable the company to track environmental data and operational outputs in real time. This enhances its ability to detect inefficiencies, reduce emissions, and improve responsiveness. Thus, this transforms sustainability monitoring from a retrospective activity into a proactive capability.

Data Management and Reporting is coded in a digital platform for safety monitoring on construction sites:

The Opera Build digital platform automates safety and labor protection monitoring, reducing risks and increasing transparency on construction sites.

Inductive sub-capability coding

Inductive coding yielded two new sub-business capabilities. The first is Blockchain-based Contract Automation. The company uses smart contracts based on blockchain technology in procurement and construction project management:

As part of process digitalization, smart contracts based on blockchain technology were implemented. This enables automation of production cycle management, increases transparency in interactions with contractors, and saves time at all stages of project execution.

This use of blockchain represents a scalable, structured mechanism for enhancing transparency and reducing risks of corruption or delays. It reflects a forward-looking digital capability, aligned with sustainable procurement principles.

The second is Post-Sale Digital Experience Integration. It covers digital platforms through which customers interact with the company after the purchase, e.g., by receiving updates, managing maintenance, or using community platforms. The report states:

Implementation of digital platforms for managing apartment repairs and fit-out stages after the sale […]

In sum, the deductive analysis shows foundational technology capabilities that support sustainability management. Inductive insights suggest experimentation with

advanced technologies that extend BI Group's sustainability reach. This interplay indicates a dual strategy: optimizing core operations while piloting transformative technologies that could redefine industry norms.

Cross-capability synthesis

The deductive coding identifies reported governance arrangements, internal systems and operational practices. Inductive coding adds specific initiatives in community engagement and technology deployment. The material shows how BI Group presents these activities across the PBC domains. It does not establish their repeatability, integration across the organization or effects on sustainability outcomes.

Eurasian Resources Group

Strategy PBC

Deductive sub-capability coding

Strategic Management

Eurasian Resources Group's approach to sustainability is deeply integrated with its corporate strategy:

In 2021, we established an Environmental, Social and Governance (ESG) Committee to support the integration of sustainability practices into our Group strategy and decision-making processes. In 2022, the Committee continued a formal process to establish 2030 ESG Goals and develop supporting action plans in priority areas for the Group […].

The excerpt names an ESG Committee that supports the integration of sustainability practices into Group strategy and decision-making, and a formal process to set 2030 ESG Goals with supporting action plans. Sustainability thus enters the strategy through committee oversight and time-bound goals.

Inductive sub-capability coding

Decarbonisation Advisory and Innovation Hub

Our Decarbonisation Think Tank in Kazakhstan, which we established in 2021, acts as a decarbonisation centre of excellence, guides efforts to reduce our carbon intensity and carries out external stakeholder engagement on this crucial issue.

The Think Tank, established in 2021, is described as a center of excellence for decarbonization. It guides efforts to reduce carbon intensity and engages external stakeholders. The report does not describe how its results enter strategic decisions.

Enterprise Operational Model Transformation

We proactively adapted to these short-term challenges by launching our 2023-2025 transformation programme, which will enable us to significantly improve our efficiency through the enhancement of our operational model and operational efficiency. This is focused on, among other measures, increasing our production of key commodities […] and optimising our procurement processes and reducing our overheads.

This highlights a deliberate strategy of enterprise-level change. While deductive coding surfaced structured planning, the inductive insight shows a systemic effort to reconfigure the operational core of the firm beyond ESG compliance. It also shows

Eurasian Resources Group embracing transformational leadership principles, potentially increasing its adaptive capacity in the face of ecological and regulatory complexity.

There is a notable synergy between deductive and inductive findings under "Strategy." The deductive findings confirm formal alignment of sustainability with business planning, while inductive insights expose deeper structural transformations such as innovation hubs and operational redesigns. Together, these show Eurasian Resources Group is both reacting to ESG pressures, and potentially reimagining its strategic logic. However, a gap exists in how these strategies cascade across levels of the organization. There is limited evidence of how these top-tier capabilities translate into localized action or innovation at the operational level which is a critical next step for realizing systemic impact.

People PBC

Deductive sub-capability coding

Organizational Structure & Staff

Eurasian Resources Group shows a structured approach embedding sustainability within its organizational architecture. This Sub-Capability emerges clearly in excerpts such as:

In 2023, we also established dedicated regional sustainability committees to support the implementation of region-specific sustainability initiatives across the Group. These committees include representation from senior region-level management and relevant functions […].

Regional sustainability committees with senior region-level management show formal structures for implementing sustainability initiatives. Responsibility for these initiatives is thus partly decentralized to the regions.

Employee Empowerment

Eurasian Resources Group places emphasis on employee involvement and motivation:

In addition, we continued to support broader organisational transformation via our established employee engagement programmes. This included the cascading of our transformation programme's strategic objectives via our League of Professionals programme and Innovators Forum, as well as the hosting of dedicated roundtable discussions and transformation 'demo days'. During the year, around 3,200 employees participated in these events.

Additionally Eurasian Resources Group states

In Kazakhstan, we provided differentiated pay raises to more than 60,000 employees, improved conditions both inside the workplace and in our mining towns, and expanded our skills development programmes (including a focus on advanced, role-specific skills).

The first excerpt shows that the company cascades the strategic objectives of its transformation program to employees through engagement programs, in which around 3,200 employees took part in 2023. The second reports differentiated pay raises for more than 60,000 employees in Kazakhstan in 2022. Empowerment is addressed through involvement in the transformation and through financial support.

Communication

Eurasian Resources Group reflects efforts to communicate sustainability both internally and externally:

This report has been prepared with reference to the Global Reporting Initiative (GRI) Standards, and is focused on our most material Sustainable Development issues […]. ERG is a signatory to the United Nations (UN) Global Compact Principles – and this report supports our ongoing commitment to report on our progress in implementing the same.

By adopting global standards, the company positions itself as both transparent and aligned with best practices. However, communication here appears more compliance-oriented than transformative, indicating a focus on reporting.

Inductive sub-capability coding

Corporate University Management

In 2023, we established the ERG Corporate University to help support our transformation goals through the development of our critical employee competencies in Kazakhstan. […] The ERG Corporate University is implemented through seven 'Academies', which focus on: occupational health and safety; production (e.g. mining, processing, geology, energy and environment); technical maintenance and repairs; production systems; leadership; project management; and digitalisation.

This inductive Sub-Capability complements Employee Empowerment. The Corporate University, established in 2023, develops critical employee competencies in Kazakhstan through seven academies, among them occupational health and safety and leadership. Environmental topics appear within the production academy, while sustainability lacks a separate field of study.

The deductive and Inductive Sub-Capability Coding under "People" reveal strong convergence. Both approaches identify the formal structures and learning platforms through which Eurasian Resources Group is embedding sustainability. Deductively, the focus lies on functional integration and ethical incentives, while inductively, deeper infrastructure (i.e., a Corporate University) is exposed. These results indicate Eurasian Resources Group is evolving toward a capability-based sustainability model, where human resource development is central. A potential barrier, however, is the primarily top-down structure implied. There is limited evidence of bottom-up sustainability innovation or employee-led initiatives, which may represent an opportunity area for deeper engagement and organizational learning.

Process PBC

Deductive sub-capability coding

The **Process** Packed Business Capability (PBC) at Eurasian Resources Group (ERG) illuminates how the company embeds sustainability principles into the design, management, and oversight of its large, geographically dispersed mining and metals operations. A deductive reading of Eurasian Resources Group's 2022-23 sustainability disclosures identifies seven interacting sub-business capabilities: process innovation and adaptation, product innovation and adaptation, continuous improvement, innova-

tion for sustainability, risk management, social responsibility, and supply-chain sustainability. Together they reveal an organisation moving from compliance to disciplined capability-building in support of the energy-transition economy.

Eurasian Resources Group's capability for **process innovation and adaptation** is visible in its growing use of digital and analytical tools to raise operational efficiency and safety.

In Africa, we are also implementing cutting edge lithospheric targeting and remote sensing technologies to help enhance our exploration capabilities. In addition, we are rolling out multi-sensor rock and core scanning platforms to improve and standardise our data collection processes.

This excerpt highlights a dual emphasis on data-rich geoscience and risk analytics. By institutionalising multi-sensor scanning, Eurasian Resources Group is converting initiatives into systematic, technology-enabled routines. The strategic intent is clear: extend asset life while lowering cost per tonne. Capital intensity and the need for specialist talent may slow diffusion across Eurasian Resources Group's African and Brazilian sites, yet the Kazakhstan roll-outs provide a test bed for global scaling.

A complementary orientation is **product innovation and adaptation**, where Eurasian Resources Group positions its outputs for low-carbon value chains.

Our R&D Centre in Kazakhstan works on an open system based on interaction with a range of internal and external stakeholders. […] Key areas of R&D focus include: The application of new pyrometallurgy technology to produce low-carbon chromium; New alumina production technology to reduce the product carbon footprint

Though still nascent, these disclosures point to upstream efforts to redesign product flows and procurement norms so that future products like copper, cobalt, ferroalloys meet emerging traceability and low-carbon criteria demanded by battery and green-steel customers. The School of Active Citizenship signals a social-innovation lens, embedding capability building for local SMEs into product-sourcing strategies. The challenge is to translate pilot projects into market-recognised low-carbon products amid volatile commodity prices.

Eurasian Resources Group's operating model is underpinned by a culture of **continuous improvement**.

During 2022, the ESG Committee met four times and reviewed the following issues: health and safety performance […] environmental protection, energy efficiency programmes, reuse and disposal of production waste

Additionally Eurasian Resources Group states: *In 2023, we increased our capex by 27% to US$1,440 million (2022: US$1,135 million). This reflected investment in our existing operations (with a focus on productivity and lifetime extensions in both Kazakhstan and Africa), the development of our broader growth pipeline (including greenfield exploration, our BAMIN project in Brazil) and new projects to improve operational sustainability in Kazakhstan.*

These passages show that the company pursues incremental efficiency gains through structured committee oversight and disciplined capital allocation. Continuous improvement links ESG reviews at board level to operational performance measures. It also aligns budget cycles with sustainability KPIs, such as energy intensity and water

reuse. Lean methods and productivity dashboards support this capability. Its success depends on sharing knowledge across Eurasian Resources Group's diverse operations and sites.

Innovation for sustainability is coded in the company's approach to artisanal mining:

Sustainability context: None of our production comes from artisanal and small-scale mining. Nonetheless, we are addressing some of the challenges that can be linked with this activity.

Here Eurasian Resources Group frames sustainability as an innovation opportunity by tackling artisanal mining externalities in host regions. By acknowledging artisanal mining even where not legally required, Eurasian Resources Group signals boundary-spanning innovation that goes beyond fence-line control.

Robust **risk management** provides the governance foundation that links innovation, operations, and finance.

At Metalkol, we also maintain a cross-departmental Joint ASM Working Group. This group meets regularly and is responsible for reviewing and assessing ASM-related information, risks and incidents – and for developing recommendations for remediation and / or mitigation measures.

Additionally, they state:

[…] our climate-related transition risks in Kazakhstan (where most of our carbon emissions occur) relate to reduced carbon quotas and / or the application of carbon taxes, the impact of the EU's CBAM (particularly in relation to our aluminium and ferrochrome sales) and increased interest rates as finance providers apply ESG criteria.

The excerpts show that risk management covers artisanal mining (ASM) and climate-related transition risks. At Metalkol, a cross-departmental Joint ASM Working Group reviews ASM-related information, risks, and incidents and develops recommendations for remediation or mitigation. According to an analysis carried out in 2021, transition risks in Kazakhstan relate to carbon quotas and taxes, the EU Carbon Border Adjustment Mechanism (CBAM), and higher interest rates as finance providers apply ESG criteria. This analysis informs the Group's decarbonization strategy. In 2023, the Group also analyzed possible regulatory developments in emissions trading in Kazakhstan, including a scenario analysis.

The **social responsibility** sub-capability manifests through proactive stakeholder engagement and conflict-avoidance routines.

Given the local context… as well as EU and US regulations around conflict minerals.

Furthermore, Eurasian Resources Group states:

> *Managing impacts on air and water; energy and climate change… expropriation of 212 plots of agricultural land.*

These passages show that Eurasian Resources Group recognizes that social acceptance of its operations can change. This is particularly relevant in sensitive jurisdictions such as the DRC and Brazil. The company seeks to address potential grievances

through a structured engagement program. Its references to conflict-minerals regulation and land expropriation show that it recognizes the importance of these issues. They also indicate procedures for negotiating with affected stakeholders. Measuring the effectiveness of social impacts remains a challenge. So does coordinating action across different cultural contexts. Finally, supply chain sustainability extends ESG practices beyond the company itself.

In 2022, we completed the first phase of the Group-wide rollout of our Group Supplier Code of Conduct (Supplier Code). This included the distribution of the Supplier Code to key suppliers, its integration into our terms and conditions and its incorporation into our supplier CPDD onboarding process.

While also

In 2023, we rolled out similar supplier training in Kazakhstan and Brazil. This is in addition to our global CPDD and TPRM processes […], as well as additional supply chain management measures in Kazakhstan, Africa and Brazil. These include: […] Sustainability-focused contractual provisions for major suppliers, including in relation to human rights (and, in Kazakhstan, GHG emissions reporting)

The excerpts describe the rollout of a Group Supplier Code of Conduct, its integration into terms and conditions and supplier onboarding, supplier training in Kazakhstan and Brazil, and sustainability-focused contractual provisions for major suppliers. These measures combine compliance (Supplier Code, Responsible Chromium) with capacity-building (training) and relate to international due-diligence requirements (e.g., OECD, EU Battery Regulation). Their reach may be limited by data integrity, audit costs, and supplier heterogeneity.

The sub-business capabilities interlock to form a Process PBC that supports Eurasian Resources Group's transition from traditional extractives to a future-oriented, low-carbon resource supplier. **Process and product innovation** focus on digitisation, tailings valorisation, and customer-driven product redesign. **Continuous improvement** and **innovation for sustainability** provide complementary learning loops one incremental, one transformational. **Risk management** acts as the orchestration mechanism, while **social responsibility** and **supply-chain sustainability** ensure that value creation is socially legitimate and systemically distributed.

Inductive sub-capability coding

Aviation Services Outsourcing Management

For example, we have developed enhanced critical risk assessment and mitigation processes and strengthened our production controls in Kazakhstan – and we are now outsourcing all aviation services in Africa to third-party service providers.

This excerpt surfaces a novel Sub-Capability: streamlined outsourcing of ancillary but critical infrastructure. While not traditionally labeled a sustainability function, this move reflects a strategic attempt to optimize safety, cost, and environmental footprint. From a capability perspective, this suggests that Eurasian Resources Group is recognizing auxiliary service management as a leverage point for sustainable performance.

Deductive and inductive findings within this PBC are complementary. While deductive results show an adaptive core in production processes, inductive analysis

brings attention to peripheral process improvements that carry strategic significance. The outsourcing decision, though operational, aligns with broader themes of control and efficiency in sustainability transitions. This blend of core and peripheral process innovations shows an organization that is scanning widely for optimization opportunities. However, a more holistic systems view (e.g., circular economy initiatives, value chain transformation) was not evident, suggesting that while Eurasian Resources Group is advancing in process adaptability, it may still operate within a linear optimization paradigm.

Technology PBC

Deductive sub-capability coding

Notably, the deductive coding did not yield any distinct Sub-Capabilities under the "Technology" PBC. This absence is itself analytically significant, as it may indicate that Eurasian Resources Group's sustainability disclosures do not conceptualize technological development as a standalone sustainability capability, or that technology is subsumed under other categories such as Process or Strategy. This could reflect a limitation in the framework's initial deductive assumptions or point to a communication gap in the company's sustainability narrative regarding its technological investments.

Inductive sub-capability coding

Battery Passport Development and Integration

We also continued to work with our partners at the Global Battery Alliance (GBA) to help develop and implement the world's first global Battery Passport. This is in the context of increasing regulations around battery value chain assurance, including the EU's 2023 Battery Regulation.

This finding reveals a forward-looking technological Sub-Capability: integrating traceability and transparency tools into the battery supply chain. The Battery Passport aligns with emerging global regulatory trends and positions Eurasian Resources Group as a first mover in digital ESG assurance. This capability goes beyond compliance as it represents innovation in product lifecycle accountability and data-enabled supply chain governance.

The inductive identification of a high-value capability like Battery Passport Development contrasts sharply with its absence in the deductive framework. This divergence supports the strength of inductive coding in surfacing emergent and novel capabilities that may be overlooked in structured frameworks.

The implication is twofold: First, Eurasian Resources Group is likely developing sophisticated technological capabilities aligned with future-facing ESG compliance and value creation. Second, the company's reporting structure might benefit from explicitly communicating its technological sustainability capabilities more systematically, enhancing strategic transparency and stakeholder trust.

Cross-capability synthesis

The reports describe formal governance arrangements and sustainability-related activities across all four PBC domains. Deductive coding organizes these disclosures into the predefined categories, while inductive coding adds specific practices in learning and digital technology. The material supports a differentiated account of reported

activities, but does not establish a transition from compliance to a more mature capability configuration or measure their effects.

Halyk Bank

Strategy PBC

Deductive sub-capability coding

The deductive coding identifies **Strategic Management** as a key Sub-Capability within the Strategy PBC. The bank demonstrates clear intent to embed sustainability within high-level planning processes:

The Bank implemented a number of initiatives in 2024 under the supervision of the Board of Directors. […] The most significant of these included the development of the Halyk Group Development Strategy for 2025–2027, Halyk Bank's ESG Strategy for 2025–2027, and an Action Plan for improving risk management, internal control, and corporate governance systems.

The excerpt reports the development of the Halyk Group Development Strategy and of an ESG Strategy for 2025-2027 under the supervision of the Board of Directors. The ESG strategy thus has a defined medium-term horizon and is anchored at the highest governance level.

Interpretation

The presence of Strategy only in the deductive coding suggests that sustainability is formally embedded at a policy level but may not have generated new, emergent capabilities recognized by inductive approach. It may imply that strategic discourse is top-down and institutionally declared, with little evidence of grassroots initiative or innovation.

Inductive sub-capability coding

The absence of Strategy-related Sub-Capabilities in the inductive coding is telling. While formal strategies exist, they may not yet have translated into distinctive, organically emergent capabilities. This gap suggests a need to ensure strategic intent is operationalized into novel practices or competencies observable on the ground.

People PBC

Deductive sub-capability coding

Organizational Structure & Staff

The Social Responsibilities Committee of the Board of Directors was transformed into the Sustainability Committee, and ESG functions were distributed among the committees of the Board of Directors.

The excerpt reports that the Social Responsibilities Committee of the Board of Directors was transformed into a Sustainability Committee and that ESG functions were distributed among the board committees. Sustainability is thus anchored in the board structure. The excerpt does not describe structures at staff level.

Employee Empowerment

In 2024, the Bank's employees raised KZT 200 million to assist those affected by floods, and the Bank increased this amount to KZT 450 million. As part of the New Year campaign 'Tree of Wishes,' employees traditionally help children from low-income families and also provide support to educational and medical institutions.

Employees raised KZT 200 million for flood victims, which the bank increased to KZT 450 million, and they support children from low-income families through the "Tree of Wishes" campaign. The excerpt shows employee participation in social initiatives. It supports Employee Empowerment only indirectly, since it does not describe decision rights or ESG responsibilities of employees.

Communication

Halyk Bank was the first in the country to publish an ESG report in accordance with GRI standards (2020) and joined the UN Global Compact (2022). It was also among the first to publish reports aligned with TCFD recommendations.

This points to sophisticated internal and external communication capabilities. Transparent reporting frameworks represent both compliance and active engagement with stakeholders on sustainability.

Inductive sub-capability coding

ESG Behavioral Training Program

Using the Bank's new Code of Ethics, we have developed a programme to educate staff on ethical standards and environmentally responsible behaviour in the workplace and beyond. Around 80% of employees who were assigned a remote course on ethical behaviour and training materials on environmental sustainability successfully completed their studies of these manuals.

This shows a structured effort to internalize ESG principles at the behavioral level. It goes beyond top-down messaging to address how employees think and act in relation to sustainability.

Interpretation

The convergence of inductive and deductive data underlines **People** as a capability-rich area in Halyk Bank's sustainability effort. Deductively, the bank reflects structural and communicative efforts. Inductively, it shows capability building through behavioral interventions. This dual presence signifies strong human capital alignment with ESG goals.

Strategic Implications

These findings suggest a deliberate institutional design, complemented by capacity-building at the employee level. A potential barrier might be ensuring consistency across departments, given the top-down initiation of many programs.

Process PBC

Deductive sub-capability coding

The **Process** Packed Business Capability (PBC) at Halyk Bank reflects how sustainability is translated into internal systems, operational practices, and performance oversight across the institution. A deductive coding of the bank's sustainability reports identifies seven relevant sub-business capabilities under this PBC: process innovation and adaptation, product innovation and adaptation, continuous improvement, innovation for sustainability, risk management, social responsibility, and supply chain sustainability. The discussion below interprets how these capabilities are manifested in practice.

Halyk Bank demonstrates a maturing capability in **process innovation and adaptation**, particularly through its efforts to embed ethical, operational, and audit-related reforms. One area of focus is digitalisation within assurance functions:

> *One of its key priorities is the study and implementation of artificial intelligence tools and automated data analysis methods to enhance the efficiency of internal audit processes.*

The institution also integrates sustainability norms through formal ethical governance mechanisms:

As part of the short-term plan for integrating sustainability principles and objectives, the Bank has developed and approved the Code of Ethics and Business Conduct […]. The Code of Ethics was developed in accordance with internationally recognised principles and norms of international law, the legislation of the Republic of Kazakhstan, corporate governance standards […]

Further evidence of procedural governance comes through its capital risk planning process:

> *The internal capital adequacy assessment process (the ICAAP) is a set of processes for managing significant risks... to determine the required level of capital sufficient to cover them, including credit risk, market risk, liquidity risk and operational risk.*

These practices illustrate how the bank is aligning its core financial and audit processes with sustainability and ethics frameworks, supported by digital innovation and risk-based thinking.

The bank's approach to **product innovation and adaptation** centres on embedding sustainability in client-facing services, primarily through digital platforms:

At the core of Halyk Bank's business model […] is an integrated digital ecosystem that brings together a wide range of products, services, and solutions for all client segments, from individuals to large corporates.

This digital ecosystem supports sustainability by improving access, reducing friction, and facilitating responsible financial decision-making. External recognition validates this product innovation:

> *These awards confirm the high level of Halyk Bank's financial services and its commitment to sustainability, innovation and social responsibility.*

While the disclosures reflect reputational success, the deeper capability lies in the continuous enhancement of customer experiences through digital channels designed with sustainability and inclusivity in mind.

A critical enabler of this innovation is the bank's orientation toward **continuous improvement**. The Sustainability and Strategy Committees actively shape ESG execution and review processes:

The Committee assists the Board of Directors in: reviewing the Halyk Group's strategy, the Bank's sustainability strategy and monitoring their implementation; setting medium/long-term goals and key performance indicators (KPIs) in the area of sustainability and monitoring the implementation of the action plan to achieve them

Capacity-building also plays a role in institutional learning:

In addition, we developed training courses on corporate governance and sustainable development, carried out corporate governance diagnostics across all Halyk Group organisations, and formulated recommendations for improvement in this area.

These excerpts highlight the feedback and performance-monitoring structures that support a learning-oriented organisation. Training and evaluation span the entire Halyk Group, suggesting group-wide adoption of improvement logics.

The capability for **innovation for sustainability** is further supported by organisational culture and leadership expertise. The firm recognises innovation and ESG as essential board-level competences:

The most sought-after competences in the work of the Board of Directors are: digital transformation; innovation development; risk management; finance, internal control and audit; HR and talent development; strategic management expertise; and sustainability (ESG).

This competence profile supports forward-looking leadership, while the bank's visibility in the national and regional banking ecosystem shows its strategic positioning:

In 2022, Asiamoney, as part of the Best Bank Awards for Kazakhstan 2022, recognised Halyk Bank as the best in three categories: Best Investment Bank, Best Bank for ESG, and Best Bank for Diversity & Inclusion.

Together, these elements indicate that Halyk Bank is both responding to sustainability pressures reactively and cultivating the expertise and recognition to shape its own ESG trajectory through innovation.

The bank's orientation toward risk is also maturing, as seen in its integrated **risk management** systems. Regulatory compliance is complemented by sanctions awareness and procedural rigor:

> *To mitigate sanctions-related risks, credit institutions continued to strengthen internal procedures and controls, including multi-level screening processes, and introduced a range of additional measures to prevent violations.*

Further evidence of internalised risk routines appears in audit practices:

The main areas of activity and responsibilities of the Risk Committee include: […] integrating ESG risk management into the overall risk management system, aiming to minimise the negative impact of credit and investment activities; […] implementing climate risk impact assessments on the Bank's business model and strategic planning, including scenario analysis and stress testing.

These examples illustrate the embedding of ESG-related risks (e.g., geopolitical, reputational) into mainstream financial and operational control procedures, securing that sustainability threats are managed alongside traditional financial risks.

The **social responsibility** sub-capability emerges through structured stakeholder engagement and transparency. Halyk Bank uses multiple channels to maintain inclusive communication with a broad range of constituencies:

Table of engagement with key stakeholders in 2022 […] Annual and interim financial statements, Quarterly conference calls with investors to present the Bank's

financial results […] Call centre, Internet-banking, including the Bank's mobile application, Corporate website, Advertising campaigns, Social media, Employee satisfaction and workplace climate surveys

The bank also commits to public accountability through ESG reporting:

Another stakeholder engagement tool that the Bank uses is the preparation and publication of its sustainability report. This report has been prepared in accordance with the best practices of non-financial information disclosure and GRI Standards to provide an objective and transparent presentation of the Bank's ESG performance.

These mechanisms point to a deeply structured engagement architecture, supporting both transparency and mutual responsiveness in bank-stakeholder relations.

Finally, the capability for **supply chain sustainability** reflects a systemic approach to embedding ESG criteria across planning, monitoring, and governance:

To ensure effective sustainability management, the Bank has implemented a multi-level ESG management system, which includes strategic planning, initiative oversight, performance monitoring, and regular reporting.

This is aligned with international standards and regulatory expectations:

> *The Bank publishes a sustainability report based on international GRI standards and in accordance with TCFD recommendations.*

Moreover, sustainability is treated not as peripheral but central to corporate performance and competitive strategy:

> *These initiatives were aimed at improving the performance of corporate governance bodies, strengthening internal control and risk management systems, and aligning the Bank's activities with ESG principles.*

Through these systems, the bank complies with ESG frameworks and builds institutional memory, performance review, and ESG-oriented decision routines into its broader supply and governance networks.

Deductive coding identifies seven sub-business capabilities within Halyk Bank's Process domain. The reports describe activities in innovation, risk management, continuous improvement, social responsibility and supply-chain sustainability. Their presence in the same domain does not establish that they operate as an integrated system. The material also does not demonstrate a transition from procedural compliance to institution-wide sustainability governance.

Inductive sub-capability coding

Portfolio Carbon Footprint Management

As part of work to determine the carbon footprint for indirect emissions from the portfolio financed by the Bank (Scope 3), carbon intensity factors were calculated for industries and major borrowers, a methodology was developed to assess the portfolio's carbon footprint, its carbon footprint was consolidated, emission standards were determined for project areas and questionnaires were prepared for project financing.

The bank calculated carbon intensity factors for industries and major borrowers, developed a methodology for the carbon footprint of its financed portfolio, and prepared questionnaires for project financing. Climate aspects thus enter the assessment of the loan portfolio. The excerpt does not state how the results are used in lending decisions.

Interpretation

Deductive coding focuses on innovation, and inductive coding adds the integration of climate aspects into financial processes. Innovation thus serves customer-facing improvements as well as ESG risk governance.

Strategic Implications

These developments show that Halyk Bank is building process-based sustainability capabilities. However, success hinges on the interoperability of innovation and risk systems. Fragmentation or redundancy could limit effectiveness.

Deductive-Inductive Interplay

Here, a productive divergence can be observed. The inductive coding introduces new forms of ESG process management, while the deductive side shows foundational innovations. Together, they offer a multi-layered portrait of process capability evolution.

Technology PBC

Deductive sub-capability coding

Technology does not feature prominently in the deductive data beyond being indirectly implied through innovations like biometric systems.

Inductive sub-capability coding

Internal Fintech R&D Unit

Acknowledging that the future of the financial market depends directly on the level of digitalisation […], we established a new subsidiary - "Halyk Lab." The company launched operations in Q4 2024 and focuses on the development and implementation of software for financial institutions

The bank established a new subsidiary, Halyk Lab, which develops software for financial institutions. The unit is a separate company within the group. The excerpt refers to digitalization in general and does not state a direct link to sustainability.

AI-Optimized Data Infrastructure

In 2024, Kazteleport significantly expanded and modernised its technological infrastructure, commissioning a commercial data centre in Astana certified to international standards, as well as a new data centre in Almaty to support high-load services such as artificial intelligence.

Kazteleport, a Halyk Group company, commissioned a data center in Astana and a new data center in Almaty for high-load services such as artificial intelligence. The report does not link this infrastructure to ESG analysis or to environmental goals, so its relevance for sustainability remains an interpretation.

Interpretation

Technology as a PBC is emergent and distinctly inductive in Halyk Bank's case. The reports present AI, data centers, and fintech R&D as digitalization measures and do not link them to sustainability.

Strategic Implications

The bank's focus on in-house technology capabilities points to autonomy in digital development. This proactive stance may offer competitive differentiation, particularly in markets where ESG digital capabilities are nascent.

Deductive-Inductive Interplay

The complete absence of technology from the deductive coding, despite its strong emergence inductively, highlights a possible analytical blind spot in the original framework. It suggests that the framework may undervalue technological dynamism or that tech innovation outpaced the pre-set categories.

Cross-capability synthesis

Deductive coding identifies reported strategies, organizational structures and communication arrangements. Inductive coding adds a methodology for the carbon footprint of the financed portfolio and the Risk Committee's responsibility for assessing climate risk in the business model and strategic planning, including scenario analysis and stress testing.

These disclosures identify specific climate-related governance practices. The reports do not link investments in Halyk Lab and data centres to ESG analysis. They therefore do not establish that the broader digital infrastructure functions as a sustainability capability or that the bank is moving from compliance to a more advanced response configuration.

KPO

Strategy PBC

Deductive sub-capability coding

KPO demonstrates a mature strategic commitment to sustainability. The firm articulates sustainability as an embedded dimension of corporate strategy:

> *The KPO mission reflects our commitment to ensuring long term social, environmental and economical sustainability, which we plan to achieve through executing our "KPO 365 Strategy", consisting of – 3 objectives, 6 focus areas and 5 roads (see fig. 1).*

The report also links its sustainability goals to national and international priorities:

> *The KPO Green Strategy was developed in 2023 in line with the country strategic plans and takes into account global world trends for reduction of the carbon footprint of products.*

Both statements are coded as Strategic Management because they tie the KPO 365 Strategy to social, environmental, and economic sustainability and state that the Green Strategy follows the country's strategic plans and global trends in reducing the carbon footprint of products. They remain general and do not show how this alignment is implemented.

Inductive sub-capability coding

The inductive analysis identifies internal carbon pricing as a business sub-capability for including climate considerations in corporate decision-making. KPO describes how carbon pricing enters its planning:

We actively monitor regulatory changes related to emissions trading systems, carbon pricing, renewable energy, and offsetting. These factors are incorporated into our potential scenarios that offer insights into how the energy transition might evolve in the medium and long terms. These insights guide our strategic vision, funds allocation, and GHG reduction targets.

The report addresses this sub-capability only indirectly. It does not describe an internal carbon price, and it states that regulatory developments on carbon pricing enter the scenarios that guide strategic vision, funds allocation, and GHG reduction targets. The report also notes that uncertainty about carbon pricing makes it harder to set assumptions for project planning and investment decisions. The finding is consistent with the deductive results on strategic integration and adds a financially oriented aspect that the deductive coding had not captured.

The development of a climate risk assessment framework as a business sub-capability is evident in companies' efforts to systematically evaluate environmental threats. KPO describes its approach as follows:

We are consistently improving our approach to assessing and managing the risks and opportunities arising from climate change. This involves considering various time horizons and their relevance to risk identification and business planning.

The statement indicates a structured approach to assessing climate-related risks and opportunities over different time horizons and links this assessment to risk identification and business planning. Neither KPO report refers to the TCFD recommendations, and the report describes the approach as still being improved.

There is strong alignment between deductive and inductive findings, both pointing to a deeply embedded sustainability strategy. However, inductive insights enrich this view by surfacing emerging strategic tools (e.g., carbon pricing in scenarios, climate risk assessment), suggesting KPO 's strategic capability is integrated but evolving in sophistication.

People PBC

Deductive sub-capability coding

KPO reports an organizational structure dedicated to sustainability, a sub-capability for internal governance:

The topics on sustainable development, such as social, economic, environmental topics are captured in Sustainability Sub-committee at Operator level – represented by both Operators and KPO. Its main purpose is to advise on identified issues, concerns and impacts of KPO business on the communities living in KPO's direct impact area.

These measures indicate a clearly defined governance framework supported by domain-specific expertise, enabling the company to effectively manage sustainability across business functions and ensure consistent internal alignment.

Employee Empowerment is confirmed as a sub-capability by the following passage on the HSE card system:

Big number of observations collected from the HSE cards system about the use of single-use disposable plasticware and violation of the principles of waste segregation fundamentals. In this regard cancellation of disposable plasticware (plates and cutlery) use in BC Karachaganak, BC Chagala, BC Nurdaulet and Samal-2 offices was initiated.

Such practices go beyond skill-building: they establish a motivational infrastructure that nurtures individual agency and encourages a workplace culture oriented toward sustainability. By enabling employees to actively engage with ESG objectives,

the organization cultivates a distributed commitment to long-term sustainability performance.

Communication was deductively coded by the following statement:

This Report is our sixteenth in a row. The Report is a tool of transparency and communication with all stakeholders about the impact of KPO activities on the region of its presence as part of the presented material topics.

This demonstrates a commitment to transparency and stakeholder engagement, foundational to the People dimension of sustainability.

Inductive sub-capability coding

Gender-Specific STEM Capability Building

Gender-specific STEM capability building emerges as a business sub-capability aimed at inclusion in technical fields. KPO reports:

As an ESG-oriented company, KPO is committed to a gender-balanced human resource. In this regard, the Women's Club supports ideas aimed at empowering women in the oil and gas industry and further promoting them to leadership roles. In addition, […] the mentoring initiative has been implemented where special attention is paid to the professional development of women

This effort reflects a strategic approach to workforce development that goes beyond regulatory compliance, actively addressing structural barriers in STEM professions. It signifies a more advanced people strategy, one that recognizes diversity as a social imperative, and as a driver of innovation and long-term organizational resilience.

ESG Supplier Capability Certification is an inductive sub-capability that links internal sustainability priorities with the development of supplier staff. KPO describes its work with contractors as follows:

KPO has sets up an objective to train and improve environmental awareness and qualification of contractors. Thus, during 2022, KPO carried out active work to raise the awareness of contractor employees during regular meetings with responsible personnel, visits, as well as familiarizing with KPO requirements at quarterly and annual Contractor HSE forums.

demonstrating a commitment to extending its capacity-building ethos beyond organizational boundaries. While this initiative intersects with supply chain governance, its positioning under "People" reflects an intentional strategy of external empowerment. By fostering ESG competencies within its supplier network, the company promotes shared standards, and advances its sustainability maturity through ecosystem-wide human capital development.

Community Co-Design for Ecological Planning is an inductive sub-capability based on the participation of local stakeholders in environmental planning. KPO reports the following on the greening of the sanitary protection zone (SPZ) around its field:

Based on the results of the work performed, decisions were made on the reconstruction of previously planted plantations around the settlements […], forest belts within the SPZ, the creation of new forest belts within the SPZ boundaries […]. Consolidated plot plans for placement of SPZ facilities and landscaping were agreed by interested parties, business organizations and agricultural producers.

The report addresses this sub-capability only indirectly. The passage describes the renovation and creation of forest belts around nearby settlements and states that the plot plans were agreed with interested parties, business organizations, and agricultural producers. This is consultation on an ecological planning project. It extends the People PBC to agreement with local stakeholders, which can support long-term community trust.

The combined deductive and inductive findings reveal an expansive view of KPO's People-related capabilities. Deductive results emphasize formal mechanisms that embed sustainability structurally and culturally. Inductive coding, by contrast, uncovers emergent, socially responsive, and context-specific initiatives that extend these capabilities into gender inclusion, supply chain development, and community partnership.

This interplay shows several patterns. First, both coding types recognize human capital development as core to the company's sustainability agenda. Second, inductive insights significantly deepen the understanding of how KPO addresses inclusivity and empowerment, which were areas not fully captured by the formal deductive framework. Third, the Inductive Sub-Capability Coding points toward a maturing sustainability orientation that is participatory, systemic, and equity-focused. From our point of view, these are hallmarks of advanced organizational sustainability capabilities.

In sum, KPO 's People capabilities are structurally embedded, and adaptively evolving. The integration of community, gender, and external partner engagement reflects an expansive and forward-looking people strategy, one that both supports operational excellence and cultivates long-term social legitimacy.

Process PBC

Deductive sub-capability coding

The Process Packed Business Capability (PBC) refers to how KPO incorporates sustainability into the internal design, operation, and governance of its value-creating activities. A deductive coding of the company's sustainability reports shows a solid integration of five interrelated sub-business capabilities that underpin this PBC: process innovation and adaptation, product innovation and adaptation, risk management, social responsibility, and supply-chain sustainability. These capabilities work in concert to translate strategic sustainability commitments into operational reality. What follows is a detailed within-case analysis of how these sub-business capabilities are expressed and institutionalised in KPO 's disclosures.

KPO 's capacity for **process innovation and adaptation** is evidenced by a clear pattern of eco-efficiency improvements and technological upgrades. The company commits to targeted emissions reductions and energy optimisation, as illustrated in the following excerpt:

As previously, we continued our journey towards zero emission and applied measures listed below to reduce greenhouse gas (GHG) emissions, and consumption of water and resources: High-efficient environmentally friendly burners to eliminate where possible / reduce the need for flaring and the need for disposal of contaminated fluids.

Further, the company's implementation of circular resource practices is made evident through its water systems:

In this view, in the past last two years, KPO has been carrying out a number of activities allowing optimization of technical water consumption and increase the reuse of treated wastewater, rainwater, and melt water.

Environmental management is also institutionalised through alignment with international frameworks:

In 2023, KPO successfully passed the ISO 14001 audit that confirmed compliance with the requirements of the standard. […] According to the RoK Environmental Code, KPO has an obligation to implement the best available techniques (BAT). In 2023, an integrated technical audit (ITA) for compliance with BAT was conducted.

Energy efficiency measures are also reported:

In 2023, KPO continued implementation of scheduled activities in accordance with Energy Saving and Energy Efficiency Plan for 2022–2026. […] The work continued on replacing lamps with LED ones at production facilities and utilities areas. In 2023, 990 lamps were replaced in the Company facilities.

The four passages show that KPO includes environmental measures in its technical operations and management routines, from burners that reduce the need for flaring and the reuse of treated wastewater to an ISO 14001 audit, a technical audit for best available techniques, and an energy efficiency plan. These upgrades probably require coordination among Operations, Engineering, and HSE teams, and their scaling may be limited by capital investment cycles and infrastructure.

Closely aligned with process change is KPO 's emerging capability in **product innovation and adaptation**. The company discloses early efforts to shift the nature of its product offerings toward lower-carbon profiles:

A key ingredient for KPO to reach net zero will be the ability to use natural gas to convert it to hydrogen. The resultant CO2 will have to be captured and reinjected. The Karachaganak Gas Plant will be a critical enabler to the development hydrogen as a fuel in the future.

The report also links energy efficiency and renewable energy to the carbon footprint of its products:

As we strive to deliver greater value with fewer emissions, currently we are focusing on energy efficiency, renewable energy, nature-based offsetting opportunities and methane emissions control. Enhancing energy efficiency and incorporating renewable energy sources will help us reducing greenhouse gas emissions and the carbon footprint of our products.

Experimentation is already underway through trial projects:

Initiated GHG emissions reduction plan and piloted other improvement initiatives. Implemented use of solar powered mobile offices used for H2S monitoring on some of our rigless sites (replacing the traditional diesel generator sets for these units).

Gas utilization is also managed through programs agreed with regulators:

In accordance with legislation requirements, KPO develops and approves with Regulatory Bodies the programmes of sour gas processing development. In 2023, the KPO gas utilization rate reached 99.95% (99.93% in 2022). The performance target

approved by the RoK Authority under the 2023 Associated Gas Processing Development Programme is 99.84%.

The disclosures indicate that KPO considers lower-carbon options for its products and operations, such as hydrogen with the capture and reinjection of CO_2, solar-powered mobile offices at some well sites, and a high rate of gas utilization. The hydrogen option is a long-term vision, and the solar offices are a pilot. The report presents gas reinjection mainly as a means to maintain reservoir pressure and not as an emission reduction measure. The activities could become a basis for diversification in a changing energy market.

KPO 's approach to **risk management** shows an advanced integration of environmental risk into enterprise-wide systems. Sustainability-related threats are treated as core strategic risks:

As a responsible oil and gas Operator, KPO makes particular emphasis on managing business risks encompassing all dimensions, including, but not limited to: 1. De-Carbonization Process affecting business; […] 5. Suspension of environmental emissions permit with further potential withdrawal

The firm also uses scenarios of the energy transition:

We actively monitor regulatory changes related to emissions trading systems, carbon pricing, renewable energy, and offsetting. These factors are incorporated into our potential scenarios that offer insights into how the energy transition might evolve in the medium and long terms.

This is done in line with widely adopted disclosure norms:

The potential impact of climate changes comes from risks, such as flooding and droughts, and high temperatures during the summer which could potentially impact KPO's facilities, operations and supply chain. The frequency of these hazards and impacts is expected to increase.

Governance procedures ensure regular oversight and accountability:

Risks are reported through Corporate HSE Risks Register […]. The HSE risk model outcomes feature into the business risk model. The final risk model is reviewed and summarized in the preparation for the KPO Risk Committee meetings, which is participated by KPO senior management.

The passages show that decarbonization and a possible suspension of the emissions permit are listed among the business risks, that regulatory changes such as carbon pricing enter scenarios of the energy transition, that physical climate risks are identified, and that the HSE risk model feeds into the business risk model prepared for the Risk Committee. This can support the prioritization of sustainability-related investment. The report also names changing preferences of investors and financial institutions as a risk for access to capital. It does not refer to the TCFD recommendations and notes a big uncertainty around carbon quota reduction rates and carbon pricing, which limits the precision of such scenarios.

The **social responsibility** sub-capability focuses on how KPO builds its social licence to operate through local engagement and investment. The company describes its approach to community development:

KPO implements social and infrastructure projects in the West Kazakhstan Oblast (WKO) on the annual basis under the terms of Annex 5 to the Final Production Sharing Agreement. […] In 2023, 24 projects were under implementation, including 15 schools in the regional districts, sports and health centres and other facilities.

Importantly, this is accompanied by participatory mechanisms:

In 2022, KPO held public hearings on the construction projects "Expansion of Karachaganak 1. 2nd stage of construction", "KPC. Construction of a new caustic neutralization complex (adjustment)". According to the requirements of the Environmental Code of the Republic of Qazaqstan, public hearings were held in the form of open meetings in 4 rural districts.

KPO also highlights the scale of its commitment:

In November 2022, KPO has received "PARYZ – 2022" Award in the nomination "The Best social project of the year" for the implementation of the Multifunctional Palace of Culture in Uralsk that was built as part of the Company's programme for social infrastructure development of the region. […] KPO total investment into the project exceeded $24 million.

The passages combine investment in schools, sports and health centers, and a cultural center with public hearings on construction projects. Such hearings can reduce the risk of social conflict and project delays. The hearings follow the requirements of the Environmental Code, and the report does not show how community input changed project plans. Measuring long-term community impact and managing diverse expectations remain challenges that may limit the effect of these efforts.

The company's capability in supply-chain sustainability shows how KPO extends ESG expectations beyond its organizational boundary. It sets standards of safety, ethics, compliance, and sustainable development for suppliers and contractors:

KPO insists on contractual relationships with suppliers and contractors, who maintain high standards and demonstrate commitment to personal and process safety when providing services or goods, as well as maintaining the set standards of ethics, compliance and sustainable development. These fundamental principles are incorporated in and are evaluated at every stage of the contract and procurement process […].

Sourcing decisions also favor local content:

The Tender Procedures focus on the development of local content including goods manufacturing in the Republic of Kazakhstan by means of early tenders, trial orders, contracts in exchange of investments, conditional bid reduction, and Kazakh-only tenders.

Procurement policies are reinforced through regulatory and safety checks:

Expanded requirements for contractors were reflected in Schedule D, updated in May 2022, to Company contracts on HSE requirements. These include requirements for […] compliance with the conditions of environmental permits, for waste management, discharges and emissions, environmental fines, etc. Thus, KPO has the opportunity to evaluate new contractors for environmental criteria.

The company also supports supplier development:

To help local potential contractors and suppliers better compete and to minimize disqualification risks for such companies, KPO conducts structured pre-tender engagement sessions. In these sessions, clear explanations of KPO tender requirements are provided to the bidders, as well as lessons learned.

This sub-capability reflects a dual rationale: managing ESG risks in the supply chain while building local economic ecosystems. It also implies strong collaboration between Procurement, HSE, and Community Relations teams. However, supplier readiness and ESG data reliability remain ongoing challenges for achieving consistent implementation.

Overall, these five sub-business capabilities show that the Process PBC at KPO is being actively developed through both strategic intent and operational embedding. Process and product innovation focus on decarbonisation and resource efficiency; risk management ensures that sustainability is governed through formal systems; social responsibility and supply-chain sustainability expand the firm's accountability and value co-creation beyond its immediate operations.

Overall, the Process PBC illustrates a shift from compliance to capability. Through structured routines, stakeholder engagement, standard alignment, and supplier integration, KPO is institutionalising sustainability across its core operations. Barriers such as capital cost, supplier heterogeneity, and data complexity remain but the presence of multiple, reinforcing sub-business capabilities positions the company to manage sustainability not as an external constraint but as a source of long-term advantage.

Inductive sub-capability coding

The inductive coding yields no additional Process sub-capability for KPO that is supported by the reports. Both reports state in their GRI content index that information on Scope 3 emissions is unavailable.

Deductive and inductive findings converge in portraying KPO 's Process capabilities as stable and changing. The company upgrades existing operations, while both reports state that information on Scope 3 emissions is unavailable.

Technology PBC

Deductive sub-capability coding

The evidence for Technology Adoption as a deductive business sub-capability reflects a deliberate strategy to enhance operational sustainability through advanced digital solutions.

For example, the Telemetry Phase I project as part of the Production Optimization focus area was successfully executed in 2021, which allows acquiring real-time data from wells thus helping to significantly reduce the personnel exposure to well sites and better tune the Integrated Network Model for production optimisation purposes.

The telemetry project provides real-time data from wells, which are used to tune a network model for production optimization. It also reduces the exposure of staff at well sites. This shows that KPO uses digital monitoring and modeling in its core operations. The report describes these effects qualitatively and does not quantify them.

The development of **Data Management and Reporting** as a business sub-capability reflects a digitally mature approach to sustainability governance and performance oversight.

In 2020 KPO has developed and introduced the environmental aspects management system EnvAR, which is a convenient and effective management tool. […] In 2022, the EnvAR system was supplemented with functionality that allows you to automatically track the implementation of additional activities.

The EnvAR system serves as a register of environmental aspects, and since 2022 it tracks the implementation of additional control measures automatically. It improves the traceability of environmental measures and supports internal accountability. The passage does not describe real-time monitoring across operations.

Inductive sub-capability coding

UAV-Based Environmental Monitoring emerges inductively as a business sub-capability that uses remote technologies for inspection and environmental oversight.

Moreover, some smaller projects like, Digital Signature (internal) or Launching the drones for remote inspection, implementation of barcodes for warehouses, monitoring of key performance indicators, exception-based well surveillance, E-medical examination units and digitization of forms and work processes are already demonstrating their benefits in daily activities.

This approach exemplifies technological agility in risk management, enabling more frequent monitoring, early detection of anomalies, and reduced human exposure to hazardous conditions. The use of UAVs reflects a mature, foresight-driven mindset in mitigating environmental and operational risks through responsive and efficient monitoring systems.

Contractor Digital Engagement emerges as a business sub-capability that extends digital tools to external actors for environmental reporting and compliance.

In order to communicate KPO requirements to the contractors, an e-guide on environmental reporting and compliance has been released. […] It should be noted that this guide and its applications can be downloaded from any electronic media via QR.

The e-guide gives contractors digital access to KPO's requirements for environmental reporting and compliance. It is a guidance tool and not a channel through which contractors report incidents. The requirements are thus communicated beyond KPO's own staff.

The deductive findings describe technology used for production optimization and for the management of environmental aspects, namely well telemetry and the EnvAR system. The inductive findings add drones for remote inspection and a digital e-guide that communicates environmental reporting and compliance requirements to contractors. The reports link only part of these applications to sustainability. Telemetry reduces staff exposure at well sites, and EnvAR tracks environmental control measures. A Digital Oil Field project aims to use machine learning for production forecasting, not for environmental purposes.

In sum, Technology supports parts of KPO's sustainability management, mainly environmental control and staff safety. The convergence of formal systems (deductive) and emergent tools (inductive) suggests a firm actively engaging in digital transformation not just for efficiency, but for broader ESG performance and stakeholder legitimacy.

Cross-capability synthesis

Deductive and inductive data align most clearly in the Strategy PBC. The deductive framework identifies institutional features, and the inductive coding adds the treatment of carbon pricing in scenarios of the energy transition and the assessment of climate-related risks and opportunities. For Process, the inductive coding adds no further sub-capability, because both reports state that information on Scope 3 emissions is unavailable. Technology appears in both codings. Deductively, it covers well telemetry and the EnvAR system, and inductively, drones for remote inspection and a digital e-guide for contractors. The inductive findings add specific mechanisms to the general deductive categories, and the deductive coding places these mechanisms within the broader corporate commitments.

The practices identified above specify how the reports describe capabilities within the PBC categories. The material does not establish their relative maturity or measure the effectiveness of their integration.

Kaspi

Strategy PBC

Deductive sub-capability coding

The **Strategy** Packed Business Capability (PBC) reflects how sustainability is embedded in Kaspi overarching strategic orientation, decision-making structures, and long-term planning mechanisms. Deductive coding under this PBC yielded a single but rich **Strategic Management** Sub-Capability supported by thematically aligned disclosures. These statements, derived from the 2023 Corporate Report, demonstrate a tightly coupled relationship between mission intent, board-level oversight, and executional planning. Although only deductive results were used, the patterns that emerge reveal a strategically coherent and purpose-driven approach to sustainability that merits close analysis.

Kaspi sustainability capability begins at the level of corporate identity. The company states that:

Our mission includes working to advance the needs of a broad group of stakeholders, namely our employees and the community in which we live and operate, while striving to reduce the environmental impact of our growing operations.

This articulation positions sustainability as an integral element of strategic purpose. Framing stakeholder responsiveness and environmental stewardship within the mission elevates ESG from a peripheral concern to a central organising principle. Such anchoring provides directional legitimacy and prepares the groundwork for strategic investments aligned with long-term value creation.

This mission-driven orientation is substantiated by a formal governance structure. The company notes that:

As part of our listing in the US, we updated our Code of Ethics and Corporate Governance Code. We aspire for our board and its committees to align with other best-in-class technology companies listed on Nasdaq.

The quote shows that the company revised its Code of Ethics and Corporate Governance Code for its listing in the US and aims to align its board and committees with best-in-class technology companies listed on Nasdaq. The report addresses board

oversight of sustainability only indirectly. It names no board committee with an explicit ESG mandate, and the quote does not show how ESG risks and opportunities enter corporate strategy.

Finally, the company outlines how it intends to take its ESG agenda forward. As reported:

Going forward we believe we can continue to make progress across four key pillars - social innovation, responsible business practices, employees & culture and environmental sustainability. We will also reinforce our efforts to ensure best-in-class transparency and disclosure around our corporate governance and ESG efforts.

The statement names four pillars for future progress and commits the company to transparency on corporate governance and ESG. It indicates a forward-looking ESG agenda. The quote does not describe a formal roadmap and does not specify how the pillars are connected to performance targets or budgets.

The reference to the board and its committees indicates that governance reforms are sponsored at the top of the organization. Board involvement can make goal-setting legitimate across departments and signals long-term commitment to external stakeholders. The report does not state whether this sponsorship extends to specific ESG goals.

Kaspi's mission names a broad group of stakeholders, and its ESG statement identifies four areas for future progress. These statements document the company's declared orientation. They do not specify stakeholder-mapping procedures, inclusive consultation processes or adaptive materiality assessments. The quoted ESG statement also does not establish the existence of ESG-linked dashboards, cross-functional KPIs or shared incentive structures. These practices cannot be inferred from the mission and stated ambitions alone.

The report describes sustainability commitments in the corporate mission, formal oversight and a roadmap. These disclosures are coded as Strategic Management. They document the stated governance arrangements, but do not establish their implementation across the organization or their effects on sustainability performance.

The main challenge ahead lies in managing growth without diluting impact reduction goals and in deepening ESG integration within operational and performance systems. The current configuration mirrors an organisation that treats sustainability not as external pressure or philanthropic obligation. By that it strategically embedded source of value creation and legitimacy. It is a model of ESG integration that blends high-level purpose with structured delivery, which is a critical condition for changing into a dynamic sustainability leader.

Inductive sub-capability coding

The capability of Disaster-Responsive Lending Relief reflects an adaptive alignment between financial services and societal resilience, presenting ESG responsiveness in times of crisis.

Following severe flooding in parts of Kazakhstan in early 2024, Kaspi.kz quickly stepped up and donated KZT 620 million to help Kazakhstani's impacted. We also offered interest free, repayment holidays to our effected loan customers.

The report describes support measures following the 2024 floods. The passage is coded as Disaster-Responsive Lending Relief because the company reports adapting its services to affected customers. The excerpt does not establish whether the response is repeatable or document its effects on social outcomes.

People PBC

Deductive sub-capability coding

The company's approach to sustainability **communication** as sub-capability is cautious and indirect. One excerpt states:

In 2023, we published our first detailed Social Impact Report, covering our activities carried out in 2022. Any information contained on our investor relations or other websites, including the Social Impact Report, does not form part of this annual report.

The annual report refers to the Social Impact Report but states that its content does not form part of the annual report. Sustainability communication is thus kept separate from financial reporting. The statement does not refer to internal engagement on sustainability, which indicates an early stage of this sub-capability.

On the other hand, the articulation of Employee Empowerment as a business sub-capability reflects an evolving alignment between talent strategy and sustainability goals, particularly from perspective of risk mitigation and motivational investment.

The concept of directly responsible individuals is the most important way by which we organize ourselves and refers to the person, with whom accountability for any given product sits. […] For employees the benefits are increased responsibility, clear expectations and accelerated career growth.

The report assigns accountability for products to named individuals and links this arrangement to responsibility and career development. The passage is coded as Employee Empowerment. It does not specify sustainability-related decision rights or show whether the arrangement improves sustainability performance.

Inductive sub-capability coding

Graduate Talent Acceleration as an emergent capability is shown by the Kaspi Lab initiative and positions the firm as a talent incubator:

Our Kaspi Lab's corporate university program is specifically designed to recruit Kazakhstan's top University graduates and is just one example of this.

This capability supports early-stage pipeline development, creating organizational stickiness and sustainability-aware employee values. It also strategically aligns recruitment with internal sustainability aspirations.

Nationwide Distributed Workforce Enablement emerged as an inductive sub-capability from the following statement:

With our flexible approach to work we can hire people located in all regions of Kazakhstan.

It shows a decentralization ethos. This democratizes access to work and builds socio-economic resilience, which can be seen as a hallmark of a stable sustainability architecture.

The deductive coding for People captures sustainability communication and product-level accountability, while the inductive results add talent development and

flexible work. Graduate Talent Acceleration complements the deductively coded Employee Empowerment with an early-career component.

Process PBC

Deductive sub-capability coding

Kaspi **Process** Packed Business Capability (PBC) illustrates how the platform-centric financial services provider translates its digital scale and product integration into operational effectiveness, innovation routines, and systemic risk oversight. The deductive coding shows seven interacting sub-business capabilities: process innovation and adaptation, product innovation and adaptation, continuous improvement, innovation for sustainability, risk management, social responsibility, and supply chain sustainability. Together, these reflect the firm's effort to transform executional agility into strategic resilience, especially as its super-app ecosystem expands across consumer and SME markets.

A key operational driver is **process innovation and adaptation**, which at Kaspi takes the form of competitive landscape mapping, macroeconomic responsiveness, and data-based market intelligence.

> *Little (ADL), a third-party consulting firm, to provide an independent view of the total addressable market for certain of our products and services in Kazakhstan, including an overview of recent macroeconomic and market dynamics, analysis of underlying trends and potential growth factors of the markets, an assessment of the current competitive landscape and other relevant topics, in the report (the 'ADL Report'). In connection with the preparation of the ADL Report, we furnished to ADL certain historical information about us and some data available on the competitive environment.*

Here, Kaspi embeds scenario analysis and external expertise into its internal process design. Strategic data feeds and external validation mechanisms keep processes aligned with changing market conditions. This is particularly relevant to product deployment and user acquisition. The excerpt does not describe backend automation or operational technologies. It does show how feedback and data inform the company's approach to scaling.

Closely related is the **product innovation and adaptation** sub-capability, which reflects how Kaspi evolves its offerings to deepen platform engagement and user retention.

> *Risks Relating to Our Business and Industry: We may be unable to attract sufficient new customers, engage and retain our existing customers or sell additional functionality, products and services to them on our platforms. The growth of our business depends on our ability to attract new customers and expand our existing customers' usage of our platforms by offering additional functionality, products and services and further integrating our Super Apps.*

This illustrates Kaspi's user-centred innovation rationale: a product launch must reinforce the super-app's core value proposition. New features are designed to increase daily active use (DAU), cross-service retention, and monetisation breadth. The innovation is systemic, integrating financial, retail, and government services into a single interface that adapts as user needs shift.

Kaspi's **continuous improvement** practices are embedded in its scoring, risk assessment, and performance calibration systems.

> *Our proprietary and highly adaptable scoring model and our regular access to data from credit bureaus, which allows us to assess the credit quality of our potential and current customers, cannot always accurately ascertain what the current indebtedness of any particular customer may be. Additionally, we have no tools to prevent our customers from taking an additional loan from other financial institutions or otherwise taking steps that heighten the risk that a customer may default on a loan from us.*

The analysis indicates the iterative evolution of Kaspi's risk-assessment rationale. The bank continually adapts its credit-evaluation frameworks to changing consumer behaviours and market liquidity risks. While the excerpt shows limitations, it also implies a culture of continuous learning, where algorithmic models are reviewed, tested, and improved over time.

The **innovation for sustainability** sub-capability is rooted in organisational culture and adaptability.

> *Our management also believes that a critical contributing factor to our success has been our corporate culture, which values and fosters teamwork and innovation. If we do not maintain the beneficial aspects of our corporate culture as we grow and implement more complex organization management structures, this would adversely affect our business, financial condition, results of operations and cash flows.*

Sustainability, in this framing, refers to cultural resilience, which may be understood as the ability to innovate at scale without eroding core values. The emphasis lies on organizational continuity rather than environmental outcomes per se. The focus is on preserving entrepreneurial energy, informal coordination, and responsiveness, even as Kaspi grows more bureaucratic. This interpretation of sustainability shows human systems and managerial adaptability as key assets.

Kaspi also expresses a user-focused model of **risk management**, where product design embeds security and simplicity.

We also aim to ensure that our products are secure and meet the highest quality standard. […] We are a user-centric organization and work to ensure that everyone involved in the creation and execution of our products does so with a user-centered design philosophy. Our teams design products based upon the experiences of the people who use them.

Rather than separate risk from product development, Kaspi integrates it into the design stage. Usability reduces operational and reputational risk by minimising friction, error, and misunderstanding. This reflects a risk-as-design perspective, where simplicity, trust, and digital literacy become control procedures.

The **social responsibility** sub-capability is more implicitly stated but connects to customer welfare and economic resilience.

> *Our efforts to attract and retain customers may also require more sophisticated and costly development, sales or engagement efforts and could be impaired for a variety of reasons, including adverse reaction to changes in general*

economic conditions or other factors. We may also take actions that fail to generate short-term financial results, and there can be no assurance that these actions will produce long-term benefits.

Here, Kaspi acknowledges the need to balance short-term pressures with longer-term social and market-building investments. Strategic patience and sustained customer engagement are treated as forms of social licence, especially in an economy vulnerable to external shocks. The implication is that digital inclusion and product stability are integral to the platform's societal role.

Finally, **supply chain sustainability** overlaps with scoring, partner risk, and ecosystem control.

We rely on third-party providers, including software and hardware suppliers, delivery services, credit bureaus and debt collection agencies. Any adverse changes in these relationships could adversely affect our business, financial condition, results of operations and cash flows.

While framed in terms of credit risk, this excerpt also reflects Kaspi's growing interdependence with third-party data providers, suppliers, and partners. The resilience of its digital supply chain, the reliability of credit bureaus, payment processors, and logistics partners impacts end-user outcomes. As the platform scales, this sub-capability will likely expand to include sustainability standards for digital and offline partners alike.

The **Process** PBC at Kaspi shows a digitally native ecosystem that blends platform innovation with procedural adaptability and user-centred controls. Process and product innovation focus on demand-side learning and agile feature deployment. Continuous improvement feeds off proprietary algorithms and partner data flows. Innovation for sustainability centres on preserving cultural agility, while risk management treats usability and design as first lines of defence. Social responsibility and supply chain sustainability emphasise long-term value creation and systemic ecosystem health.

Inductive sub-capability coding

The inductively coded **Consumer Circular Marketplace Management** as a business sub-capability illustrates a platform-based approach to enabling circular economy practices through consumer participation.

Kaspi Classifieds allows consumers to advertise services and jobs, as well as contribute to the rapidly growing circular economy with the sale and purchase of used goods.

The report presents Kaspi Classifieds as a contribution to the circular economy through the sale and purchase of used goods. A resale marketplace can extend the use of consumer goods through the platform. The excerpt does not quantify environmental effects.

The excerpt

e-Grocery is a great example of how with our data led approach and focus on superior user experience, we can be a force for positive change.

showcases a new process-innovation sub-capability, termed e-Grocery Operations Management. While primarily customer-facing, the capability incorporates logistical optimization, potentially reducing last-mile emissions. However, the environmental intent remains implicit.

Deductive and inductive coding emphasize different aspects of Kaspi's reported process activities. Inductive coding identifies Consumer Circular Marketplace Management and e-Grocery Operations Management as additional sub-capabilities. These activities may have environmental implications, but the cited passages do not quantify their effects or establish that environmental objectives guide their operation. The additional codes broaden the description of the case without demonstrating a more advanced sustainability capability configuration.

Technology PBC

Deductive sub-capability coding

Kaspi **Technology** Packed Business Capability (PBC) underpins every facet of its super-app ecosystem. Two mutually reinforcing sub-business capabilities, data management and reporting and technology adoption, explain how the firm captures value from its digital infrastructure while managing the operational and regulatory risks that accompany rapid platform growth.

Kaspi's commitment to **data management and reporting** is immediately apparent in its handling of sensitive information across multiple jurisdictions.

We collect, process and store personal data (including names, addresses, ages and bank details) from our customers, business contacts and employees […] and we must comply with data protection and privacy laws and industry standards in Kazakhstan, Azerbaijan, Ukraine and Uzbekistan. Those laws and standards impose certain requirements on us in respect of the collection […] and storage of such personal data.

The excerpt states that Kaspi collects, processes and stores personal data and is subject to privacy requirements in several jurisdictions. It is coded as Data Management and Reporting because it describes responsibilities for handling data. The passage does not specify encryption or access-control procedures and does not establish a direct link to sustainability-related data management.

The bank also embeds external market intelligence directly into its reporting architecture:

> *In connection with the preparation of the ADL Report, we furnished to ADL certain historical information about us and some data available on the competitive environment.*

The excerpt states that Kaspi supplied historical information and market data for the preparation of an external report. It documents information sharing with an external analyst. It does not establish independent validation of growth assumptions, assurance of sustainability disclosures or the use of the analysis in internal planning.

Finally, the strategic importance of reliable data streams is emphasized by Kaspi's own platform-scale ambitions:

Our ability to maintain our position as a business used by people in Kazakhstan for all aspects of their day-to-day spending relies, among other things, on: […] the

effectiveness and security of the procedures we have in place to maintain the safety, security and integrity of the data in our platforms

Kaspi identifies the security and integrity of platform data as conditions for maintaining its service offering. This supports the coding of data governance as an operational capability. The excerpt does not specify the timeliness of the data or show how the capability is used for sustainability-related monitoring.

Kaspi's second sub-capability, **technology adoption**, centres on the continual integration of proprietary and third-party digital solutions to enhance user experience and operational efficiency. Competitive pressure sets the pace:

> *Additionally, our competitors may have the ability to devote more financial and operational resources than we can to the development of new technologies and services and… a reduction in the fees we can generate.*

Awareness of this arms race drives Kaspi to invest aggressively in in-house R&D while scanning the market for complementary technologies. At the heart of its risk-pricing engine lies a home-grown algorithm:

We have developed an automated, centralized and big data-driven proprietary loan approval process that enables us to make instant credit decisions. The risk management department is responsible for maintaining scoring models and the decision-making process. The quality of approved loans is monitored by the risk management department on a day-to-day basis with periodic validation of the models.

The adaptability of this scoring model is a strategic asset. It lets Kaspi extend instant-credit services to millions of consumers while keeping default rates in check. Yet the excerpt also concedes residual uncertainty highlighting the need for continuous model refinement as new behavioural data and macro-signals emerge.

Reliance on external technology is equally explicit:

In addition to our own innovations, we rely in part on third parties for the development of, and access to, modern technologies.

Such partnerships accelerate time-to-market for contactless payments and other convenience features, and they introduce dependency risks (e.g., vendor lock-in, supply-chain disruptions, or security vulnerabilities). Mitigating those risks requires sophisticated vendor-assessment protocols and fallback architectures, processes that marry technology adoption with the governance muscle built under the data-management sub-capability.

Key enablers include an agile engineering culture, external validation through analytics partnerships, and a multi-jurisdiction compliance framework. Persistent challenges involve balancing speed with security, deepening cyber-resilience, and diversifying technology suppliers to avoid concentration risk. Addressing these gaps will be critical as Kaspi scales its super-app into new products and geographies, where data-sovereignty rules and competitive dynamics may differ markedly from its Kazakh core.

Inductive sub-capability coding

Inductively, a Transaction-Based Loyalty Engine was identified in the following statement:

Kaspi Bonus enables consumers to earn points when making transactions, which they can apply at checkout to reduce the cost of future purchases.

It reflects a behavioral design capability. While not directly linked to sustainability, this capability could support ESG nudging (e.g., rewarding sustainable consumption). It reflects advanced technological capabilities. These could influence behavior in ways that support sustainability.

The deductive coding identifies technical enablers, while the inductive coding describes a loyalty system. The report does not link that system to ESG objectives. Its possible use for sustainability-related purposes is therefore a proposal for future application, not an observed capability in this case.

Cross-capability synthesis

The qualitative coding identifies reported activities across all four PBC domains. Deductive codes capture formal governance and risk-related arrangements, while inductive codes add specific activities in talent development, crisis response and digital products.

This breadth of reported activities does not establish their integration or effectiveness. In the CMS application in sub-chapter 3.2, both Kaspi reports are classified as Internal-first and Process is the lowest-scoring domain. The case illustrates the distinction between reported activities and disclosed evidence of supply-chain governance.

Kaspi exhibits a rich and developing sustainability capability landscape. The combination of deductively structured and inductively emergent Sub-Capabilities offers both a diagnostic view of current maturity and a prognostic insight into future readiness. To move from compliance to transformation, the company must build tighter integration across PBCs, especially between Technology and Strategy, and elevate inductive insights into strategic planning cycles. The foundation is strong, and what remains is orchestration.

KAZ Minerals

Strategy PBC

Deductive sub-capability coding

Strategic Management is identified as a business sub-capability at KAZ Minerals in the following statement:

Climate-related risks are evaluated as part of the overall investment decision of whether to proceed with significant new projects. The Group has also begun to apply a theoretical price of carbon of $100/t to investment decisions and will continue to develop this process.

The statement shows that climate-related risks are part of the decision on whether to proceed with significant new projects and that KAZ Minerals has begun to apply an internal carbon price of $100/t to investment decisions. Sustainability considerations therefore enter investment planning, although the report presents the carbon price as a process that is still being developed.

Inductive sub-capability coding

Net Zero and Carbon Strategy Alignment emerges inductively as a business sub-capability that links the climate measures of KAZ Minerals to the national decarbonization pathway.

In the longer term, the Group will seek to increase the use of renewable energy sources where possible and in 2023 the Group made an investment into a portfolio of small operating and planned hydro power stations in Kazakhstan. The Government of Kazakhstan […] has adopted The Strategy on Achieving Carbon Neutrality by 2060.

The excerpt presents the Group's investment in hydro power stations with the national strategy for carbon neutrality by 2060. The report does not state a net zero target for the Group. Its climate targets are short-term intensity targets for the five-year period ending in 2024, so the alignment with net zero pathways is indirect.

These inductive insights reveal emergent strategic-level Sub-Capabilities previously absent in the deductive framework. This divergence illustrates how top-down strategic intentions may not yet be fully reflected in documented internal practices or frameworks but are nonetheless taking root as the company evolves.

People PBC

Deductive sub-capability coding

KAZ Minerals shows a mature **Communication** capability. The reports state

The Group uses a number of channels to communicate with its staff including websites, intranet sites, WhatsApp message groups, a corporate newsletter, TV news, a YouTube channel and a corporate podcast. Each of these communication channels has certain strengths which are suitable in different scenarios.

The report lists a range of internal communication channels and notes that each suits different situations. It does not state that sustainability performance is communicated through these channels, so the passage supports the Communication sub-capability only indirectly. The reports also describe quarterly town hall meetings and a yearly question and answer session with the Chair, which add a two-way element.

Employee Empowerment was coded deductively on the basis of the Direct Line, a yearly question and answer session between the Chair and employees:

Over the years, the Direct Line's influence has resulted in a number of employee-driven changes in KAZ Minerals – from the construction of new sports and leisure facilities at the Group's operations and parks in rotational camps, to the alteration of procurement procedures.

The report attributes concrete changes to employee input, such as new sports and leisure facilities and altered procurement procedures. This indicates that employees can influence decisions. The examples concern working conditions and procedures, so the passage shows employee voice in general, not employee ownership of sustainability.

Organizational Structure & Staff was confirmed as a business sub-capability through a Board committee with responsibility for sustainability matters:

The Health, Safety and Sustainability ('HSS') Committee is a Board Committee which is responsible for oversight of the Group's environmental policies, reporting, standards and compliance. Senior management are responsible for the Group's overall environmental performance.

The passage assigns oversight of environmental policies, reporting, standards, and compliance to a Board committee and responsibility for environmental performance to senior management. Responsibility for sustainability is thus anchored at both the governance and the management level.

Inductive sub-capability coding

The reports also state:

A Leadership Development Programme is in place to identify potential future leaders so that support in the form of training and mentoring can be offered. Potential successors are identified for key positions and individual development plans are created to support those identified.

This illustrates a targeted capability: **Operational Leadership Training for Engineers** as an inductive coded sub-capability. This inductive category enriches the deductive findings. It suggests that beyond general communication and training, there is a strategic attempt to cultivate sustainability champions within operational leadership as a forward-looking move in capability development.

Psychological Risk Awareness Training emerged as a novel Sub-Capability within the following statement:

During 2023, the Group's safety training was enhanced to include a training programme at Bozshakol, titled the Psychological Prevention of Unsafe Behaviour and Occupational Injuries. As part of this programme the in-house safety and health team was supported by external psychologists to improve employee safety through specialised training.

This reflects a progressive shift from traditional physical safety toward a more holistic understanding of worker wellbeing.

The deductive and inductive findings within the "People" PBC are largely complementary. Deductive categories captured broad structural and procedural investments, while inductive coding unearthed more specific, emergent practices such as psychological risk training. The synergy between these findings points to a deliberate, yet changing, approach to embedding sustainability within human capital strategies.

Process PBC

Deductive sub-capability coding

The reports reveal structured mechanisms for sustainability learning as **Continuous Improvement** as sub-capability:

We also believe that learning from incidents is fundamental, and as a result we thoroughly investigate all incidents, hazards and near-misses to understand all contributing factors and put effective controls in place.

Such iterative feedback loops are core to organizational learning and performance calibration. This can be read as indicating institutionalization. It suggests a well-developed culture of evaluation, essential for adaptive capacity and resilience in sustainability performance.

Innovation for Sustainability was also found at KAZ Minerals and was emphasized with the following statement:

During 2021, the Group has enhanced its usage of artificial intelligence ('AI') in its mine to mill process in order to improve production efficiency and reduce its energy use per tonne of copper produced.

The Group uses artificial intelligence in its mine to mill process to raise production efficiency and to lower energy use per metric ton of copper. The innovation thus

serves resource efficiency. According to the report, the system was first tested at Aktogay and is being rolled out to Bozshakol, so it is moving from trial to regular operation.

Inductive sub-capability coding

On-Site Preventative Occupational Health Services emerges inductively as a sub-capability that the deductive analysis did not cover:

Medical services on site at the East Region, where all of the Group's occupational health cases arose in 2023, have been enhanced to deliver greater focus on preventative management of occupational health, which the Group expects will result in improved health outcomes.

This suggests a shift toward anticipatory risk management and broadens the definition of process capability from compliance to care. It reflects a sustainability maturity where health is viewed not just as an output to manage but as a process to enable.

Here, inductive findings deepen the deductive understanding, especially by surfacing domain-specific and preventive capabilities like occupational health. The alignment across methods shows that KAZ Minerals embeds sustainability both as compliance and as an operational foresight and innovation pathway.

Technology PBC

Deductive sub-capability coding

Data Management and Reporting is coded on the basis of statements on environmental monitoring and emissions reporting:

The Group conducts detailed environmental due diligence prior to the development of new mining projects and continually monitors the impact of its activities on the environment, publishing key performance indicators on an annual basis.

The quote shows that KAZ Minerals monitors its environmental impacts continuously and publishes key performance indicators every year. The report of 2023 also states that Scope 1 and Scope 2 emissions are calculated according to the GHG Protocol. The report also names a limit: Scope 3 emissions have not yet been calculated because reliable data from key external sources are missing. The reports do not describe the systems used to manage these data.

Technology Adoption was found as a business sub-capability and illustrates KAZ Minerals' transition from traditional engineering practices toward digitally enabled environmental optimization.

Aktogay has partnered with Motion Metrics, a Canadian technology company which drives digital innovation in mining. Motion Metrics is working with Aktogay to implement an AI-based solution in the mine to mill process which aims to minimise energy consumption and improve safety throughout the site.

The passage shows that KAZ Minerals adopts external digital technology through a partnership with a specialized provider. The AI-based solution is meant to lower energy consumption and improve safety at the site. The report states these aims but gives no measured results for this tool.

Inductive sub-capability coding

Inductively, the emergence of **Drone-Based Operational Hazard Mapping** as a business sub-capability reflects KAZ Minerals' use of advanced technologies to enhance risk management and workplace safety in complex operational environments.

The use of drones is therefore not only significantly faster, but also safer as it reduces the need for employees to access hard-to-reach areas around the site. In geotechnics, drones are used to map structural disturbances, analyse pit stability, and visually inspect rock deformation as part of the ongoing works to monitor pit wall stability.

Drones replace manual surveys in hard-to-reach areas and are used to map structural disturbances and to monitor pit wall stability. This reduces the exposure of employees to hazardous areas and supports the preventive management of geotechnical risks.

Integrated Environmental Impact Monitoring System emerged as a further business sub-capability, based on the technical monitoring of sites exposed to climate-related risks:

To manage the risk posed by high levels of precipitation to open pits, underground mines or tailings storage facilities, the Group employs technology to monitor water inflow and wall movements.

The report addresses this sub-capability only indirectly. It states that technology is used to monitor water inflow and wall movements in open pits, underground mines, and tailings storage facilities as a response to heavy precipitation. At Aktogay, drones are also used to analyze pit wall stability and water inflows in the pit. The reports do not describe a sensor-based system for real-time monitoring of air or water quality, and the monitoring named here serves the management of climate-related physical risks.

Technology capabilities at KAZ Minerals are strongly represented and mutually reinforced across deductive and inductive coding. The deductive coding captures environmental monitoring, annual KPI reporting, and an AI-based solution for energy use. The inductive coding adds operational technologies such as drones and the monitoring of water inflow and wall movements. These findings reveal a company not just adopting technology, but integrating it strategically into sustainability performance systems. The inductive insights enrich the picture with emerging frontier technologies, while the deductive structure shows that such technologies are embedded in a cohesive, digitally oriented sustainability architecture.

Cross-capability synthesis

The deductive and inductive coding identify reported practices across all four PBC domains. In People, the material describes communication, training and organizational arrangements. Inductive coding adds training on the psychological causes of unsafe behaviour and operational leadership development. Process includes continuous improvement and preventive occupational health services. Technology includes environmental monitoring, digital systems, drones and the monitoring of water inflow and wall movements.

In Strategy, the deductive coding captures the use of climate risk and an internal carbon price in investment decisions. Inductive coding adds the reported link between

hydropower investment and the national carbon neutrality strategy. Oversight through the HSS Committee of the Board belongs to the deductive coding. These practices make the general PBC categories more specific. Their presence in the reports does not establish organization-wide integration, a transition from reactive to proactive management or a competitive advantage.

The deductive framework on the other side captures the foundational architecture, reporting lines, decision-making systems, training programs, and data structures. Meanwhile, the inductive coding exposes the edges of innovation, revealing how KAZ Minerals is experimenting with novel tools and governance procedures to address rapidly changing ESG demands. As sustainability expectations become more complex and institutionalized globally, KAZ Minerals appears to be shifting from reactive compliance to proactive capability-building. The company is integrating sustainability into its operating routines but is also positioning itself for strategic advantage in a resource-intensive industry under intense scrutiny.

In sum, this case illustrates how Packed Business Capabilities can serve as a powerful analytical lens for understanding how companies operationalize sustainability, not just in principle, but in practice, systems, and structure.

Kazatomprom

Strategy PBC

Deductive sub-capability coding

The presence of **Strategic Management** as a business sub-capability reflects Kazatomprom's commitment to formalizing sustainability within its organizational planning and oversight structures. They state:

In 2024, the Company approved its Sustainable Development Program for 2024–2030, defining strategic goals and risk management mechanisms related to the environmental, social and governance aspects of its activities. […] The Program includes specific goals and tasks for each ESG direction, as well as mechanisms for implementation, monitoring and evaluation of effectiveness.

The program defines strategic goals, risk management mechanisms, and tasks for each ESG area, with mechanisms for implementation, monitoring, and evaluation. It therefore represents a structured approach to ESG governance with internal accountability. The passage describes planning and control within the company and does not refer to external stakeholders, which leaves room for external engagement and adaptation to new sustainability challenges.

Inductive sub-capability coding

Inductively, Innovation Ecosystem Engagement emerges as a business sub-capability shows Kazatomprom's willingness to promote cross-sector collaboration and open innovation in support of sustainability goals within the following statement:

As part of its strategy to integrate science and industry, Kazatomprom, in cooperation with the Science Committee of the Ministry of Science and Higher Education, held a scientific and technological hackathon […]. Scientists and industry experts collaborated to solve 25 technological challenges presented by Kazatomprom. As a result of the hackathon, two projects were selected for program-targeted funding.

The hackathon brought scientists and industry experts together to work on technological challenges set by the company and gave the company access to external knowledge. The report addresses sustainability only indirectly here, since it presents the hackathon as part of its strategy to integrate science and industry and does not name sustainability goals. As a single event with two funded projects, it does not yet show a change in the innovation strategy.

The development of **Cross-Border Strategic Capability Sharing** as a business sub-capability reflects Kazatomprom's strategic engagement in international sustainability networks and knowledge exchange.

NAC Kazatomprom JSC actively engages with professional communities, industry associations and international organisations, recognising the importance of collective business efforts in achieving sustainable development goals. Participation in industry initiatives facilitates the exchange of experience, the adoption of best practices and the resolution of strategic challenges […].

This initiative shows both strategic foresight and geopolitical awareness, positioning the company as an active participant in shaping global sustainability discourse. By extending capability-building efforts beyond national boundaries, Kazatomprom signals a commitment to mutual learning, influence-building, and alignment with transnational sustainability standards, which can be regarded as an advanced form of strategic integration.

The deductive findings reflect internal control, while the inductive results reveal strategic agility. This dual approach suggests a hybrid strategic capability: grounded in governance, yet exploratory in implementation. However, the deductive framework may under-conceptualize dynamic, relational, and cross-border strategy components, highlighting a need to revise theoretical models.

People PBC

Deductive sub-capability coding

The deductive coding of **Communication** as a business sub-capability reflects Kazatomprom's commitment to structured and transparent external sustainability reporting.

Kazatomprom operates a robust system of internal and external communications, ensuring a multi-channel format for engagement with various stakeholders. […] The primary channel for external engagement is the Company's official website (kazatomprom.kz), which provides news updates, financial reports, sustainability data and operational information.

The passage names the corporate website as the main external channel and lists sustainability data among its content, which supports transparency and public accountability. The same section describes two-way internal communication through employee surveys and meetings with senior management, but it does not connect these internal channels to sustainability. Communication on sustainability therefore appears mainly one-way and directed at external stakeholders.

By contrast, the presence of **Employee Empowerment** as a business sub-capability shows Kazatomprom's efforts to activate sustainability engagement at the individual level through participatory initiatives.

An important element of the corporate culture […] is social volunteering, which brings employees together and promotes staff involvement […]. In 2023, employees of the Company and subsidiaries and affiliates continued implementing large-scale volunteering projects. They are aimed at support for vulnerable groups and veterans […] and environmental campaigns.

Volunteering projects, including environmental campaigns, give employees opportunities to take part in social and environmental activities, and the report presents volunteering as a way to promote staff involvement. Empowerment is framed as participation in these projects. The passage does not describe employee leadership, co-creation, or influence on sustainability decisions, so the coded material gives no indication that decision-making authority on sustainability is shared with employees.

Organizational Structure & Staff is coded on the basis of defined sustainability responsibilities at several organizational levels:

For a deeper examination of specific areas and to develop recommendations on ESG issues, specialised committees operate under the Board of Directors. […] The Company's Management Board ensures the implementation of approved strategic decisions and programs […]. Specific tasks are assigned to specialised departments and subsidiaries, creating a unified management system and ensuring a comprehensive approach to ESG activities.

Responsibilities of Board committees, the Management Board, and specialized departments and subsidiaries indicate that sustainability is formally assigned within the organization. The passage names these bodies but does not describe individual roles or staffing. A formal structure of this kind may also indicate a bureaucratic implementation style that limits flexibility.

Inductive sub-capability coding

Inductively, the emergence of **Targeted Educational Pipeline Development** as a business sub-capability reflects Kazatomprom's forward-looking investment in cultivating sustainability-oriented technical talent.

In 2024, NAC Kazatomprom JSC continued implementation of the "Murager" program aimed at supporting applicants, college graduates and students from the regions where the Company operates. The program provides free educational grants to study in technical colleges and universities of Kazakhstan in priority specialties of the nuclear industry.

This initiative extends the "People" capability beyond the current workforce, embedding sustainability competencies into the company's future talent pipeline. By integrating sustainability into workforce renewal, Kazatomprom shows a long-term, strategic approach to human capital development and complements existing structural and engagement procedures and reinforcing an integrative sustainability talent strategy.

The People PBC reveals both operational maturity and strategic foresight. Deductive findings emphasize formalization and current engagement, while inductive coding introduces future-oriented human development. However, a lack of integration between communication and empowerment points to a potential misalignment between symbolic and substantive engagement.

Process PBC

Deductive sub-capability coding

Kazatomprom's **Process** Packed Business Capability (PBC) shows how the world's largest uranium producer is embedding sustainability considerations into the design, control, and day-to-day conduct of its extraction, processing, and marketing activities. A deductive reading of its latest integrated and sustainability reports shows seven mutually reinforcing sub-business capabilities: process innovation and adaptation, product innovation and adaptation, continuous improvement, innovation for sustainability, risk management, social responsibility, and supply-chain sustainability. Together they point to a company that is gradually moving from compliance rhetoric to structured capability-building in support of a low-carbon, high-integrity nuclear-fuel value chain.

Kazatomprom demonstrates a growing proficiency in **process innovation and adaptation**, centred on operational efficiency, resource stewardship, and safety digitalisation.

In 2022, Kazatomprom adopted a standard defining the procedure for issuing and using work permits for hazardous operations, as well as a form of a Safe Work Analysis. The latter helps assess existing and potential risks and take measures to mitigate them before work commences. In 2023, the Company began to develop the e-system for issuing and using work permits.

By digitising permit-to-work and risk-assessment routines, the firm is institutionalising preventative controls. Its operating-review roadmap emphasises phased capacity expansions through 2026, signalling a disciplined approach to scaling ISR (in-situ recovery) projects while keeping environmental footprints low. The capability is still nascent in some mines, and the direction of travel is clear: data-enabled processes that balance volume growth with tighter HSE oversight.

The company's **product innovation and adaptation** capability is intertwined with its strategic positioning in a decarbonising energy system. Stakeholder disclosures highlight heightened customer scrutiny of lifecycle emissions and traceability:

> *O-3 Increase in the cost of products and services above target: probability grew from 3 to 4 and impact grew from 3 to 4.*

The risk item itself concerns rising costs of products and services and does not refer to emissions. The listed mitigation measures include monitoring the specific consumption of chemical reagents, materials, and energy, improving energy efficiency, and reducing reagent consumption rates. R&D projects completed in 2024 include a well repair and recovery technology for in-situ leaching wells and an ammonia capture technology in uranium oxide production that lowers costs and environmental impact. Downstream activities already exist. Ulba-FA reached its full design capacity for fuel assemblies in 2024, and refining and conversion is presented as a new business line. The 2024 report presents the company as a partner in the global clean energy transition, but the reports do not link these activities to the decarbonization goals of customers.

Underlying both innovation streams is a culture of **continuous improvement** that embeds ESG criteria into corporate ethics, performance dashboards, and stakeholder mapping.

Promoting sustainability standards and initiatives - we declare support and take them into account in our internal corporate documents. Principles of sustainable development of NAC Kazatomprom JSC: Openness, Accountability, Transparency, Ethical conduct, Respect, Lawfulness, Respect for human rights, Zero tolerance for corruption.

These principles are implemented through training and performance indicators. The company conducts regular compliance and anti-corruption training, and in 2024 all employees completed anti-corruption training. The KPI "Improving Safety Culture" is cascaded to the performance indicators of management and employees, and energy efficiency is monitored through KPIs and annual targets for specific electricity consumption. Bonuses of the Management Board depend on the achievement of corporate and functional KPIs. The reports do not state that anti-corruption training is linked to bonuses or that individual mines are benchmarked against SDG indicators.

Kazatomprom frames **innovation for sustainability** as a cross-cutting mandate that attracts R&D funding and international partnerships.

Decent work and economic growth… achieve higher levels of economic productivity through diversification, technological upgrading and innovation.

The company conducts exploratory studies on nanofiltration, a membrane method, for extracting scandium from uranium sorption mother liquors. It also develops a technology for the utilization of spent ion exchange resins that aims to reduce the volume of low-level radioactive waste by three to five times and to recover residual uranium and rare and rare-earth metals. Pilot tests of this technology were carried out in 2023. In the same year, joint R&D projects with Orano Mining began. The company declares support for UN and ILO conventions and takes them into account in its internal corporate documents. The reports do not show how these conventions shape specific practices in labor safety or community engagement.

A robust **risk management** architecture provides the governance foundation for all process-oriented actions.

Kazatomprom strives to factor in the risks and opportunities in the area of sustainable development in its operations and make informed and ethical decisions related to sustainable development.

The report also lists the following disclosure item:

Describe metrics used by the organisation to assess climate-related risks and opportunities.

The corporate risk register covers climate risk and environmental risk together with financial risks such as liquidity risk, and the risks are reassessed quarterly. The Audit Committee of the Board reviews the quarterly risk management reports, and the HSE Committee reviews the ESG Practices Improvement Roadmap and reports on the Environmental and Social Action Plan. The decarbonization strategy works with a realistic and an optimistic scenario. In 2024, an electronic permit-to-work system for high-risk operations was introduced. The reports do not mention carbon price scenarios, the EU CBAM, or risk dashboards fed by this system. The TCFD recommendations are disclosed only partially, and Scope 3 emissions for 2024 are to be reported in the CDP report.

The **social responsibility** sub-capability focuses on safeguarding the company's social licence across Kazakhstan's mining regions. Stakeholder maps rank unions, local communities, and public authorities alongside investors:

Kazatomprom stakeholder ranking map 2023 […] Shareholders, Partners, Creditors, Local executive authorities, Labour unions, Mass media, Public organisations and local communities […]

Engagement channels include grievance mechanisms, memoranda of cooperation with local executive authorities on the development of the social sector in the regions, and payments under subsoil use contracts for the socio-economic development and infrastructure of the regions. Zero tolerance for corruption is one of the company's sustainable development principles. It is backed by an enhanced anti-corruption clause in all procurement contracts and by annual conflict of interest declarations of employees. Transparent and inclusive governance of this kind can reduce conflict risk and support continuous operations.

Finally, **supply-chain sustainability** extends ESG oversight to goods, services, and joint-venture partners.

> *Promoting sustainability standards and initiatives - we declare support and take them into account in our internal corporate documents.*

Since mid-2021, the model procurement contracts include a Supplier and Contractor Code with seven core principles in line with ESG principles, and suppliers must adhere to it. The standard procurement contract also obliges suppliers to complete an ESG questionnaire, developed in 2023, on quality management, environment, supply chain security, and occupational health and safety, and the answers are used for an internal analysis of suppliers' ESG practices. The company also discloses its S&P Global ESG rating, an external assessment of the company. Audits are reported for contractors' compliance with health and safety requirements, but not for the ESG practices of suppliers in general. The company holds outreach activities on tender requirements and supports domestic manufacturers, and the reports do not describe ESG capacity building for local SMEs.

The company's progress is enabled by strong state-shareholder backing, access to global nuclear markets, and alignment with UN and ILO frameworks. Key challenges include capital intensity for advanced water-treatment and tailings technologies, the complexity of aligning joint-venture partners with uniform ESG standards, and the need for granular climate-scenario analytics. Nonetheless, Kazatomprom's structured approach positions it to convert external sustainability pressures into enduring operational and strategic advantage within the global nuclear-fuel cycle.

Inductive sub-capability coding

Climatic Risk Tech Adaptation emerges inductively as a business sub-capability for testing technology against weather-related risks at production facilities.

Signing of a Memorandum of Understanding with Furunkawa Electric Power Systems Co. and Sumitomo Corporation Power & Mobility Co. on the implementation of a pilot project to test equipment/technology at production facilities that enables automated prevention of snow and ice accumulation on overhead power lines.

This initiative reflects an adaptive process capability that moves beyond reactive risk management toward proactive sustainability planning. The inductive identification of this capability shows a strategic shift not captured in deductive frameworks, signaling shifting awareness of climate-related vulnerabilities and a readiness to integrate resilience into technological and operational decision-making.

Kazatomprom's Process capabilities reveal a mixed picture. A strong example of process innovation is evident, and the inductive emergence of climate risk adaptation is promising. However, the lack of content for other theorized sub-business capabilities signals potential blind spots or missed opportunities in operationalizing sustainability across the value chain.

Technology PBC

Deductive sub-capability coding

The **Technology** Packed Business Capability (PBC) at Kazatomprom is structured around two key sub-business capabilities: data management and reporting and technology adoption. These capabilities are foundational to how the company operationalises sustainability commitments in a high-risk, globally scrutinised sector such as uranium mining. The evidence suggests that Kazatomprom is developing integrated, policy-driven digital systems for reporting, governance, and performance management although the operational visibility of these technologies still has room to grow.

Kazatomprom's **data management and reporting** sub-capability is anchored in global ESG frameworks and national regulatory alignment. The company consistently references adherence to international principles and standards:

> *Promoting sustainability standards and initiatives - We declare support and take them into account in our internal corporate documents.*

This strategic alignment is backed by reporting to the UN and ILO systems, and performance is tracked against Sustainable Development Goals (SDGs):

The Company identified priority UN SDGs and key targets for each of the UN SDGs. […] The 2021 Integrated Annual Report included key indicators of achievement of the UN Conference on Trade and Development (UNCTAD) Sustainable Development Goals.

Kazatomprom also shows governance principles embedded in its sustainability architecture:

> *Principles of sustainable development of NAC Kazatomprom JSC: Openness, Accountability, Transparency, Ethical conduct, Respect, Lawfulness, Respect for human rights, Zero tolerance for corruption.*

The program also sets quantified targets for the ESG rating and GHG emissions:

Expected key results of the Programme implementation by 2030: Increase in the Company's ESG rating/assessment by 10% from 2022 level. Reduction of the Company's greenhouse gas emissions under Scopes 1 and 2 by 10% from 2021 level.

The cited disclosures identify SDG indicators, governance principles and quantified targets for ESG assessment and greenhouse gas emissions. They describe elements of reporting and planned performance monitoring. References to GRI or SASB identify reporting standards and do not, by themselves, establish external assurance. The quoted passages also do not identify dashboards, ERP integration or other digital

monitoring platforms. The existence and use of such systems therefore remain unverified in this material.

In tandem, the **technology adoption** sub-capability shows how Kazatomprom integrates digital and organisational innovation into its sustainability strategy. Governance of business processes is guided by a wide range of internal documents:

> *The Company has adopted a number of internal documents governing sustainability aspects and business processes on good governance and integrity, health and safety, environmental protection, personnel management, community involvement, and supply chain management.*

This approach reflects a top-down institutionalisation of ESG goals within the firm's technology framework. Moreover, the company connects its innovation aims to global sustainability principles:

> *Businesses should encourage the development and diffusion of environmentally friendly technologies.*

Adoption is also visible in stakeholder engagement architecture, which uses digital and participatory tools to gather feedback, communicate sustainability objectives, and measure satisfaction. For example:

Surveys, questionnaires, testing… Annual report and website of the Company.

And

Joint working groups, meetings, negotiations. Discussion of the implementation status of sustainable development processes with the Fund.

Further channels are:

Handling letters (complaints, requests) sent to the Company. The Hotline, social media.

These channels allow the company to collect stakeholder feedback and use it in ESG governance and reporting. Engagement ranges from shareholders and local governments to community organizations and international investors. Most of the listed channels are meetings, documents, and hotlines, so the passages support technology adoption only indirectly. Elsewhere, the report mentions information systems for complaints and occupational safety reports.

Technology adoption also contributes to a culture of compliance and performance. For instance, stakeholder-specific digital workflows help manage legal compliance, tender transparency, safety training, and social investment performance:

> *Transparent procurement system with public access… Reports on the performance by the Company's subsidiaries… production safety briefings… internal corporate communications.*

Through these mechanisms, Kazatomprom enhances traceability, responsiveness, and ESG alignment. However, while the governance infrastructure is advanced, concrete examples of physical or operational technologies such as emissions monitoring systems, energy optimisation algorithms, or real-time risk management software are not described in detail. The emphasis remains on document governance and stakeholder interfaces.

Kazatomprom's **Technology** PBC demonstrates a solid top-down approach to sustainability governance, enabled through a combination of data management and reporting and technology adoption. In the first, the company integrates SDG tracking, ESG assurance frameworks, and global disclosure practices to structure how performance is captured and communicated. In the second, it institutionalises ESG norms across all stakeholder-facing systems through digital engagement, document governance, and training infrastructures.

The coded excerpts for Kazatomprom's Technology PBC concern policy integration, international alignment, and stakeholder systems. The reports also describe operational technologies outside the coding. These include automated emissions and wastewater monitoring at two subsidiaries in 2024. They also include two pilot robotic complexes at the Irkol uranium mine and software controlling several downhole pumps. The intensity of greenhouse gas emissions per metric ton of uranium produced is also reported. The reports provide no mention of predictive analytics.

Inductive sub-capability coding

Localized Technology Manufacturing Partnerships emerge inductively as a business sub-capability for the local production of industrial technology within a national industrial framework:

Kazatomprom and Siemens signed a strategic agreement for the phased localisation of the production of high-tech measuring instruments, industrial automation systems and distribution and switching electrical equipment in the Republic of Kazakhstan.

The agreement concerns the phased local production of measuring instruments, automation systems, and electrical equipment in Kazakhstan and thus links technology partnerships with national industrial policy. The report does not connect the agreement to environmental or other sustainability goals, so it supports the sustainability dimension of this sub-capability only indirectly. The quote documents the agreement, not its results.

The absence of deductive technological Sub-Capabilities suggests an oversight in the original coding framework. In Kazatomprom's case, technology plays a key strategic and operational role, blending environmental goals with national industrial policy. Inductive coding highlights how essential this capability is in emerging markets.

Cross-capability synthesis

Deductive coding identifies reported formal structures and strategic programmes. Inductive coding adds specific innovation practices and cross-border engagement. The two approaches overlap in People and differ in the practices captured under Strategy and Process.

These differences indicate where the predefined categories require further specification. They do not establish a transition from compliance-based management to an innovation-driven strategy. Integration across functions and the effects of the reported partnerships remain to be examined with additional evidence.

KazMunayGas

Strategy PBC

Deductive sub-capability coding

KazMunayGas links its low-carbon planning to the national strategy for carbon neutrality. This statement is coded as Strategic Management.

In accordance with the new Action Plan to improve KMG's ESG Risk Rating approved by KMG's Board of Directors on 5 October 2023, the Company is required to develop a 2060 Low-Carbon Development Programme to align it with the Strategy for Achieving Carbon Neutrality by 2060 approved by the Government of the Republic of Kazakhstan in 2023.

This alignment indicates an awareness of global sustainability norms and a willingness to position the company within broader climate and development agendas. However, the strategic integration appears largely symbolic, with limited evidence of operational detail or mechanisms to translate these goals into actionable plans. It seems that while direction is set, execution remains underdeveloped.

Inductive sub-capability coding

The emergence of **Investment Optimization for Complex Fields** as a business sub-capability illustrates a strategic approach to capital deployment that integrates sustainability with technological and geological complexity as statements like the following show:

In 2023, to improve competitiveness and attract investment in geological exploration of complex projects, the Company introduced an improved model contract providing for fiscal and regulatory benefits. These measures seek to increase the profitability of exploration at fields with high geological risks […].

The excerpt describes an improved model contract with fiscal and regulatory benefits that is meant to attract investment and to make exploration at fields with high geological risks more profitable. It does not name a sustainability objective, so the link between this investment practice and sustainability remains indirect.

The development of **Petrochemical Industrialization Capability** reflects KazMunayGas's strategic move toward downstream diversification as a means of aligning industrial growth with long-term sustainability considerations.

In addition, the Company has launched a large-scale integrated gas chemical complex LLP Kazakhstan Petrochemical Industries Inc. with a design capacity of up to 500,000 tons of finished products per year. The raw material used is propane from the Tengiz field, purified from harmful impurities, which minimizes the impact on the environment.

This initiative demonstrates a shift in value chain positioning, aimed at reducing carbon exposure by focusing on less emissions-intensive and more stable outputs. It shows a sustainability response rooted in industrial transformation, balancing economic resilience with environmental performance. This capability signals an evolution in how resource-based companies manage transition risk through structural diversification.

Deductive coding captures policy-level alignment, whereas inductive coding shows capital-intensive investment decisions in exploration and petrochemicals.

People PBC

Deductive sub-capability coding

At KazMunayGas, Communication is coded from statements on the internal communication system.

A unified system of internal communications is designed to enhance the effectiveness of 'feedback'. Mandatory scheduled meetings of management with labour collectives are held at all enterprises to discuss social, every-day, and production issues.

This statement expresses a commitment to responsible behavior. However, the communication approach appears mainly top-down and focused on formal statements. There is limited evidence of active, two-way engagement with internal stakeholders. Repeated messages and low inductive coding scores also suggest limited opportunities for participation. Sustainability communication therefore appears to focus more on making statements than on dialogue.

At KazMunayGas, Employee Empowerment includes assessments that identify training needs.

The need to train managerial, administrative and engineering personnel is based on Individual Development Plans following the results of regular comprehensive personnel performance assessments and needs stated by employees' direct supervisors based on the objectives of the business unit. Production personnel training is based on assessment of professional knowledge, skills and business needs.

The excerpt describes how KazMunayGas identifies training needs through performance assessments, individual development plans and business-unit requirements. It documents a procedure for planning employee development. It does not describe the resulting training, employee decision rights or participation in sustainability initiatives. The maturity and effectiveness of Employee Empowerment cannot be assessed from this passage alone.

The articulation of **Organizational Structure & Staff** as a business sub-capability reflects KazMunayGas's effort to formalize sustainability governance through internal mechanisms.

The Sustainability Sector of KMG's Strategy and Portfolio Management Department is responsible for initiating, coordinating and implementing the sustainable development management system and achieving the SDGs, assisting in its integration into the Company's business activities, methodological support on sustainable development issues […] as well as training in the field of sustainable development.

The passage shows that a designated unit coordinates the sustainable development management system, providing a formal basis for sustainability governance. The unit's tasks include methodological support and training in the field of sustainable development, which links it to staff development. The passage lists responsibilities but does not report staffing, resources, or results, so the approach appears largely administrative.

Inductive sub-capability coding

Executive Low-Carbon Capability Building refers to energy transition training in which management was involved.

In 2023, employees were trained under the Green Project Management programme, where the best practices of applying the concept of sustainable development in projects were studied, and under the Energy Transition programme, involving specialists and management of the Corporate Centre and SDEs.

The report addresses this sub-capability only indirectly. It states that the Energy Transition program involved specialists and management of the Corporate Centre and the subsidiaries, but it does not specify their role, the management level, or the content and results of the program. The excerpt therefore shows that management was involved in energy transition training, not that executives were trained in low-carbon technologies.

The articulation of **Integrated Employee Social Support** as a business sub-capability shows KazMunayGas's commitment to staff welfare through substantial, sustained investment in employee and retiree well-being.

In 2023, KMG Group retained all social benefits and securities and paid in accordance with collective agreements. Overall, in 2023, the social assistance to the employees and retirees was provided for the amount of over KZT 27.65 bln.

This initiative is backed by resources and supports long-term social cohesion and organizational loyalty. In post-Soviet contexts, socio-economic stability remains closely linked to employer responsibility. Such support is therefore important for sustaining human capital. It embeds social sustainability in the organization. It also strengthens resilience and legitimacy within the organization.

Local Workforce Competency Enablement was identified from KazMunayGas's reporting on employment created by major projects. For its planned polyethylene plant, the company states:

The plant will promote the maintenance of social stability in the region and creation of new jobs. In particular, about 8,000 jobs will be created during the construction phase, and 875 permanent jobs will be created during the operation period.

The excerpt quantifies the jobs expected from the polyethylene plant during construction and operation and links them to social stability in the region. Job creation in major projects supports regional development and can strengthen the company's social license to operate. The passage does not explain how local workers are trained for these jobs. Evidence for the competency aspect of this sub-capability therefore remains limited.

People-related capabilities reveal a dual picture. Deductive coding identifies formal structures and stated commitments. Inductive coding reveals active practices that are changing over time. These are particularly visible in executive development and regional inclusion. Together, the findings suggest a shift from formal commitments to practical action in People-related sustainability capabilities.

Process PBC

Deductive sub-capability coding

Continuous Improvement is coded at KazMunayGas because employee survey results are used to identify areas of concern and to plan improvements.

Based on the results of the Samruk Research Services survey, each enterprise develops Action Plans to minimise and eliminate the areas of concern identified in the

Social Stability Index measurement. The Plan's activities include actions to improve the level of satisfaction of employees, trust in the actions of the management, establishing a feedback system, improving working conditions, accommodation, catering, etc.

This excerpt signals the existence of institutional learning loops focused on workforce development and quality enhancement. However, the generally low coding scores suggest that such practices may lack deep procedural embeddedness. While the intent to improve is evident, the capability appears under-used, operating more as a diagnostic tool than as a fully integrated engine for adaptive organizational change.

At KazMunayGas, Innovation for Sustainability / Product & Process Innovation & Adaptation takes the form of incremental technical improvements that increase energy efficiency.

In 2024, a total of 70 initiatives were implemented to upgrade process equipment, replace gas burners in furnaces, introduce energy-saving technologies, optimise heat generation and consumption, and modernise lighting systems, etc. Estimated annual savings of fuel and energy amounted to 2,361 thous. GJ, equivalent to a reduction of GHG emissions by 174.9 thous. tonnes of CO_2.

While this example indicates attention to resource use and cost-effectiveness, it represents a marginal retrofit. The framing suggests a focus on localized upgrades to innovation for sustainability. This capability appears to be at an early stage, with a focus on efficiency. It appears to lack the integration and ambition typically associated with sustainability-driven innovation ecosystems.

Risk Management is coded as a business sub-capability because KazMunayGas monitors environmental and climate-related risks on a regular basis.

HSE risks, including environmental, climate change and water scarcity risks are monitored on a quarterly basis. KMG regularly analyses environmental performance and benchmarks against leading international oil and gas associations (IOGP, CDP). The Company pays particular attention to environmental aspects and environmental risk assessment.

The excerpt shows that sustainability-related risks are reviewed periodically. This suggests alignment with standard governance practices. However, the deductive findings show limited attention to anticipating future risks or adapting to them. The capability appears to focus on established procedures and compliance. There is less evidence that it enables flexible responses to emerging ESG-related uncertainties.

Social Responsibility at KazMunayGas refers to financial support for the regions where its subsidiaries produce.

Under the contracts for subsoil use and the Comprehensive Development Plan, KMG's enterprises finance socially significant facilities, the construction of sports complexes, the social and economic development of the region, etc. The subsoil use contracts of KMG's subsidiaries provide for the allocation of significant amounts of money to develop the regions of production presence […].

This initiative illustrates a legacy corporate social responsibility (CSR) model, which is reactive and transactional in nature. The approach shows awareness of social impact but remains largely philanthropic. There is limited evidence of a shift toward

shared value creation. There is also limited evidence that community engagement is integrated into core business models. This suggests that social sustainability is still treated as an external obligation.

Supply Chain Sustainability is coded from the environmental and social obligations that KazMunayGas includes in its contracts with counterparties.

At the same time, KMG offers, in turn, reciprocal obligations to counterparties to comply with the requirements of applicable legislation, treat employees fairly, avoid the use of child labour, ensure safe working conditions, protect the environment and adhere to other principles of ethical conduct. These conditions are included in the terms of contracts concluded by KMG with counterparties […].

The excerpt documents environmental and social requirements included in contracts with counterparties. It does not describe how compliance is monitored or how breaches are addressed through corrective action, supplier development or joint improvement. These mechanisms are not disclosed in the cited passage. This limits the assessment of implementation, but does not establish that the mechanisms are absent or that supply-chain integration is immature.

Inductive sub-capability coding

The emergence of **Green Office Transformation Capability** as a business sub-capability reflects KazMunayGas's commitment to embedding ecological principles into everyday workplace operations.

By adhering to Green Office principles, the Company aims to reduce resource consumption, create a favourable environment and achieve economic efficiency in our operations. Our efforts include environmental education of employees, resource conservation (energy saving, electricity saving, separate waste collection, paper saving, etc.) and organising green events.

The excerpt describes a Green Office initiative that combines changes to infrastructure and workplace practices. It is coded as an inductive process capability because it specifies practices beyond the deductive categories. The excerpt does not establish implementation across the organization or quantify environmental outcomes.

Process-related Sub-Capabilities in deductive coding often remain surface-level and compliance-oriented. However, the inductive findings illuminate a growing depth in internal ecological restructuring and operational innovation. The deductive-inductive interplay indicates a trajectory from reactive compliance to proactive transformation.

Technology PBC

Deductive sub-capability coding

Data Management and Reporting is present at KazMunayGas as structured management of environmental data.

The automated environmental monitoring information system is designed to create a shared information space in environmental protection and covers the following critical tasks: automated generation of environmental reports to government agencies; maintaining the database of authorisation regulations and calculating environmental emission fees; day-to-day environmental monitoring based on environmental controls at production sites.

The statement indicates a digital infrastructure for collecting and managing large amounts of ESG-related information. However, the excerpts do not explain how the data are analyzed or used in decisions. This leaves their strategic value unclear. The system supports transparency and may help the company prepare for compliance requirements. Yet the excerpts provide little detail on how it generates insights or supports organizational learning. The technical capability appears well established. Its integration into strategic planning and performance management remains unclear.

Technology Adoption refers to the first installations of automated emission monitoring systems at KazMunayGas subsidiaries.

Two oil and gas SDEs were the first among the Group's companies to launch AMS. […] the integrated AMS equipment was installed at the gas turbine power plant (GTPP) of the Kalamkasmunaigas Production Department and was successfully tested. Commissioning of such unique systems is not only an important step in the modernization of plants, but also increases environmental efficiency and transparency.

The passage reports the first installation and successful testing of automated emission monitoring equipment at subsidiaries. The report notes that the Environmental Code requires such systems from 1 January 2023, so the adoption also responds to a legal requirement. The coded material does not show how the monitoring data are used in operational or strategic processes, so the capability is still at an early stage.

Inductive sub-capability coding

Gas Value Chain Extension Capability was identified from plans for the construction of gas processing facilities.

On Karachaganak field, the projects are being actively implemented to maintain the production plateau. In 2023, a concept was developed for the construction of a gas processing plant with a capacity of 4 billion m3 of commercial gas per year. Implementation of the project will allow commercialisation of produced raw gas from Karachaganak field and its refined products.

The excerpt shows a planned extension of the value chain from raw gas to marketable gas and refined products. The project was at the concept stage in 2023. Natural gas is often described as a bridge fuel in the energy transition, but the excerpt does not state a decarbonization objective.

Hybrid Energy Infrastructure Development refers to a hybrid power plant that combines renewable and gas-fired generation.

The project "Construction of a 120 MW RES hybrid power plant with Eni S.p.A." was initiated in spring 2023 […] to ensure stable electricity supply for Ozenmunaigas and KazGPZ, as well as to reduce the carbon footprint of the Republic of Kazakhstan. The project involves electricity generation from renewable RES (wind and solar) and a gas-fired power plant.

The project combines wind and solar generation with a gas-fired plant to secure the electricity supply of two subsidiaries and to reduce the carbon footprint. It was initiated in 2023, and the 2024 report states that construction started in July 2024. If implemented, such projects can reduce dependence on high-emission energy sources, although the gas-fired component remains a fossil source.

Renewable Energy Grid Stability Management is coded from a planned energy storage system for a wind power plant.

The WPP will be located in the settlement of Mirny and will be equipped with a 300 MW / 600 MWh energy storage system, ensuring stability of power supply and reducing risks associated with intermittent wind generation.

The planned storage system is meant to stabilize power supply and to reduce the risks of intermittent wind generation. The project therefore goes beyond adding renewable capacity and addresses the stability of supply during the transition to low-carbon energy. According to the report, commissioning is expected at the end of 2027, so the capability is planned.

Technology as a PBC shows the most pronounced gap between deductive and inductive insights. While the deductive view captures sustainability intelligence and pilot-level efforts, the inductive view reveals transformational infrastructure capabilities. This suggests that KazMunayGas's technology transition is occurring faster in operations than it is in official narratives.

Cross-capability synthesis

KazMunayGas shows a mixed profile. Deductive coding captures foundational and structural elements, while inductive coding identifies specific strategic and technical practices in energy transition, infrastructure modernization, and regional development. The two coding approaches agree mainly in People and Strategy, where both identify leadership development and long-term planning. They diverge in Technology and Process, where the inductive findings are more specific than the framework anticipates. Highly specific inductive sub-capabilities such as Green Office Transformation Capability, Renewable Energy Grid Stability Management, and Petrochemical Industrialization Capability indicate that technical and capital-intensive investment is a main driver. Formal instruments such as surveys and committees recur in the reports and shape the deductive results.

Samruk-Energy

Strategy PBC

Deductive sub-capability coding

Samruk-Energy’s long-term strategy names the reduction of the net carbon footprint as one of three strategic goals, which is coded as Strategic Management.

On October 29, 2021, the Board of Directors of Samruk-Energy JSC decided to confirm the new Development Strategy of Samruk-Energy JSC for the period of 2022-2031. […] we will focus on the fulfillment of three strategic goals, such as: Reduction of net carbon footprint; Increase in productivity; Increase in net asset value.

This framework places ESG at the center of organizational planning. It shows an intention to align long-term growth with sustainability objectives. However, the implementation mechanisms remain unspecified. These include measurable KPIs, stakeholder engagement processes, and links to capital allocation. Clearer information on these mechanisms would help demonstrate the strategic maturity of the commitment.

Inductive sub-capability coding

The emergence of **Green Finance Instrumentation** as a business sub-capability signals Samruk-Energy's pioneering role in aligning capital markets with sustainability objectives through innovative financial procedures.

APP JSC registered a sustainable bond program […] For the first time in Central Asia.

Issuing and managing sustainable bonds requires financial expertise, governance structures, and risk oversight, so the capability is cross-functional. The excerpt reports the registration of the program, not its use or its effect on the financing of the company. Deductive coding captures planning, while inductive coding shows implementation through green finance. The bond program is an implementation step and also informs the capital market that sustainability is part of the company's value proposition. In the Strategy PBC, the two coding approaches are consistent.

People PBC

Deductive sub-capability coding

The articulation of **Communication** as a business sub-capability reflects a strategic use of external recognition to reinforce ESG credibility and institutional positioning.

Samruk-Energy JSC entered the top 5 best companies in terms of ESG information disclosure level and took 1st place among Kazakhstan electric power companies according to the results of the annual contest of annual reports.

This example shows how ESG performance rankings are applied to enhance transparency and brand equity. Such public acknowledgment supports reputational capital and may incentivize sustained reporting practices across the organization. However, the emphasis remains on outward perception. The absence of clear procedures for internal dissemination or two-way stakeholder engagement suggests limited use of sustainability communication as an internal change lever, indicating a gap in internal ESG knowledge flows and cultural embedding.

The identification of **Employee Empowerment** as a business sub-capability highlights a strong organizational commitment to workforce development as a foundation for sustainability transitions.

Employees are the highest value and key success factor for the Group of companies of Samruk-Energy JSC […]. One of our priorities is personnel development, and a comprehensive training system has been developed for this purpose. Investments in training in 2023 amounted to over KZT 440 million.

This level of investment and reach signals a systemic approach to upskilling, potentially aligned with strategic workforce planning and future readiness. In the context of sustainability, such large-scale training initiatives are critical for embedding ESG competencies across roles and functions. However, the lack of detail on content specificity, learning outcomes, or alignment with sustainability priorities limits the ability to fully assess the maturity and strategic depth of this empowerment capability.

The development of **Organizational Structure & Staff** as a business sub-capability reflects a formal commitment to institutional reform as a foundation for sustainability integration.

Our strategic priority is to further enhance corporate governance through the lens of sustainability. In 2023, we approved the Roadmap for the improvement of the sustainable development management system of Samruk-Energy JSC for 2023-2024, which, among other things, includes measures to improve our activities in environmental and social aspects.

The excerpt reports approval of a roadmap for improving the sustainable development management system in 2023 and 2024. It documents a formal commitment to changes in environmental and social activities. It does not specify the structural changes implemented, their progress or measurable results. Roadmap approval therefore supports the coding of a planned governance initiative, while its implementation and effectiveness remain unverified in this passage.

Inductive sub-capability coding

The articulation of **Inclusive Workforce Policy Governance** as a new business sub-capability reflects the formal integration of ESG values into the human resources governance framework.

In 2023, a new version of the Personnel Policy of Samruk-Energy JSC […] was adopted. This policy is based on strict observance of human rights and includes the principles of openness, responsibility, transparency, legality, and ethics. It ensures equal opportunities for all candidates in the employment process, emphasizing our commitment to fairness and equality in the workplace.

The policy bases personnel management on human rights and on principles such as openness, transparency, and ethics, and it commits the company to equal opportunities in recruitment. Equal treatment is thereby anchored in formal policy. The passage speaks of equal opportunities and fairness, which the report addresses in a separate section on diversity and inclusion. The excerpt does not show how the policy is applied.

The development of **Structured Youth Engagement Platforms** as a business sub-capability reflects a strategic approach to generational inclusion and participatory workforce development.

'II Youth Forum of Samruk-Energy JSC' was held on 14.09.2023, which was attended by 100 employees of the Group of companies of Samruk-Energy JSC. Main objective: bringing together the youth of subsidiaries and affiliates for general organizational development of Samruk-Energy JSC, a platform for social and professional development of personality through exchange of thoughts, experience and implementation opportunities.

The forum, held for the second time, brought together 100 employees from across the group for the exchange of experience and professional development. Such a format can support talent development and succession planning, which ESG strategies often overlook. The excerpt does not describe dialogue with company leaders or report results of the forum.

Deductive results in *People* focus on formal procedures like training, structure, and external ESG visibility and suggesting a top-down implementation of sustainability. The inductive findings reveal deeper layers of internal transformation: inclusivity and youth empowerment as strategic practices. Both approaches present sustainability as a capability centered on people. Their emphasis differs. Deductive coding highlights

compliance and structural change. Inductive findings reveal emerging practices that shape organizational culture.

Process PBC

Deductive sub-capability coding

The identification of **Continuous Improvement** as a business sub-capability confirms a structured, performance-driven approach to advancing sustainability through operational refinements.

In 2023, a total of 61 various activities were completed, and the implementation of measures to improve energy efficiency in the Group of companies of Samruk-Energy JSC resulted in savings of 362.9 thousand tons of equivalent fuel, amounting to KZT 2.06 billion.

The number of measures and the reported fuel and cost savings indicate a systematic improvement process with quantified results. The excerpt reports savings in fuel and costs but not in emissions. The capability connects sustainability objectives with operational efficiency.

Innovation for Sustainability refers to investments in new gas turbines and to automated emission monitoring.

In 2023, we launched projects to build new combined cycle gas turbines at CHPP-2 and CHPP-3 in Almaty to replace outdated pulverized coal equipment with modern, environmentally friendly combined cycle gas turbines, which will significantly reduce environmental impact. To develop environmental monitoring, an automated system for monitoring emissions into the environment was introduced in test mode at EGRES-2 JSC.

This initiative shows a commitment to process transformation through innovation, particularly in support of decarbonization goals. The focus on energy efficiency and automation indicates a capability centered on technical enhancement. However, the innovation approach remains primarily efficiency-oriented, with limited evidence of disruptive thinking or integration of social inclusivity suggesting that while technologically progressive, the capability's broader transformational potential is still emerging.

Process & Product Innovation and Adaptation is coded from technological upgrades in operational systems. For the coal mining subsidiary Bogatyr Komir, the report lists:

Accomplishments 2023: […] Introduction of an automated dispatch control system for overburden transportation by railway transport (ADCS railway); Implementation of an automated fuel flow accounting system […].

The excerpt shows innovation at several stages of the value chain. These innovations improve operational precision and responsiveness. However, the account focuses mainly on technical aspects. It provides little information on stakeholder participation or the use of user feedback. It also leaves unclear how the innovations respond to changing environmental conditions and stakeholder needs. Their flexibility and inclusivity as contributors to sustainability therefore remain insufficiently explored.

The development of **Risk Management** as a business sub-capability reflects the integration of environmental risk considerations into strategic planning and operational execution.

To manage the risks associated with greenhouse gases, the key activities that the Company is implementing to mitigate the environmental impact of greenhouse gas emissions are presented. A range of initiatives is discussed, including coal preparation and gasification, carbon dioxide capture and storage, energy efficiency and green transportation.

The excerpt indicates mature risk management procedures. It presents risk management as a way to anticipate risks and build resilience, alongside its compliance role. Concrete mitigation plans suggest that risk assessments lead to action. These plans support the organization's ability to adapt to environmental uncertainty. This strategic approach strengthens its ability to address sustainability-related vulnerabilities proactively.

Social Responsibility refers to charitable assistance by Samruk-Energy's subsidiaries. For the coal mining subsidiary Bogatyr Komir, the report states:

Non-profit organizations were allocated KZT 83,130 thousand to purchase coal, crushed stone, gifts for children for the New Year, holding various forums and events, as well as for the repair of buildings, equipment and other. Individuals were provided funding in the amount of KZT 27,063 thousand for medical treatment, surgeries and funerals.

While this financial commitment demonstrates social visibility and corporate goodwill, it aligns with a traditional CSR model, transactional and externally focused. As such, the capability appears oriented toward reputation management.

Supply Chain Sustainability is coded from Samruk-Energy's statements on ESG criteria for suppliers in its Code of Conduct.

The "Code of Conduct of Samruk-Energy JSC" was updated to include information on principles of (green) procurement, approaches, ESG criteria in selecting suppliers and monitoring their compliance with norms and laws in the social/environmental sphere […].

The updated Code of Conduct refers to ESG criteria for selecting suppliers and to monitoring their compliance with social and environmental norms. The passage describes the content of the code but not how the criteria are applied, how many suppliers were assessed, or what follow-up exists. The capability is at an early stage, and the passage provides no description of supplier capacity-building.

Inductive sub-capability coding

The emergence of **Cyclic Mining Operations Management** as a business sub-capability reflects a shift toward integrated, process-efficient models of resource extraction grounded in sustainability principles.

Replacement of the main worn-out means of coal shipment, crushing and transportation, as well as phased transition of Bogatyr open pit mine to the flow-through technology of coal delivery by conveyor transport to surface averaging warehouses, with its subsequent loading at surface loading complexes is aimed at increasing the production capacity of the enterprise.

The project replaces worn-out shipment and transport equipment and moves the mine to a flow-through technology in which coal is delivered by conveyor. Mining logistics thereby shift toward continuous transport. The report states the aim of increasing production capacity and does not link the project to environmental performance in this passage, so the sustainability dimension of this sub-capability is supported only indirectly. The case shows how a core industrial process is redesigned for efficiency.

Deductively coded process Sub-Capabilities span a spectrum from operational tweaks (energy efficiency) to systemic planning (risk-based environmental strategy). The inductive findings are fewer. They add insight into the strategic role of process change and ongoing technological shifts. Both approaches portray the organization as focused on processes. The inductive data show how these changes appear in operations. They also suggest a proactive approach to technology governance.

Technology PBC

Deductive sub-capability coding

The articulation of **Data Management and Reporting** as a business sub-capability shows the role of digital systems in enabling ESG transparency and organizational coordination.

Detailed accounting of water consumption is maintained through an automated system, which includes daily tracking of the volume of water withdrawn from the Kanysh Satpayev Canal […]. Data are collected and analyzed by entering information into an Excel spreadsheet and keeping a log of primary water accounting, which ensures accuracy and transparency of water resources monitoring.

The passage describes automated daily accounting of water consumption, combined with manual entry into a spreadsheet and a log. The report presents this as a way to ensure accurate and transparent monitoring. The description covers one environmental indicator at two plants and does not show how the data is used in strategic or operational decisions, which limits the assessment of this capability's maturity.

Technology Adoption is coded from the introduction of an automated system for recording occupational safety incidents.

As part of the Concept of a unified automated system for recording incidents and violations in the field of occupational health and safety, the Safe Production Project was implemented in 2023. The goal of the project is to reduce occupational injuries and raise the level of awareness of top managers on occupational health and safety issues.

The Safe Production Project introduces a digital system for recording incidents and violations, and the report adds that the system informs employees about hazards through mobile applications or PCs. The project aims to reduce occupational injuries. It also aims to raise awareness of safety issues among top managers. The passage describes the adoption of a digital tool for occupational safety. It does not report the tool's effects.

Inductive sub-capability coding

The establishment of **Automated Environmental Monitoring** as a business sub-capability reflects a technologically enabled approach to environmental compliance, performance, and risk mitigation.

In order to supervise processes and minimize accidental emissions, we are implementing stage-by-stage deployment of automated environmental monitoring systems at EGRES-1 (Units 7 and 8), SEGRES-2, as well as at APP (CHPP-1, CHPP-2, WEC), which ensures the redirection of collected data to the information system of the body responsible for environmental control.

The systems are introduced step by step at several plants and pass the collected data to the information system of the environmental control authority. According to the report, they serve the supervision of processes and the reduction of accidental emissions, so automation supports both compliance and environmental management. The report does not state whether the data is available in real time, and the deployment is still in progress.

In Technology, both deductive and inductive insights highlight advanced digital transformation. The capability to monitor, predict, and act upon environmental metrics reflects high functional maturity. This integration of AI-driven tools (digital twins, automated monitoring) suggests a future-ready stance. The company demonstrates strong coherence here, likely enabled by centralized investment and technical expertise.

Cross-capability synthesis

Across all four PBCs, the interplay between deductive and inductive results is largely complementary. First, a**lignment** is evident in Strategy and Technology, where planning and innovation co-exist. Second, e**nrichment** is found in People and Process, where inductive insights introduce nuance (e.g., youth engagement, cyclic operations). Third, d**ivergence** appears in the scope: deductive coding emphasizes structure and compliance, whereas inductive insights often reveal emergent, often tacit, capabilities.

The reports describe strategic planning, technical initiatives and proposed structural reforms. These disclosures indicate the activities addressed by the company, but do not establish a mature capability configuration or demonstrate improvements in organizational agility.

APPENDIX Q – APPLICATION OF THE CAPABILITY MATURITY SCORE TO THE STUDY II SAMPLE

Purpose and procedure

This appendix documents the application of the GRI-anchored Capability Maturity Score (CMS), the routing condition scores and the response type classification function of sub-chapter 3.2 to the complete document corpus of Study II. The results are summarized in Table 38 of the main text. The appendix contains the list of the 20 report units (Table 53), the indicator-level scores (Table 54), the routing sub-scores (Table 55), the page anchors of the evidence for a score (Table 56), and the company-level results with changes between reporting years (Table 57). The full evidence entries, one quotation or paraphrase per score, are held in the case-study database (workbook Modell_CMS-Studie-II, sheet Belege) and are available to the dissertation council on request.

The unit of scoring is the report. Where a company published its sustainability disclosure for a year in more than one document, the documents were scored as one report unit (Kaspi.kz 2023, Form 20-F and Social Impact Report, and Samruk-Energy 2023, the full version of the Integrated Annual Report, whose page numbers are cited). Each of the 30 disclosures of Table 33 was scored 0 (absent), 1 (described) or 2 (evidenced) following Table 32, and the six routing sub-criteria of Table 35 were scored on the same scale. Page anchors refer to the pages of the PDF files listed in Table 53, not to printed page numbers, because several reports place two printed pages on one PDF page. The GRI content index of a report, where present, was used to locate disclosures, never as evidence of their quality: a disclosure listed in an index without content in the report was scored 0.

Decision rules applied across the sample

Between 1 and 2, the score 1 was assigned unless a number, a dated target, a coverage percentage, a certification or an assurance statement could be cited for the specific disclosure. Between 0 and 1, the score 1 was assigned only where the report states an approach, policy or activity on the specific topic. Six rules resolved recurrent borderline cases, and a seventh rule states the treatment of non-applicable indicators. (1) 401-1 was scored 2 only where hires or turnover are quantified for the reporting entity as a whole, whereas figures for a subset of sites or programmes were scored 1. (2) 305-2 was scored 2 where Scope 2 figures are reported, including cases in which the current year is deferred to the CDP response and prior years are quantified, whereas a deferral without any figure was scored 1. (3) 414-2 was scored 2 where contractor inspections with findings and actions are quantified, including inspections whose scope is occupational health and safety, since these are social impacts in the sense of GRI 414. (4) PC3 was scored 2 where incidents are classified by external definitions (GRI 403-9 categories, ICMM, IOGP 456, IFC Performance Standards), and 1 where they are framed internally. Under a reading restricted to GRI 308-2 and 414-2, PC would fall from 2 to 1 in R01, R04, and R07, and R01 would be classified as Selective Joiner and R04 and R07 as Internal-first. (5) OR2 was scored 2 where third-party assurance covers the report as a whole or at least one supply-chain disclosure (204-1, 308, 414),

1 where it covers a selected list of indicators without supply-chain content or only greenhouse gas data, and 0 where the report states that no external verification was performed. The audit of financial statements does not count. (6) 3-1 was scored 2 where a materiality process is described or a materiality matrix is presented. (7) No indicator was treated as non-applicable in this application. All 30 disclosures were scored for all 20 reports, because the indicator set is defined at the level of GRI disclosures that apply to every reporting organization in the sample. Where a company provides a documented reason under GRI 3-2 for excluding a topic from its material topics, the corresponding indicator is scored 0 and the reason is recorded in the evidence entry, since the instrument measures disclosed evidence rather than the appropriateness of the company's materiality judgment. Users applying the instrument to a sector where a disclosure is genuinely inapplicable should exclude it from the domain and recompute the domain denominator accordingly, and report the change.

The scoring reproduces the worked example of sub-chapter 3.2 exactly (the hypothetical firm with domain scores 64.3, 68.8, 42.9 and 68.8 yields a composite CMS of 61.7 and, with PC = 1 and OR = 0, the Internal-first type), and the composite CMS obtained through the weighted domain formula (equation 3) equals total points divided by 60 for every report, as the weights are proportional to the indicator counts.

Table 53 – Report units of Study II used for the CMS application

ID	**Company**	**Report**	**Year**	**PDF pages**	**Language**	**GRI index**
R01	Air Astana	Integrated Annual Report 2023	2023	91	English	yes
R02	Air Astana	Integrated Annual Report 2024	2024	100	English	yes
R03	BI Group	Integrated Annual Report 2024 with ESG projects brochure	2024	124 + 40	English	yes
R04	Bank CenterCredit	ESG Report 2023	2023	121	English	yes
R05	Eurasian Resources Group	Sustainable Development Report 2022	2022	94	English	yes
R06	Eurasian Resources Group	Sustainable Development Report 2023	2023	107	English	yes

R07	Halyk Bank	Sustainability Report 2022	2022	129	English	no
R08	Halyk Bank	Annual Report 2024	2024	228	English	no
R09	KAZ Minerals	Sustainability Report 2021	2021	26	English	no
R10	KAZ Minerals	Sustainability Report 2023	2023	22	English	no
R11	KPO	Sustainability Report 2022	2022	89	English	yes
R12	KPO	ESG Report 2023	2023	92	English	yes
R13	Kaspi.kz	ESG Report 2022	2022	31	English	yes
R14	Kaspi.kz	Form 20-F Annual Report 2023 with Social Impact Report 2023	2023	267 + 28	English	yes
R15	KazMunayGas	Sustainability Report 2022	2022	98	English	yes
R16	KazMunayGas	Sustainability Report 2023	2023	123	English	yes
R17	KazMunayGas	Annual Report 2024	2024	178	English	no
R18	Kazatomprom	Integrated Annual Report 2023	2023	192	English	yes
R19	Kazatomprom	Integrated Annual Report 2024	2024	336	English	yes
R20	Samruk-Energy	Integrated Annual Report 2023 (full version)	2023	307	English	Yes

Note – Year = reporting year. PDF pages = length of the file(s) scored. GRI index = the report contains a GRI content index. Source: case-study database, sheet Hinweise je Bericht.

Table 54 – Indicator-level scores of the 30 GRI disclosures for the 20 reports

D	GRI	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
S	2-22	2	2	1	2	2	2	2	1	2	2	1	2	1	1	2	2	2	2	2	2
S	2-23	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
S	2-24	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
S	2-29	2	2	2	2	2	2	2	1	1	2	2	2	2	1	2	2	2	2	2	2
S	3-1	2	2	2	2	2	2	2	0	2	2	2	2	0	0	2	2	0	2	2	2
S	3-2	2	2	1	2	2	2	1	1	2	2	2	2	1	1	2	2	1	2	2	2
S	3-3	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
P	2-9	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2
P	2-17	2	1	1	2	0	0	1	1	0	1	1	1	2	2	1	1	1	1	2	2
P	2-18	2	2	1	2	0	0	2	2	0	0	1	1	0	0	2	2	2	2	2	2
P	2-20	2	2	1	2	1	1	1	2	1	1	2	2	2	2	2	2	2	2	2	2
P	401-1	2	2	2	2	1	1	2	1	1	1	2	2	2	2	2	2	2	2	2	2
P	401-2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2
P	403-1	2	2	2	2	2	2	1	0	1	1	2	2	1	1	2	2	2	2	2	2
P	403-5	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2
Pr	308-1	1	1	0	1	1	1	0	0	1	1	1	1	0	0	1	1	1	1	1	1
Pr	308-2	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	1	0	1	1	1
Pr	407-1	1	1	1	1	2	2	1	1	1	1	2	2	1	1	1	1	1	1	1	1

Pr	408-1	0	0	1	1	2	2	1	1	2	2	2	2	1	1	1	1	1	1	1	1
Pr	409-1	1	1	1	1	2	2	1	0	2	2	2	2	1	1	2	1	1	1	1	1
Pr	414-1	1	1	1	1	2	2	0	1	1	1	1	1	0	0	2	1	1	1	1	1
Pr	414-2	0	1	1	0	2	1	0	0	1	1	2	2	0	0	2	2	2	1	1	2
T	302-1	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2
T	302-3	1	0	0	2	0	0	1	0	2	2	2	2	0	0	2	2	2	2	2	2
T	302-4	2	1	1	2	2	2	2	0	1	1	2	2	2	1	2	2	2	2	2	2
T	305-1	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2
T	305-2	1	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2
T	305-4	2	2	0	2	1	1	0	0	2	2	2	2	0	0	2	2	2	2	2	2
T	306-3	2	2	2	2	1	1	2	0	2	2	2	2	1	1	2	2	1	2	2	2
T	306-4	2	2	1	2	2	2	1	0	2	1	2	2	2	2	2	2	1	1	1	2

Note – D = PBC domain (S Strategy, P People, Pr Process, T Technology). Columns = report IDs of Table 53. Scores per Table 32: 0 absent, 1 described, 2 evidenced. Domain sums and scores in Table 38. Source: author's scoring.

Table 55 – Routing sub-scores for the 20 reports

RC	Sub	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
PC	PC1	1	1	1	2	2	1	1	1	1	1	2	2	1	1	2	2	1	2	2	1
PC	PC2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
PC	PC3	2	2	2	2	2	2	2	1	2	2	2	2	1	1	2	2	2	2	2	2
OR	OR1	2	2	1	1	2	2	1	1	1	1	2	2	0	0	2	2	2	2	2	2
OR	OR2	2	2	0	1	1	1	0	0	0	0	1	2	0	0	2	2	1	2	2	1
OR	OR3	1	1	0	1	1	1	0	0	0	0	1	1	0	0	1	1	1	1	1	1

Note – RC = routing condition (PC perceptual convergence, OR prevalent cross-firm orchestration). Sub-criteria per Table 35: PC1 cross-tier stakeholder input, PC2 shared frameworks, PC3 shared incident definitions, OR1 initiative membership, OR2 third-party assurance, OR3 shared supplier platforms. PC and OR = rounded mean of the three sub-scores (Table 38). Source: author's scoring.

Table 56 – Page anchors of the evidence for every score (PDF pages of the files in Table 53)

Disclosure	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
2-22	23,26	24	6,60	4,29,41	7,12,13	11,42	11,24,57	32,71	5	4,10	4,7,48	6,53	3,14	S3,4 / F76	24,26	18,10,15	23,69	3,45	60,52	4,39,185
2-23	24,25	25,27,61	42,59,63	30,47,48	72,79,87	73,89	8,28,104	71,74,108	22,20	17,16	23	26	22,20,19	S13 / F149	43,44	83,21	68,119	76,44	188,189	119
2-24	24,34	25,26	64	30,48,31	64,66	72,75	7,11,34,125	108,72	20,19	16	24,22	27,28	22,19	S13, 12 / F151	26,49	20,21	61,82,73	108,109	190,134	87-88,113,38

2-29	10,11,12	20,21,22	13,14	32,33,34,15	16,82-84	93-97	68,69,83	19,75,101	16,22	14	8	8,9	10,3	S3,18 / F77,78	28,29	22,23	68,79,82	46,47,48	55,57	107-115
3-1	25	25	111	15	16	13	70,125	–	5	4	9	8	–	–	28	22	–	50	196	91-92
3-2	25,26	27,28	111	16	17,18	14,13	70	71	5	4	9	8	3	S3	28	22	61,76	51	197	93
3-3	26,30	27	111,48,50,113	45,30	28,53,34	43,48,90-92	57,11,83	72,75,76	5,8,10	4,8,12	54,56,61	60,65	27,28,29,30	S25,26,27,28	26,54,73	18,69	69,78,72	45,53,66	52,53	91,185
2-9	49,51	56,25	58,59,60	20,22,19	72,73	81	36,37,30	80,85,92	9	7,19	20,21	21,22	20,22	S14,15,25,26 / F127,129-131	19	93,20	94,95,107	89,86	148,154	205,209,225
2-17	24,50	59,27	59,116	29,48	–	–	29,37	94,107,86	–	9	6	27,32	22,31	S13,26	23	97	93,94	89	148	208,90
2-18	50	59	58,116	22	–	–	28,29,39	83,94,95	–	–	20	22	–	–	23	97	101	93	153,154	207-208
2-20	53	61,60	58,59,60	27	72	81	36,96,99	90	18	15,19	38	42,43	22,12	F129,131 / S15,	23,24,26	97,98,18	114,61	99	161,162	229,38,91

														17,27						
401-1	32	33	113	71,72	33	53,52	95,124	75	18	15	37	41	12,11	S18,16	40	77	80	71,118,119	102	123
401-2	33,31	33	36,37	75	30,36,34	58,59	96,97	75	18,19	15,16	37,38	42,43	12,13	S18,17,27	46	85	84,83,63	75,68	113,114	127-129,124
403-1	30	30	38,114	80	28,76	47,86	107,126	–	7	5	22	23	13	S18	52	42,41	75	68,69	89	136-137,9,145
403-5	30	30	113,41	81,71	29	48	107	–	18	15	41	45	13	S18	67	80	79,81	69,68	96	146
308-1	34,26	36,27	–	61,62	66,78	75,89	–	–	19	16	50	54	–	–	83	103	73,75	80,54,109	134	168,87-88
308-2	–	–	–	–	78	87,75	–	–	–	–	50	54	–	–	55,56	62,63	–	54,69	134	168
407-1	33,25	33,27	42	48,67	36,34	59,89	104,8	74	16,22	14,17	43	47,48	12	S18 / F131	46	85	83	76,46	54,118	130,290
408-1	–	–	42	48,61	45,65,69	73,67	94,12	72	20	16	23,43	26,47	12	S18	43,83	83,103	68	76	191,239	120
409-1	33,34	34,36,25	42	48,61	65,63	73,75	94,12	–	20	16	23,43	26,47	12	S18	45	83,87	68,62	76	191,240	120

414-1	34	36,25	64,45	62,61	64, 65, 69	77, 72	–	108	19,20	16	25, 66	27,28	–	–	49	103	119, 79,86	109, 80	134	113, 87-88,119
414-2	–	25,26	64	–	65, 69, 63	77	–	–	20	16	43, 44	47,48	–	–	49	88, 87	78,117	69,109	134,185	145
302-1	27	29	50	99,98	53	43	115	–	9, 10	8	56	60	14,30	S28, 19	74	69	73	53	64	190, 270
302-3	36	–	–	98	–	–	11	–	9	8	57	61	–	–	75	70	74	53	64, 65	271
302-4	36,27	29,24	50,51	98,99	52	42	115, 11	–	11,10	9, 8	57	61	14	S19	75	70, 29	74	53	63	189-190
305-1	28	29	48	94	53	43	115, 116, 113	–	10	8	55	59	30,16	S28, 19	73	68, 69	72	51,52	61	184, 186
305-2	27,29	29	48	95	53	43	115, 116	–	10	8	55	59	30	S28	73	68	72	52	62	187, 184
305-4	28	29	–	95	51, 7	42, 25	–	–	10,11	8, 9	55	59	–	–	73, 88	69	72	52	63	186
306-3	28	29	52	97	54	87, 44	118	–	13	11	61, 62	65,66	15	S20	62	52	76	59	77	170, 184
306-4	28	29	53	98,97	55	45	118, 109	–	13	11	62	66	29,14	S28, 20	62	52	76	59,140	76	269
PC1	25,10,11	25,20	111,13	15,43	16, 17	13, 93	70,125	19, 75, 101	5	4, 14	8,9	8	10,3	S3,18 / F77	28	22	68,61	50	196	92,107-115

PC2	2,28,86	92,95,27,29	111,2,119	14,108	3,16,89	13,2	5,70,125,127	71,15	6,12	4,9	5,8	5,7,76	23,16,4	S21,19,5	9,28,34	9,22,67	74,71,67	112,50	192,196	92,276,297-298,89
PC3	87,30,24	31,30,26	114,64,38	82,50	69,63	72,73	126,109,118	108	8,6	4,5	17	15,16	22,19,26	S13,12,18	54,56	63,42	78,75	67,136,69	216,94	91,278-279,186
OR 1	30,31,27,86	29,30,31,92	14,116	86,30,5	87,92,69	100,77	8,28,123	15,71	13,8	13,4	6,68	74,9	–	–	9,31	9,24,18	79,70,67,72	46,125	54,59	118,94,89
OR 2	87,88,2	94	–	14,115	3,67,53	2,77,43	–	–	–	–	6,55	76,82,83,84	–	–	9,86	9,107	72,78,81	116,104,142	201,178	259,292-296
OR 3	31,25	24,36	–	61	66,68,69	77,75	–	–	–	–	25,66	71	–	–	83	104	85,86	80	133	84-85
Note – Entries are PDF page numbers of the scored file. – = no disclosure found (score 0). R14: F = Form 20-F 2023, S = Social Impact Report 2023. R20: pages of the full version of the Integrated Annual Report 2023. The quotation or paraphrase behind each anchor is held in the case-study database (sheet Belege). Source: author's scoring.																			

Table 57 – Company-level results, most recent report in the corpus and change against the earlier report

Company	**Sector**	**Latest report**	**CMS**	**PC**	**OR**	**Response type**	**Earlier report**	**CMS earlier**	**Change**
Air Astana	Airline	R02 IAR 2024	78.3	2	2	Collaborative-first	R01 IAR 2023	80.0	-1.7

BI Group	Construction	R03 IAR 2024	66.7	2	0	Co-Developer	–	–	–
Bank CenterCredit	Banking	R04 ESG 2023	85.0	2	1	Co-Developer	–	–	–
ERG	Mining	R06 SDR 2023	78.3	2	1	Co-Developer	R05 SDR 2022	80.0	-1.7
Halyk Bank	Banking	R08 AR 2024	33.3	1	0	Internal-first	R07 SR 2022	68.3	-35.0
KAZ Minerals	Copper Mining	R10 SR 2023	73.3	2	0	Co-Developer	R09 SR 2021	71.7	+1.7
KPO	Oil & Gas	R12 ESG 2023	91.7	2	2	Collaborative-first	R11 SR 2022	90.0	+1.7
Kaspi.kz	FinTech / E-Commerce	R14 20-F + SIR 2023	58.3	1	0	Internal-first	R13 ESG 2022	61.7	-3.3
KazMunayGas	Oil & Gas	R17 AR 2024	78.3	2	1	Co-Developer	R16 SR 2023	88.3	-10.0
Kazatomprom	Uranium Mining	R19 IAR 2024	86.7	2	2	Collaborative-first	R18 IAR 2023	85.0	+1.7
Samruk-Energy	Energy Provider	R20 IAR 2023	90.0	2	1	Co-Developer	–	–	–

Note – Company classification uses the most recent report in the corpus without further selection. The document-type effect discussed in sub-chapter 3.2 applies to Halyk Bank and KazMunayGas, whose most recent documents are annual reports. Under the sensitivity check of sub-chapter 3.2, which selects the most recent standalone sustainability, ESG or integrated report of each company, the selected report changes for three companies: Halyk Bank (R07 SR 2022, CMS 68.3, Co-Developer), KazMunayGas (R16 SR 2023, CMS 88.3, Collaborative-first) and Kaspi.kz (R13 ESG 2022, CMS 61.7, Internal-first). All other companies keep the report and type shown. Distribution over the 11 companies by most recent report: Co-Developer 6, Collaborative-first 3, Internal-first 2, Selective Joiner 0. Distribution under the sensitivity check: Co-Developer 6, Collaborative-first 4, Internal-first

1, Selective Joiner 0. Company-level mean 74.5 and 78.9 respectively, document-level mean 76.8 in both cases. Source: Table 38.

Reading the results

Three regularities stand out in Table 54 to Table 57 and are discussed in sub-chapter 3.2. Disclosures 2-23 and 2-24 reach the evidenced level in all 20 reports, whereas 308-1 and 308-2 reach it in none, so the distance between articulated commitment and supplier-level evidence is a pattern of the whole corpus. OR3 is never scored 2, because no report cites a collaborative supplier platform or scheme with coverage data. The Selective Joiner type does not occur for a separate reason: it requires PC of 1 or lower together with OR of 2, and the seven reports that reach OR = 2 all have PC = 2. Final OR is the rounded mean of three sub-scores, so OR = 2 is reached without OR3 = 2, as in the case of Air Astana with sub-scores 2, 2 and 1. Changes between reporting years are small where the document type is constant (Air Astana −1.7, ERG −1.7, KAZ Minerals +1.7, KPO +1.7, Kazatomprom +1.7, Kaspi.kz −3.3) and large where it changes (Halyk Bank −35.0, KazMunayGas −10.0), which supports the recommendation in sub-chapter 3.2 to score the most complete sustainability disclosure of a reporting year.