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RESEARCH PAPER

Behavioural Economics in Business Networks: A Sustainability Compliance and Innovation Case

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Abstract
This paper examines how behavioural economics mechanisms shape compliance and innovation in business-to-business (B2B) networks. In a case study of Alpha Pharma, a leading pharmaceutical firm adapting to the Corporate Sustainability Due Diligence Directive (CS3D) and EU Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) framework, the study investigates how regulatory pressures interact with inter-organisational collaboration and network interdependencies. The findings show that compliance processes are not driven by linear optimisation but emerge from bounded rationality, heuristics, reciprocity, and trust. By integrating behavioural economics with the network interaction approach, the paper develops new hypotheses on how micro-level decision behaviours aggregate into network-level adaptations that underpin sustainable innovation. The study contributes to behavioural economic and IMP (industrial marketing and purchasing) literature by demonstrating how cognitive biases and social norms influence resource mobilisation and collective decision-making in B2B settings. Practical implications include guidance for managers in addressing biases and fostering trust-based collaboration, and for policymakers in designing compliance mechanisms that account for bounded rationality and heterogeneous supplier capacities.

Keywords Policy design innovation · Sustainability compliance · Corporate sustainability due diligence directive · Business-to-business networks · Behavioural economics

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1 Introduction

This paper investigates how behavioural economics can contribute to understanding sustainability compliance challenges in business-to-business (B2B) networks. Rather than approaching compliance as the outcome of isolated firm-level decisions, the study examines how decision-making unfolds within ongoing interaction among interdependent actors. Its approach responds to long-standing insights from industrial network research, according to which adaptation and change are shaped by interaction processes rather than by unilateral choice (Håkansson and Snehota 1995; Håkansson et al. 2009).

The analysis treats sustainability policy as an empirical context rather than as the primary object of inquiry. Attention is directed at the behavioural mechanisms by which firms interpret, negotiate, and respond to regulatory requirements in networked settings. In line with work emphasising heuristics as situated and narrative-based devices emerging from business interaction, decision-making is examined as embedded in concrete relational practices rather than as abstract cognitive calculation (Guercini et al. 2014, 2015; Guercini 2019).

Sustainability has become a critical societal concern due to the environmental and socio-economic consequences associated with unsustainable production and consumption patterns (Rockström et al. 2009; Steffen et al. 2015). International and European initiatives, such as the United Nations Sustainable Development Goals, the Paris Agreement on Climate Change, and the European Green Deal, provide reference points, but their effectiveness depends on how regulatory expectations are translated into coordinated action in business networks characterised by interdependence and asymmetry (Waluszewski et al. 2019; Harrison et al. 2023). The industrial marketing and purchasing (IMP) research tradition offers a valuable foundation, as it conceptualises markets as networks of interaction in which actors, resources, and activities adapt and are continuously adapted in relation to one another (Håkansson and Snehota 1995; Håkansson et al. 2009).

Behavioural economics has demonstrated that decision-making under uncertainty rarely follows optimisation logic. Instead, actors rely on heuristics, rules of thumb, and socially shaped expectations under conditions of bounded rationality (Simon 1957; Tversky and Kahneman 1974; Thaler and Sunstein 2008; Thaler 2016). While much of its literature has been developed by experimental and individual-level studies, growing attention has been devoted to understanding how heuristics operate in organisational and inter-organisational contexts (Gigerenzer and Brighton 2009; Gigerenzer and Gaissmaier 2011).

In industrial network research, several studies have shown that heuristics are enacted and refined by interaction in customer–supplier relationships, where decision-making is shaped by history, trust, and mutual expectations (Guercini et al. 2014, 2022). These contributions resonate with the notion of ecological rationality, according to which heuristics function as adaptive responses co-developed within specific relational environments rather than as universal cognitive shortcuts (Gigerenzer and Gaissmaier 2011; Guercini 2019). This suggests a strong conceptual affinity between behavioural economics and IMP research, as both address how actors cope with complexity, uncertainty, and interdependence.

Sustainability-oriented research on industrial networks has further highlighted how innovation and compliance are deeply intertwined with resource interaction and the reconfiguration of business relationships under regulatory and environmental pressures (Baraldi et al. 2012; Harrison et al. 2023; Guercini et al. 2020). Recent studies have proposed systematic ways of organising such interaction processes in different settings, including developing, producing, and using settings (Prenkert et al. 2022; Cinti et al. 2024b). The network interaction approach (NIA) is one, though the present study does not treat it as a standalone theoretical model but rather as a background vocabulary for ordering empirical observations.

Despite growing interest in both behavioural economics and industrial networks, several gaps remain. Behavioural mechanisms such as heuristics, reciprocity, and satisficing have rarely been examined as embedded in network interaction processes. Empirical research on sustainability compliance in B2B contexts has predominantly focused on dyadic or firm-level perspectives, leaving broader network interdependencies underexplored (Blankenburg and Johanson 1992; Johnsen et al. 2017). Moreover, limited attention has been devoted to how decision-making behaviours mediate the translation of regulatory requirements into coordinated and sustained adaptation within networks (Guercini et al. 2020; Runfola et al. 2021).

The contribution of this paper lies in addressing these gaps by bringing behavioural economics into closer dialogue with industrial network research. The analysis explores how heuristics and interaction processes shape compliance and innovation in interconnected settings of business activity. Empirical attention is directed at the mechanisms by which actors interpret regulatory demands, negotiate responsibilities, and co-develop adaptive responses in sustainability-oriented business networks.

The study addresses the following research question:

RQ1: How do behavioural economics mechanisms shape compliance and innovation within sustainability-oriented business networks?

The remainder of the paper is organised as follows. Section 2 outlines the theoretical background, positioning behavioural economics in relation to interaction-based perspectives from industrial network research. Section 3 describes the case study design and the abductive analytical approach. Section 4 presents the empirical material, followed by a discussion in Sect. 5 that interprets the results in relation to existing literature. Section 6 outlines conclusions, limitations, and implications for future research.

2 Theoretical Background

The study is theoretically grounded in behavioural economics, while the empirical analysis is organised with an interaction-based perspective that allows the decision-making mechanisms in ongoing network interaction processes to be examined. The argument builds on two complementary bodies of literature. Behavioural economics offers explanations of decision-making under bounded rationality, heuristics, and social norms.

Industrial network research in IMP studies conceptualises business markets as configurations of interaction, in which adaptation is an emergent process arising from the

mutual adjustment of actor bonds, resource ties, and activity links across developing, producing, and using settings (Prenkert et al. 2022).

2.1 Behavioural Economics

Behavioural economics diverges from traditional economic theories by revealing how decision-making often relies on bounded rationality and heuristics, which act as rules of thumb under uncertainty (Simon 1957; Gigerenzer and Brighton 2009). Rather than resulting from solely exhaustive optimisation, choices are shaped by cognitive limitations, time constraints, and situational complexity, which prompt actors to simplify decision processes. Its line of research has demonstrated how heuristics may systematically bias judgements and choices by introducing deviations from the normative assumptions of full rationality that underpin classical economics and much of managerial decision theory (Tversky and Kahneman 1974; Jolls et al. 1998; Thaler 2016).

Behavioural economics has stressed that heuristics are not merely sources of error but can also operate as *adaptive strategies in complex environments*, particularly when actors face interdependence and high uncertainty (Gigerenzer and Gaissmaier 2011; Gigerenzer 2018). The notion of ecological rationality suggests that simple heuristics may prove effective precisely because they are attuned to specific contexts of interaction rather than abstract optimisation problems. In this view, heuristics are not just mental shortcuts but rules refined by experience and tested in interactional contexts, helping actors navigate complexity efficiently. Recent contributions have suggested that heuristics are refined through experience and repeated exposure to complex decision contexts (Guercini et al. 2024).

For the study of sustainability compliance, these insights imply that firm responses to regulatory requirements are not reducible to static cost–benefit calculations. Instead, they are shaped by biases (e.g. status quo bias, loss aversion), social norms (e.g. reciprocity, fairness), and relational heuristics (e.g. trust-based rules of adaptation), all of which guide the behaviour of managers embedded in networks (Thaler and Sunstein 2008; Cialdini 2007; Guercini et al. 2022). Sustainability compliance is therefore the outcome of boundedly rational and socially embedded decision-making processes rather than a purely calculative response to regulation.

By foregrounding the role of heuristics as both biases and adaptive strategies, behavioural economics provides the micro-foundations to analyse how actors make decisions under uncertainty—which are further developed in industrial network studies on interactive decision-making, which we discuss next.

2.2 Heuristics and Decision-Making in Business Networks

IMP network studies have long emphasised that business relationships are not static contractual exchanges but *dynamic interaction processes* shaped by interdependence and mutual adaptation (Håkansson and Snehota 1995; Håkansson et al. 2009). Decisions emerge not from isolated rational actors but from continuous negotiation between firms, in which *actors, resources, and activities* are tightly interconnected (Guercini

et al. 2014). This implies that managerial decision-making must be understood as embedded in networks, where outcomes depend on how firms adapt to each other (Håkansson and Snehota, 2017).

Recent contributions have sought to open the "black box" of interaction by examining the role of individual actors' behaviours and heuristics in shaping network outcomes (Guercini et al. 2014; 2024). They show that interaction episodes are often characterised by time pressure, incomplete information, and uncertainty (conditions under which systematic analysis is infeasible), and managers resort to heuristic decision rules. For instance, rule-based behaviours such as "tit-for-tat" cooperation or simple reciprocity mechanisms can stabilise relationships and allow adaptation despite uncertainty (Gigerenzer and Gaissmaier 2011; Guercini et al. 2015). In this sense, heuristics provide a bridge between cognition and behaviour, as they enable managers to react to partners' actions and co-construct viable solutions without relying on full optimisation.

Research has also highlighted that heuristics are not purely individual but shaped and tested in interaction itself. Business relationships serve as contexts for the emergence, validation, and dissemination of heuristic rules that managers adopt in recurrent encounters (Guercini et al. 2022; Mouzas 2022). Over time, these rules become embedded in relational practices and influence how actors coordinate resources, build trust, and frame negotiations. Thus, heuristics act as both cognitive devices and network resources that organisations share, adapt to, and institutionalise (La Rocca 2013).

Decision-making in business networks is therefore better understood as interactive rationality, where the effectiveness of a choice depends not on its internal logic alone but on its ecological fit with partners' expectations and network conditions (March 1994; Guercini 2019; Guercini et al. 2022). Heuristics provide the behavioural mechanisms by which this interactive rationality is enacted in practice.

This insight directly links heuristics to the challenge of sustainability compliance, since regulatory adaptation and innovation require firms to mobilise not just individual cognitive shortcuts but also collective interaction rules around resources and processes—a topic we now turn to in the context of sustainability and resource-based perspectives. The following section discusses sustainability and resource interaction perspectives in order to make the connection explicit.

2.3 Sustainability as a Systemic Challenge in B2B Contexts

Sustainability in B2B contexts is a systemic challenge that extends beyond firm-level initiatives; it requires innovation embedded in interdependent relationships (Rockström et al. 2009; Elkington 2018). Industrial network studies have emphasised that innovation occurs in resource interaction, where firms combine, adapt, and reconfigure technical, organisational, and knowledge resources (Baraldi et al. 2012; Håkansson and Waluszewski 2007; Waluszewski et al. 2024). Because resources are embedded in networks, changes made to improve environmental or social performance in one relationship inevitably reverberate with connected actors, often generating tensions as well as opportunities for innovation (Waluszewski et al. 2019; Aarikka-Stenroos et al. 2022).

The pharmaceutical sector provides a relevant example of how these dynamics unfold. Studies show that market access and sustainability efforts in pharma depend on interactions between suppliers, customers, scientific communities, healthcare institutions, and patient associations (Milanesi et al. 2020; Guercini et al. 2020). Sustainable innovation in pharmaceuticals is rooted in networked resource configurations where the coordination of diverse actors is necessary for both compliance and competitiveness.

Addressing sustainability requires a framework capable of capturing the behavioural mechanisms of actors and the resource dynamics of networks. The NIA provides such a framework by combining the actor–resource–activity (ARA) perspective with resource interaction analysis (RIA), which informs understanding of how decision-making behaviours and resource adaptations jointly shape sustainability-oriented innovation (Cinti et al. 2024b).

2.4 Interaction and Networks as an Analytical Lens for Behavioural Mechanisms

Research with the IMP approach has long emphasised interaction and interdependence as defining features of business markets (Håkansson and Snehota 1995; Håkansson et al. 2009). Firms are embedded in networks of relationships in which adaptation occurs in interaction rather than in isolated decision-making (Håkansson and Snehota 1995; Håkansson et al. 2009). From this perspective, innovation and change emerge from negotiated adjustments among interdependent actors rather than from linear optimisation or unilateral choice (Håkansson and Waluszewski 2007).

In this paper, we draw on this body of work by adopting what we refer to as an interaction-based lens, in the literature recently labelled the NIA, not as a separate theoretical model but as an organising vocabulary that helps structure analysis of interaction in different business activity settings (Prenkert et al. 2022; Cinti et al. 2024b). An interaction-based perspective helps order empirical material such that we can observe behavioural mechanisms in network interaction, The methodological implications of this choice are discussed in Sect. 3.2 (Håkansson and Snehota 1995; Baraldi et al. 2012). Rather than introducing additional technical constructs, this lens foregrounds three analytical ideas rooted in IMP research: interaction, interdependence, and adaptation (Håkansson and Snehota 1995; Håkansson et al. 2009). These ideas are analytically comparable to the abstract categories developed in behavioural economics, such as heuristics and bounded rationality, as they address how actors cope with uncertainty, complexity, and limited knowledge in real decision-making situations (Simon 1957; Kahneman 2011; Guercini 2019).

In this interaction-based perspective, empirical observations are organised by distinguishing the different settings in which interaction unfolds—commonly referred to as developing, producing, and using (Håkansson and Waluszewski 2002; Baraldi et al. 2012). These settings do not represent rigid analytical stages but recurrent contexts in which various coordination problems dominate: exploration and negotiation of solutions in developing, operational integration in producing, and evaluation and feedback in using (Håkansson and Waluszewski 2007; Baraldi et al. 2012). This distinction allows researchers to locate where specific behavioural mechanisms become visible

in interaction without assuming stable sequences or optimal outcomes (Håkansson et al. 2009; Cinti et al. 2024b).

The lens makes clear that behavioural mechanisms are not individual cognitive deviations detached from context but situated responses that emerge at the interfaces where actors, resources, and activities meet (Håkansson and Waluszewski 2007; Baraldi et al. 2012). We refer to these points of interaction as deep interfaces, namely moments where heterogeneous expectations, resource constraints, and activity dependencies intersect and require practical resolution (Waluszewski and Håkansson 2007; Baraldi et al. 2012). At these interfaces, heuristics, trust-based expectations, reciprocity, and satisficing logics become observable as collective responses to interdependence rather than as (purely) individual biases (Simon 1957; Ostrom 1990; Kahneman 2011).

Viewing heuristics as situated responses emerging through interaction at deep interfaces is consistent with Guercini's (2019) argument that heuristics in business contexts should be understood as "tales from the field": empirically grounded patterns of sensemaking that emerge from narratives of interaction and problem-solving and not universally generalisable cognitive rules. Accordingly, qualitative case studies offer a suitable empirical strategy for examining behavioural mechanisms in business networks while maintaining analytical discipline regarding their scope and contextual embeddedness (Guercini 2019; Håkansson and Snehota 1995).

3 Methodology

3.1 Research Design

Behavioural economics research has increasingly emphasised the value of qualitative and case-based approaches to examining how heuristics and decision-making rules emerge in real organisational contexts, rather than solely making inferences from experimental settings (Guercini 2019; Loewenstein et al. 2015). As mentioned, Guercini (2019) conceptualises heuristics as "tales from the field" namely empirically grounded patterns of sensemaking that arise from business narratives and situated problem-solving, highlighting the importance of studying decision-making as embedded in interaction rather than as an application of abstract cognitive rules.

This perspective motivates the research design of this study, which combines behavioural economics with an interaction-oriented analysis of business networks. To capture how heuristics, reciprocity, and satisficing logics unfold in practice, the study builds on analytical tools developed in the IMP tradition, where interaction and interdependence are treated as defining conditions of economic action (Håkansson and Snehota 1995; Håkansson et al. 2009).

In IMP research, the ARA model has long been used to analyse business networks as configurations of interdependent actors whose relationships, resources, and activities evolve through interaction over time (Håkansson and Snehota 1995; Håkansson et al. 2009). From a behavioural standpoint, the model is particularly valuable because it allows decision-making to be examined as situated within network-level interdependencies, tensions, and coordination problems rather than as isolated, firm-level choices (Håkansson and Waluszewski 2007).

Complementing it, the RIA has contributed to a deeper understanding of how heterogeneous resources are combined, adapted, and stabilised through interaction at interfaces between technical, organisational, and relational elements (Baraldi et al. 2012; Prenkert et al. 2022). These interfaces represent critical empirical locations where heuristics, trust-based expectations, and reciprocal commitments become observable as actors confront resource constraints and coordination frictions, particularly in innovation and sustainability-oriented processes (Håkansson and Waluszewski, 2007; Baraldi et al. 2012).

However, recent work has proposed a more integrated interaction-based lens that brings together network-level interdependencies and resource-level interfaces within a single analytical ordering; it is commonly referred to as the NIA (Cinti et al. 2024b; Waluszewski et al. 2024). As discussed above, the NIA is not treated as an additional theoretical model but as an organising lens that synthesises insights from the ARA and the RIA in order to observe how behavioural mechanisms emerge from network innovation processes rather than from individual cognition detached from context (Baraldi et al. 2012; Cinti et al. 2024b).

3.2 Case Selection and Data Collection

Case studies are widely recognised for their effectiveness in exploring complex, context-dependent phenomena, particularly in behavioural economics and industrial networks (e.g. Eisenhardt 1989; Yin 2018). In behavioural economics, case studies are increasingly used to examine how heuristics and decision-making rules operate in real organisational contexts, complementing experimental approaches (Guercini 2019; Loewenstein et al. 2015). For example, Gneezy and List (2013) conducted case studies to understand how behavioural insights apply to organisational practices, while Ostrom (1990) performed case studies to explore cooperative behaviours and governance structures in resource management. Loewenstein et al.'s (2015) investigations into organisational behaviours demonstrate the richness and applicability of case study methodologies in advancing behavioural economic theories (La Rocca and Snehota 2017).

The focal firm, Alpha Pharma, was selected from a cohort of more than 30 Small and Medium Enterprises (SMEs) participating in the SITUM project[1] (Scuola di Innovazione Tecnologica Umanistica Manageriale), a university–industry collaboration programme aimed at fostering sustainability and innovation through multidisciplinary training. Alpha Pharma operates in a heavily regulated pharmaceutical industry and faces unique challenges in embedding sustainability into its innovation processes, which makes it an ideal candidate for exploring the behavioural and network dimensions of policy design and implementation.

In a purposeful sampling approach (Eisenhardt and Graebner 2007), Alpha Pharma was chosen based on specific criteria, including its central role in international supply

[1] The SITUM project involves a consortium of enterprises that constitute the SITUM laboratories. The synergetic collaboration between academic institutions and industrial entities provides students with a contemporary and dynamic understanding of present and anticipated career trajectories, requisite professional competencies, and potential developmental pathways.

networks, its significant interactions with regulatory frameworks, and its active participation in sustainability initiatives. The case allowed for a firm-level perspective of network dynamics while being relevant to broader supply chain challenges (Halinen and Törnroos 2005).

Primary data collection involved 29 semi-structured, in-depth interviews with key actors in Alpha Pharma and its supply network. The interviews captured diverse perspectives on sustainability practices, compliance challenges, and network interactions.

To ensure coherence while allowing flexibility (Brinkmann and Kvale 2018), the interview guide was organised into four thematic areas:

- Sustainability compliance challenges (e.g. perceptions of regulatory requirements, adaptation strategies).
- Interaction and collaboration (e.g. relationships with suppliers, customers, and regulatory bodies).
- Decision-making processes (e.g. use of heuristics, perceptions of risk, role of trust and reciprocity).
- Innovation and organisational change (e.g. adoption of new technologies, collective problem-solving, long-term cultural shifts).

Each area was introduced with open-ended questions (e.g. "Can you describe a recent situation where regulatory requirements influenced your collaboration with partners?"), followed by probing questions to elicit concrete examples and clarify underlying mechanisms. This flexible protocol allowed respondents to elaborate freely on their experiences while maintaining the comparability of interviews.

Secondary data included internal reports, regulatory documents, and publicly available sustainability disclosures. This multi-source approach ensured data triangulation, enhancing the study's validity and reliability (Patton 2014; Yin 2018). The data collection period spanned July 2024 to July 2025.

3.3 Data Analysis

The data analysis followed an abductive approach using the *systematic combining* method (Dubois and Gadde 2002), which integrates empirical findings with theoretical insights iteratively. This approach is particularly suited to case study research in behavioural economics, where emergent findings often challenge existing theoretical frameworks (Timmermans and Tavory 2012; Earl Rinehart 2021).

The analysis was guided by an interaction-based analytical lens combining behavioural economics with insights from industrial network research. Rather than functioning as a formal analytical model, this lens was used to order the empirical material and locate where behavioural mechanisms became visible in network interaction (Cinti et al. 2024b; Håkansson and Johanson 1992; Baraldi et al. 2012). It was used to anchor the empirical material and to locate points where actor behaviours, resource exchanges, and activity links intersect with sustainability compliance challenges (Cinti et al. 2024a, 2024b).

The data were transcribed and coded in two iterative rounds. In the first round, descriptive coding captured key topics such as compliance challenges, sustainability practices, and behavioural dynamics. In the second round, pattern coding established

relationships between codes and linked them to theoretical constructs (Miles and Huberman 1994). This procedure allowed us to move from fragmented accounts to a structured interpretation of decision-making mechanisms and network adaptations.

Themes emerging from the interviews were initially organised inductively (e.g. compliance barriers, trust, reciprocity, resource constraints). In a subsequent step, they were systematically re-mapped using the NIA as guide for the creation of a unified analytical structure for the findings. This step did not introduce new categories but clarified where and how behavioural mechanisms were enacted in network interaction, ensuring close alignment with the research question.

Finally, the comparison between emergent themes and the theoretical framework was explicitly guided by the research question. The analysis focused on how behavioural economic mechanisms operate in shaping compliance behaviours and how heuristics and interaction mechanisms influence adaptation in business networks. When discrepancies arose, the framework was adapted to incorporate new insights, which ensured that it accurately reflected empirical findings while contributing to theoretical development.

4 Findings

4.1 Prequel: Alpha Pharma's Journey Towards Sustainable Innovation

Founded in 1919 in a mid-size city in the middle of Italy, Alpha Pharma began as a small pharmaceutical laboratory. Its activities quickly expanded with the creation of a chemical industry spin-off in 1941, focusing on pharmaceutical production and distribution. A turning point came after World War II when Alpha Pharma introduced a medicine based on vitamin B12 to combat anaemia, which marked its early commitment to public health and innovation.

The 1950s saw the company's relocation to a major metropolitan centre, now its headquarters, and diversification into consumer goods. In 1958, it launched an over-the-counter medicine widely used in Italy. Its active ingredient, paracetamol**,** became a cornerstone of its success, and it ranks among Italy's top-selling medicines.

During the 1960s and 1970s, Alpha Pharma expanded its research capabilities, developing groundbreaking molecules such as oxolamine (an antitussive), benzydamine (an anti-inflammatory), and trazodone (an antidepressant). These advancements positioned the company as a leader in pharmaceutical innovation.

The company began its international expansion in the 1980s, acquiring manufacturing and commercial operations in Spain and Portugal. It also pioneered the use of marketing in pharmaceuticals, launching a successful brand for ibuprofen.

Entering the twenty-first century, Alpha Pharma pursued strategic acquisitions, including an antibacterial brand in 2000, reinforcing its portfolio with disinfectants and hygiene products. In 2021, its acquisition of a brain health therapeutics medicine strengthened its position in mental health and its pain management offerings.

Alpha Pharma operates with over 3000 employees and generates an annual revenue of €1.5 billion.

Alpha Pharma integrates behavioural insights and network-level strategies to address sustainability challenges. The case underscores the dynamic interplay of historical success, regulatory pressures, and the drive for sustainable innovation.

4.2 Scene 1: The Catalyst—Regulatory Shifts and Strategic Imperatives

By 2020, Alpha Pharma (Focal Actor—producing setting) had a governance model that placed sustainability at the centre of its business strategy. A cross-functional sustainability team (Resource—organisational unit, developing setting), led by a sustainability manager (Actor—developing setting), was established to embed ESG[2] principles in all operations, from *supply chain management* (Activity—producing setting) to *product innovation* (Activity—developing setting).

The company aligned its efforts with Alpha Group Sustainability Plan 2024–2026 (Resource—organisational unit, developing setting), setting ambitious goals to be achieved by 2030: reducing greenhouse gas emissions and improving energy efficiency (Activities—producing setting; Resources—facilities), minimising industrial waste through recycling and circular practices (Activities—producing setting; Resources—products/facilities), promoting diversity and inclusion (Activities—developing setting; Resources—organisational units), and building sustainable supply chains supported by a vendor rating system with EcoVadis (Resource—relationship, producing setting).

By 2024, however, EU regulatory pressures such as the Corporate Sustainability Due Diligence Directive (CS3D) and updates to the REACH framework (Resources—facilities, producing setting) had imposed stringent requirements for transparency, lifecycle assessments, and human rights safeguards. For Alpha Pharma, entrenched in complex supplier relationships (Resources—relationships, producing setting), these regulations generated frictions.

The executive board (Actor—developing setting) responded by convening a cross-functional task force (Resource—organisational unit, developing setting), bringing together procurement managers, supply chain coordinators, and quality assurance (QA) staff (Actors—producing setting), sustainability officers and regulatory affairs experts (Actors—developing setting), supported by external consultants (Actor—using setting). Each actor mobilised distinct resources: *procurement contracts and supplier databases* [OU]; *logistics systems and traceability tools* [F]; *ESG metrics and EcoVadis scores* [OU]; *production protocols and safety files* [F]; and *compliance dossiers and legal expertise* [OU].

In the first joint workshops (Activities—developing setting), divergent priorities surfaced: procurement focused on cost containment; sustainability demanded structured reporting; QA emphasised safety; and regulatory experts warned about legal exposure. Behavioural biases shaped decision-making: *status quo bias* among procurement managers hesitant to alter contracts; *rule-of-thumb heuristics* in QA, relying on past audits; and *loss aversion* among executives fearing reputational or financial

[2] Environmental, Social, and Governance, a framework used by investors and stakeholders to evaluate a company's sustainability and ethical impact beyond just financial performance, covering its environmental footprint (E), treatment of people (S), and quality of leadership/ethics (G).

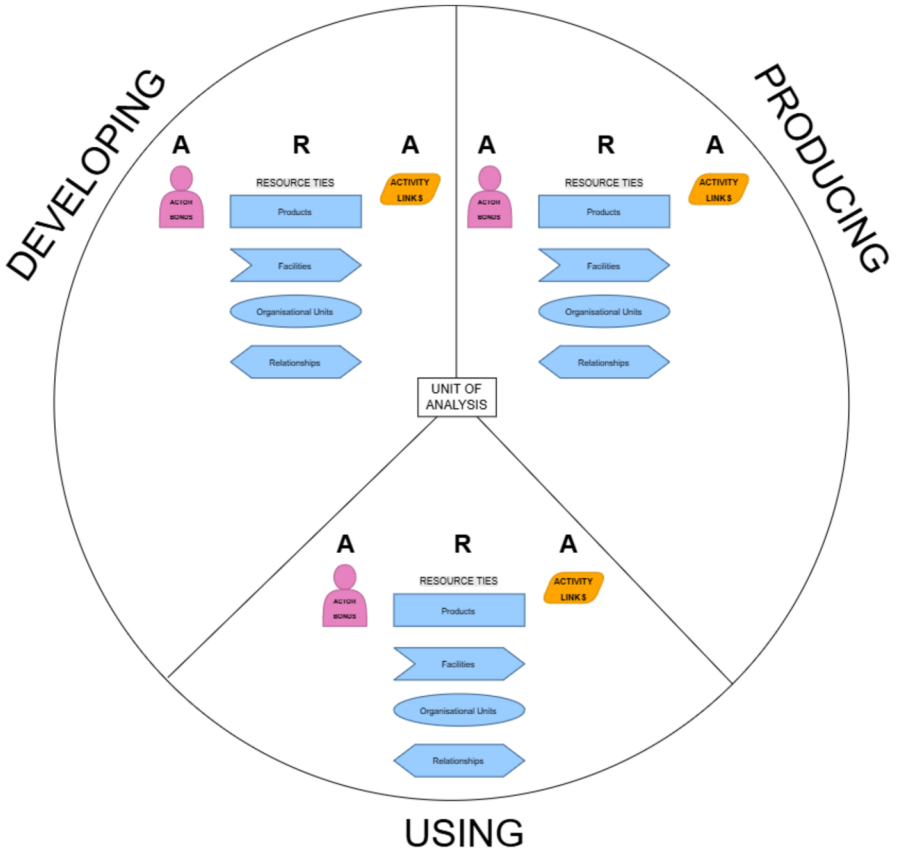

Fig. 1 NIA—An interaction-based analytical lens. Source: Authors' elaboration from Cinti et al. (2024b)

penalties. A strategic workshop facilitated by consultants mapped these divergences into readiness assessments, illustrating that adaptation was not linear optimisation but negotiation between organisational units (Fig. 1).

Tensions were acute with small and medium suppliers (Actors—producing setting), many of which lacked IT facilities and compliance systems (Resources—facilities/organisational units). Procurement managers faced trade-offs between replacing suppliers or tolerating temporary misalignment, often guided by *reciprocity norms* and *trust-based relationships* [R] with long-standing partners.

Internally, production facilities (Resources—facilities, producing setting) required upgrades to meet standards, and the supply chain unit (Actor—producing setting) had to reconfigure transport and warehousing flows. These interdependencies generated organisational frictions, often resolved with *satisficing heuristics*—"good enough" compromises under uncertainty—rather than optimisation.

Figure 2 depicts the Alpha Pharma network in the catalyst phase, illustrating actors, resources and activities in developing and producing settings, with deep interfaces where behavioural biases influenced early regulatory adaptation.

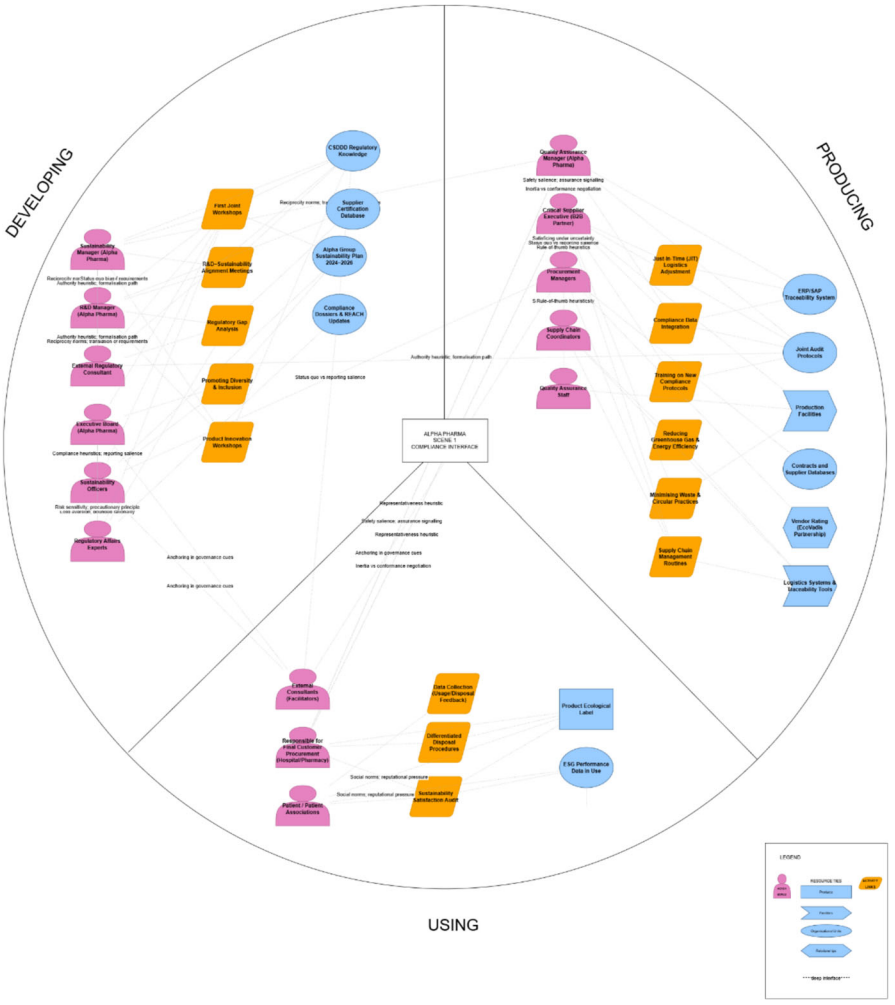

Fig. 2 Alpha pharma network—scene 1. Source: Author elaboration from Cinti et al. (2024b)

The initial assessments documented the need for technical improvements (e.g. monitoring software, facility reporting systems) and the challenge of aligning heterogeneous organisational units, supplier relationships, and regulatory requirements. Decision-making unfolded as an iterative negotiation among developing and producing settings, with bounded rationality and heuristics shaping the collective response to regulatory pressures.

4.3 Scene 2: Collaborative Action—Building a Network Approach

By 2024, Alpha Pharma (Focal Actor—producing setting) recognised that compliance with CS3D and REACH could not be achieved with isolated initiatives but required coordinated action by its organisational units and extended network. The earlier task force (Resource—organisational unit, developing setting) evolved into a structured collaborative programme involving procurement managers (producing setting), supply chain coordinators (producing setting), R&D scientists (developing setting), QA specialists (producing setting), legal and regulatory experts (developing setting), together with tier-1 suppliers (producing setting) and an external auditing partner (using setting).

Each actor mobilised distinct resources. Procurement drew on framework contracts [OU] and supplier relationships [R]; the supply chain team activated logistics hubs and traceability platforms [F]; R&D contributed laboratory facilities [F] and pilot eco-innovation projects [P]; QA relied on audit protocols [OU] and testing equipment [F]; legal and regulatory experts produced interpretative dossiers [OU]; suppliers brought production facilities [F] and local process knowledge [OU]; while the auditing partner provided external validation systems [R].

Cross-setting activities revealed frictions in decision-making. Collaborative workshops (developing) exposed procurement managers' anchoring bias, as they clung to historical cost indicators; supply chain coordinators displayed availability heuristic, prioritising visible issues like packaging waste while neglecting water consumption; R&D scientists showed optimism bias in scaling green technologies; and suppliers, under bounded rationality and loss aversion, hesitated to invest without guarantees of renewed contracts. At the same time, supplier audit and testing sessions (producing/using) highlighted tensions between QA specialists, who insisted on strict reporting protocols, and procurement, who feared alienating cost-sensitive suppliers.

Relational mechanisms nevertheless facilitated adaptation. Reciprocity norms and trust-based relationships [R] allowed for phased transition contracts, where suppliers were given time for gradual upgrades. The compromise was not dictated top-down but emerged from satisficing strategies under uncertainty, balancing reputational risk with supplier viability.

Figure 3 shows the collaborative programme involving internal units, suppliers, and an external auditing partner, indicating cross-setting interdependencies and decision-making shaped by heuristics, reciprocity norms, and satisficing strategies.

A concrete initiative concerned the launch of a digital vendor reporting platform (Resource—facility, producing setting). The IT unit (developing setting) proposed a standardised interface for sustainability reporting. Resistance from suppliers, citing costs and lack of expertise, was countered with training and co-funding initiatives (developing setting; Resources—OU/R), which facilitated gradual alignment. Once again, decision-making was distributed: adaptive heuristics and negotiated adjustments, rather than linear optimisation, shaped the collective solution.

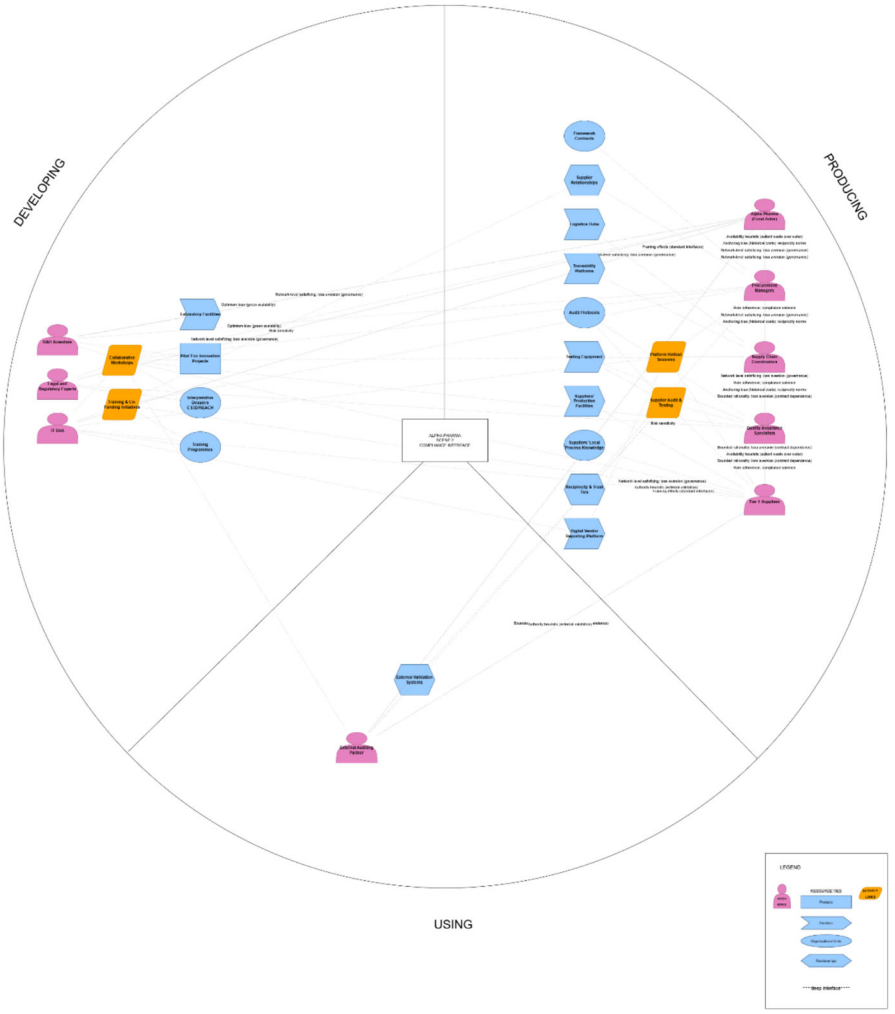

Fig. 3 Alpha pharma network—scene 2. Source: Author elaboration from Cinti et al. (2024b)

4.4 Scene 3: Strategic Reframing

Following the initial collaborative phase, Alpha Pharma (Focal Actor—producing setting) moved into the operationalisation of its compliance and sustainability strategy. The cross-functional programme was expanded to incorporate IT developers (developing setting), external sustainability consultants (using setting), and tier-2 suppliers together with a logistics partner (producing setting), reflecting the widening scope of interdependencies. Alongside these, the sustainability office (developing setting) and a technology provider (developing setting) took on increasing prominence.

A heterogeneous set of resources was mobilised. In the producing setting, production facilities [F], tacit process knowledge [OU], logistics flows [F], and trust-based supplier relationships [R] underpinned ongoing adaptations. In the developing setting, digital traceability platforms [F], the EcoVadis scoring system [OU], specialised recycling equipment [F], and sterilisation protocols [OU] were activated. The using setting contributed benchmarking data and best practices [OU], alongside compliance dossiers and reporting standards [OU], which served as external references for validation.

Activities intensified in all settings. In the developing setting, R&D scientists and the sustainability office co-designed eco-innovation pilots, while consultants convened scenario workshops to test alternative compliance trajectories. In producing, procurement and suppliers engaged in contract negotiations embedding sustainability clauses, supported by vendor selection processes that ranked ESG performance. In parallel, the IT unit advanced platform development and rollout, linking procurement and suppliers through digital traceability. In using, auditors and regulatory bodies conducted audit and compliance validation, anchoring the network to formal standards.

Frictions became more visible during this orchestration phase. Procurement managers displayed status quo bias, resisting major redesigns of contracts in order to preserve cost stability. Suppliers revealed loss aversion, voicing concerns about investments in reporting systems without guaranteed returns. QA staff applied rule-of-thumb heuristics, insisting on traditional audit protocols even when these conflicted with new metrics. R&D scientists showed optimism bias, overestimating the scalability of eco-friendly production lines. These behavioural tendencies surfaced at the deep interfaces where negotiations and adaptations were mediated.

Relational mechanisms nevertheless enabled progress. Reciprocity norms led procurement to offer phased transition contracts, giving suppliers time for gradual upgrades. Trust-based relationships facilitated knowledge sharing, allowing sensitive data to circulate under conditions that would not have been possible at arm's length.

A flagship initiative of this phase was a closed-loop recycling project for medical-grade plastics. Here, Alpha Pharma worked with a technology provider (developing setting) and a logistics partner (producing setting). The project mobilised production facilities, specialised recycling equipment, and inter-organisational routines [OU/R]. Activities spanned all three settings: testing sterilisation protocols (developing), implementing collection flows across hospitals [F] (producing), and validating compliance with EU circular economy directives (using). Decision-making was distributed: actors adopted satisficing strategies ("good enough" sterilisation standards) and shared costs through reciprocity, which encouraged incremental innovation.

In parallel, vendor selection was restructured, with suppliers now ranked on ESG as well as cost and quality. Smaller suppliers resisted disclosure of sensitive data, which compelled procurement, under bounded rationality, to accept partial information in the short term while planning gradual escalation of requirements.

Figure 4 presents the operationalisation phase, where eco-innovation pilots, closed-loop recycling, and revised vendor selection processes mobilised actors in all three settings, with decision-making distributed through trust-based relationships and adaptive heuristics.

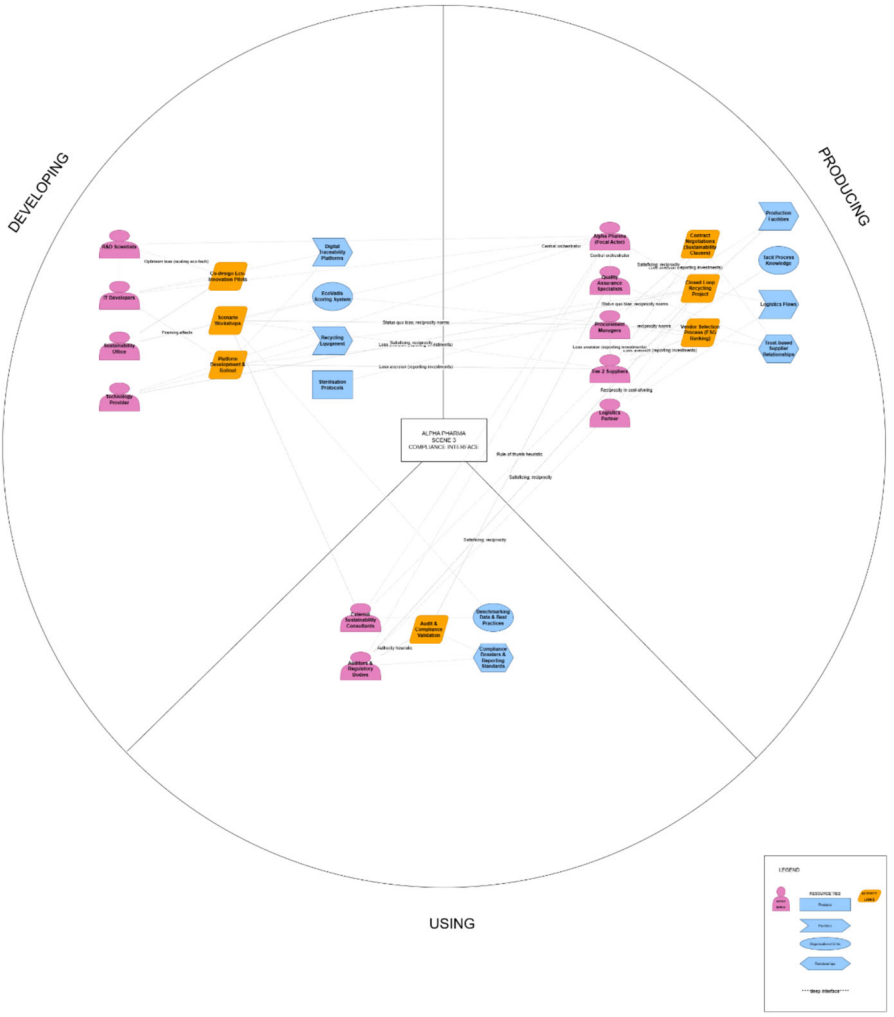

Fig. 4 Alpha pharma network—scene 3. Source: Author elaboration from Cinti et al. (2024b)

Through these intertwined activities, the network progressively shifted from fragmented responses towards orchestrated compliance. Yet the process remained characterised by heuristics and bounded rationality rather than by linear optimisation; regulatory adaptation occurred with negotiated interdependencies across developing, producing, and using settings.

4.5 Sequel: Realising the Vision—Integrating Advanced Technologies and Building Resilience

By late 2026, Alpha Pharma is set to reach a pivotal stage in its sustainability journey, where regulatory compliance and innovation will become fully intertwined with its network activities. The company does not simply aim to meet CS3D and REACH requirements but plans to leverage them as catalysts for technological and organisational renewal.

Advanced technologies will be mobilised as resources: 3D printing units for prototyping eco-friendly components (Resource—facilities, developing setting), closed-loop material reuse systems (Resource—facilities, producing setting), and digital monitoring dashboards for real-time ESG performance (Resource—organisational units, developing setting). These technologies are expected to reshape the interdependencies among actors and force new forms of collaboration by suppliers, logistics partners, and regulators.

One standout project will involve a collaborative initiative by Alpha Pharma (Focal Actor—producing setting), a technology provider (Actor—developing setting), and a logistics partner (Actor—producing setting). The goal is to optimise the reuse of medical-grade plastics—a significant challenge in an industry with strict regulatory standards. The actors will exchange facilities (sterilisation plants), products (medical-grade plastics), and inter-organisational routines (joint collection and validation protocols). Activities will be distributed across settings: testing sterilisation protocols (developing setting), running recovery flows through hospital networks (producing setting), and validating EU-compliant material reuse (using setting).

The expected outcome is reduced waste generation and compliance with EU circular economy directives. Decision-making in this project is likely to be shaped by satisficing heuristics (i.e. actors will agree on "good enough" sterilisation thresholds under uncertainty) and by reciprocity, with costs and risks shared proportionally by the partners.

Internally, Alpha Pharma's culture will undergo a profound transformation. The HR department (Actor—developing setting) plans to mobilise organisational units as resources and launch employee engagement programmes and training workshops (Activities—developing setting) to embed sustainability into daily routines. Employees are expected to rely on simple heuristics (e.g. "if in doubt, choose the greener option") as decision rules in order to reinforce sustainability as a shared value rather than an external imposition.

In parallel, Alpha will reorient its supplier relationship management systems to prioritise environmental and social goals. Vendor selection criteria will include ESG performance metrics (Resource—organisational units, producing setting), which will encourage suppliers (Actors—producing setting) to adopt sustainable practices. Collaboration agreements will be revised to emphasise shared accountability and long-term reciprocity norms (Resource—relationships, producing setting). Suppliers are to receive technical assistance and financial support to adapt—especially smaller firms that lack the resources to comply independently.

In these initiatives, frictions are expected to persist: suppliers may complain about increased reporting burdens, QA staff may raise concerns over balancing safety with circularity, and procurement may struggle to reconcile rising costs with sustainability commitments. But these frictions will act as triggers for innovation as actors negotiate adaptive solutions under bounded rationality.

As Alpha Pharma advances its sustainability agenda, the company is expected to demonstrate a capacity to adapt to future challenges. The network as a whole will become more resilient: developing-setting actors (R&D, sustainability managers) will generate new solutions; producing-setting actors (suppliers, procurement, QA) will align processes; and using-setting actors (auditors, regulators, hospitals) will validate practices and reinforce legitimacy.

The culmination of these efforts will illustrate the behavioural economics mechanisms at play: loss aversion spurring early compliance investments, reciprocity sustaining supplier engagement, and satisficing heuristics enabling incremental but cumulative improvements. By fostering shared commitments among employees, suppliers, and partners, Alpha Pharma will create a resilient network equipped to respond to evolving regulatory and market demands.

This phase of the journey is expected not only to solidify Alpha Pharma's position as a sustainability leader in the pharmaceutical industry but also to serve as a model for other firms navigating similar transformations.

Figure 5 traces the Alpha Pharma case timeline with its progression from the catalyst phase through orchestration and operationalisation to the prospective 2026 stage, where regulatory compliance, innovation, and behavioural mechanisms converge into an integrated sustainability strategy (Table 1).

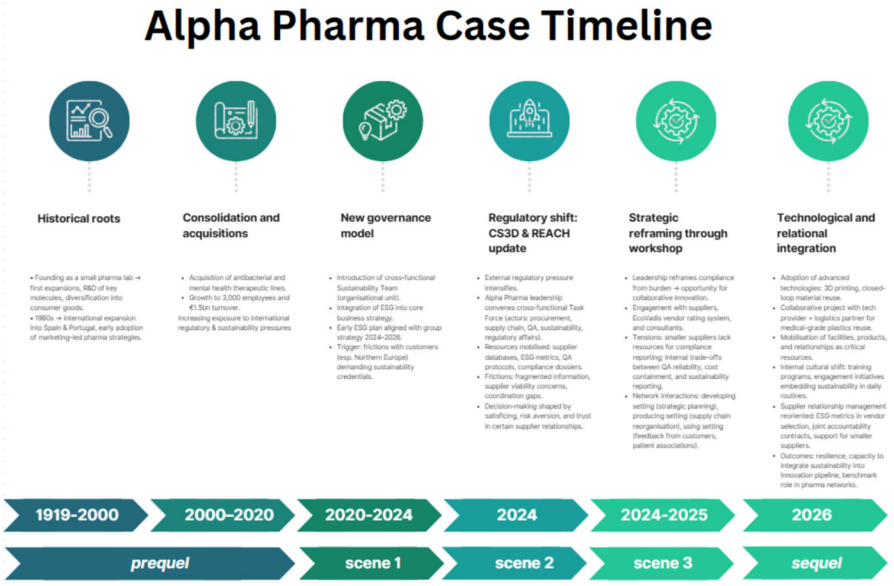

Fig. 5 Alpha pharma case timeline. Source: Authors' elaboration

Table 1 Primary data collection Source: Authors' elaboration

#	Role	Modality	Duration	Date	Notes
1	Sustainability manager	Face-to-face	1 h 30 min	10/07/2024	Company history, facilities, projects, TCFD, Angelini Ventures, ESG, EcoVadis, CBAM, IPCC
2	Sustainability manager	Videocall	45 min	20/07/2024	Team questions analysis, European directives, carbon footprint
3	Supply Chain executive director	Videocall	50 min	25/07/2024	Organisation, vendor rating, pharmaceutical sector characteristics, carbon footprint, logistics footprint, inventory optimisation, waste management, innovation
4	Capex & procurement sustainability manager	Videocall	30 min	02/08/2024	CS3D, due diligence, PVC to PET transition, sustainability integration, EcoVadis, joint strategies, sustainability team
5	Global procurement director	Videocall	30 min	05/08/2024	CS3D, due diligence, PVC to PET transition, sustainability integration, EcoVadis, joint strategies, sustainability team
6	Global internal communication manager	Videocall	40 min	10/08/2024	Internal communication, sustainability team, external communication
7	Project & portfolio management head	Videocall	50 min	15/08/2024	GDO marketing channels, sustainability integration, challenges and opportunities, green shaming, product development, regulation implementation, impact
8	Marketing manager	Videocall	50 min	20/08/2024	GDO marketing channels, sustainability integration, challenges and opportunities, green shaming, product development, regulation implementation, impact
9	Head of industrial operations HRBP	Videocall	30 min	25/08/2024	Sustainability commitment, training, recruitment strategies, sustainability team, supplier sustainability, specialised roles
10	Preclinical development manager	Videocall	60 min	01/09/2024	New context, antibiotic resistance, balancing innovation and sustainability, sustainability policies, ecodesign strategies, internal/external relations, CS3D

Table 1 (continued)

#	Role	Modality	Duration	Date	Notes
11	Group IT & innovation integration director	Videocall	60 min	10/09/2024	Digital sustainability, green IT project, sustainable innovation collaboration, digital innovation, supplier relations, regulatory frameworks
12	Sustainability manager	Videocall	45 min	15/09/2024	CS3D, supply chain mapping, supplier inspections, extreme cases (e.g. India), commercial sustainability consequences
13	CSDDD webinar	Webinar	60 min	20/09/2024	Focus on CS3D
14	Quality assurance manager	Videocall	50 min	25/09/2024	Supplier quality verification, sustainability audits, compliance challenges, material traceability, integration with SAP systems
15	Senior R&D scientist	Videocall	60 min	01/10/2024	Innovations in sustainable formulations, balancing efficacy and environmental impact, R&D–supply chain interactions
16	HR development manager	Videocall	40 min	05/10/2024	Recruitment strategies for sustainability roles, employee engagement programmes, internal sustainability training initiatives
17	Packaging innovation specialist	Videocall	50 min	10/10/2024	Development of sustainable packaging solutions, vendor collaborations, compliance with EU packaging waste directives
18	Sustainability consultant	Videocall	45 min	15/10/2024	Strategic sustainability alignment, ESG benchmarking, EcoVadis rating improvements, collaboration frameworks
19	Logistics manager	Videocall	40 min	20/10/2024	Sustainable logistics strategies, carbon footprint reduction in transportation, partnerships with logistics providers
20	Digital transformation specialist	Videocall	50 min	25/10/2024	Integration of sustainability goals into digital transformation projects, IT system enhancements, data-driven sustainability decision-making

Table 1 (continued)

#	Role	Modality	Duration	Date	Notes
21	Compliance officer	Videocall	40 min	30/10/2024	Regulatory compliance challenges, CS3D implementation, stakeholder communication strategies
22	Environmental analyst	Videocall	45 min	02/11/2024	GHG emissions measurement, water usage tracking, waste reduction strategies, collaboration with EcoVadis
23	Senior procurement officer	Videocall	40 min	05/11/2024	Vendor evaluation processes, cost–sustainability balance in procurement, joint initiatives for ESG compliance
24	Innovation and sustainability specialist	Videocall	50 min	08/11/2024	Circular economy implementation in supply chain, partnerships with academic institutions, innovation-driven ESG goals
25	Strategic planning manager	Videocall	50 min	10/11/2024	Long-term sustainability planning, alignment with corporate strategy, stakeholder engagement processes
26	Sustainability manager	Videocall	50 min	15/11/2024	Final review of sustainability roadmap, assessment of key milestones, preparation for 2025 ESG report
27	Environmental analyst	Face-to-face	35 min	15/07/2025	Discussion on data gaps in environmental monitoring; evaluation of reporting tools for CS3D/REACH alignment
28	Sustainability manager	Face-to-face	40 min	15/07/2025	Insights on internal coordination challenges; integration of supplier audits into ESG compliance framework
29	Sustainability manager	Videocall	30 min	18/07/2025	Follow-up on training initiatives; feedback on digital traceability platform; reflections on staff engagement

4.6 Interaction-Based Analysis of Settings, Actors, and Behavioural Mechanisms

In Alpha Pharma's sustainability journey, behavioural mechanisms shaped compliance and innovation within a highly regulated B2B network. To capture them, we combined the initial thematic analysis with a structured NIA-based interpretation. The thematic step provided a first overview of the main issues—compliance challenges, collaborative responses, innovation practices, and cultural shifts—while the NIA analysis situates these themes in terms of actors, resources, activities, and settings. This approach clarifies how heuristics, reciprocity, and bounded rationality operated at different stages of Alpha Pharma's transformation by linking micro-level decision-making to systemic outcomes.

Table 2 applies the NIA to the case. It shows how actors in the developing, producing, and using settings mobilised heterogeneous resources and engaged in interdependent activities, while the network itself was continuously reshaped by regulatory pressures and organisational responses. Adaptation did not unfold as linear optimisation but as a sequence of negotiated adjustments under uncertainty. Behavioural mechanisms such as heuristics, reciprocity, and satisficing were repeatedly observed in the interactions reported in the empirical material, accompanying how actors interpreted challenges, coordinated activities, and mobilised resources. Heuristics such as status quo bias, anchoring, and optimism guided how challenges were interpreted; reciprocity and trust-based relationships provided the conditions for sustaining collaboration despite tensions; and satisficing solutions emerged as pragmatic compromises in place of optimisation. Table 2 highlights how the interplay between interdependencies and behavioural economics shaped network-level decision-making and shows that compliance and innovation evolved incrementally in negotiated interdependencies.

Table 2 organises the empirical material by presenting the behavioural mechanisms observed in developing, producing, and using settings and their associations with specific configurations of actors, resources, and activities. It provides an overview of where and how such mechanisms became visible in interaction.

The following section discusses the empirical findings by interpreting the observed behavioural mechanisms using an interaction-based perspective.

5 Discussion

Drawing on the NIA analysis, this section addresses the research question: How do behavioural economics mechanisms shape compliance and innovation within sustainability-oriented business networks? The case of Alpha Pharma shows how cognitive biases, heuristics, and social norms become embedded in inter-organisational interactions in developing, producing, and using settings (Baraldi and Wagrell 2022; Waluszewski et al. 2024).

Three key insights emerge.

First, behavioural mechanisms condition how regulatory pressures were interpreted and translated into action. Instead of being neutral, regulations such as CS3D and REACH were framed differently by procurement managers, sustainability officers, and suppliers. Procurement anchored decisions to historical cost structures (Tversky

Table 2 Mapping heuristics, reciprocity, and adaptation across NIA settings

Setting	Actors	Resources & activities mobilised	Deep interface	Behavioural economics mechanisms	Insights & implications
Developing	Sustainability manager; R&D; Regulatory affairs; Consultants	Sustainability plan [OU]; Compliance dossiers [OU]; Workshops and readiness assessments [A]	Intra with Developing (task force); Inter with Producing	Framing effects (compliance as burden vs. opportunity); Bounded rationality; Loss aversion (Jolls et al. 1998; Kahneman and Tversky 1979; Thaler and Sunstein 2008)	Regulatory adaptation framed as negotiated process; compliance pressure catalysed organisational change
Producing	Procurement; Supply chain; QA; Tier-1 and tier-2 suppliers; Logistics partners	Vendor rating [R]; Contracts [OU]; Logistics systems [F]; Traceability platforms [F]; Recycling facilities [F]; Collection flows [A]	Inter with Developing (compliance protocols); Inter with Using (audits)	Status quo bias (procurement); Anchoring bias (cost focus); Reciprocity; Trust-building; Satisficing (Samuelson and Zeckhauser 1988; Kahneman 2011; Ostrom 1990; Simon 1957)	Supplier relationships balance cost–compliance trade-offs; reciprocity norms sustain gradual adaptation
Using	External auditors; Regulatory bodies; Patient associations	Validation systems [R]; Reporting standards [OU]; Audits [A]; ESG performance data [OU]	Inter with Producing (supplier audits); Inter with Developing (reporting protocols)	Availability heuristic (visible vs. invisible issues); Rule-of-thumb heuristics (QA audits); Conditional cooperation (Tversky and Kahneman 1974; Gigerenzer 2018; Thaler 2016)	External validation consolidates legitimacy; heuristics shape which sustainability metrics are prioritised

Authors' elaborations based on Baraldi and Wagrell (2022), Baraldi et al. (2024), Waluszewski et al. (2024), Cinti et al. (2024b), and Cinti and Lillini (2024)

Data availability statement: The data supporting the findings of this study are not publicly available due to the sensitive nature of the qualitative interview material and the risk of compromising participant confidentiality. Consent for publication of raw data was not obtained, and although transcripts have been anonymised, the contextual richness of the data means that complete anonymity cannot be fully guaranteed. The benefit of publishing selected excerpts was deemed to outweigh the minimal risk to confidentiality, in line with guidance provided by Springer Nature Guidelines. Further information may be made available upon reasonable request, subject to appropriate confidentiality safeguards

and Kahneman 1974), while sustainability managers relied on framing effects that positioned compliance as an opportunity rather than a burden (Thaler and Sunstein 2008). These divergences illustrate how bounded rationality mediates the uptake of external pressures (Simon 1957; Jolls et al. 1998) and explains the fragmented trajectories visible in the early stages of Alpha Pharma's adaptation.

Second, decision-making did not follow a linear optimisation logic but was negotiated at the deep interfaces between actors, resources, and activities. Status quo bias (Samuelson and Zeckhauser 1988), loss aversion (Kahneman and Tversky 1979), and rule-of-thumb heuristics (Gigerenzer 2018) surfaced in negotiations around supplier contracts, audit procedures, and reporting systems. At the same time, reciprocity norms and trust-based relationships (Ostrom 1990; Aarikka-Stenroos et al. 2022) acted as stabilisers enabling continuity and gradual adaptation. Compliance and innovation therefore emerged from satisficing strategies and incremental adjustments (Simon 1957; Kahneman 2011) rather than from top-down coordination or rational calculation.

Third, behavioural economics helps connect micro-level biases with systemic network outcomes. The cumulative effect of heuristics and relational mechanisms shaped the trajectory of the network: frictions around supplier capacity gaps, innovation pilots, and recycling initiatives did not block progress but reoriented interactions towards pragmatic compromises (Baraldi et al., 2024; Cinti et al. 2024b). The use of heuristics such as "good enough" standards, combined with reciprocity in cost-sharing, allowed the network to sustain momentum under uncertainty (Festinger 1957; Thaler 2016). This underscores how sustainability-oriented business networks evolve not despite but through behavioural mechanisms that transform frictions into sources of negotiated innovation (Waluszewski et al. 2024).

5.1 Behavioural Mechanisms Shaping Interaction in Developing, Producing, and Using Settings

Decision-making in Alpha Pharma's sustainability strategy was strongly shaped by bounded rationality, as managers relied on heuristics and satisficing rather than full optimisation when facing conflicting priorities (Simon 1957; Kahneman 2011). Procurement managers anchored on historical cost indicators, sustainability officers emphasised structured ESG reporting, and regulatory affairs experts warned of legal exposure. These divergent priorities could not be resolved through rational optimisation. Instead, the task force adopted heuristics such as satisficing ("good enough" compromises; Simon 1957) and was influenced by loss aversion (Tversky and Kahneman 1974), particularly in the fear of reputational and financial penalties. External consultants facilitated framing effects (Jolls et al. 1998; Thaler and Sunstein 2008) by presenting compliance not as a burden but as a trigger for innovation. This reframing reduced resistance and enabled organisational units to align around joint objectives. The findings resonate with research on heuristics in industrial networks, which shows that managers use simplified rules to navigate interdependence and uncertainty (Guercini et al. 2014, 2015; Gigerenzer 2018). By embedding these behavioural mechanisms into cross-functional collaboration, Alpha Pharma was able to mobilise

resources and move from fragmented priorities to collective strategic planning (Baraldi and Wagrell 2022; Waluszewski et al. 2024).

Behavioural mechanisms enabled collaboration under conditions of asymmetry, where smaller suppliers—lacking adequate facilities and organisational routines—showed resistance to change driven by status quo bias and loss aversion (Jolls et al. 1998; Kahneman 2011; Thaler 2016). Alpha Pharma mitigated this obstacle by relying on long-standing relationships and social norms of reciprocity and trust (Ostrom 1990; Aarikka-Stenroos et al. 2022). These mechanisms acted as a "network lubricant," lowering perceived risks and motivating suppliers to invest in compliance despite short-term costs. A concrete illustration was the collaborative project on medical-grade plastics reuse. Instead of being guided solely by cost–benefit logic, the initiative was enabled by conditional cooperation and trust-based commitments: suppliers accepted temporary inefficiencies in exchange for long-term partnership continuity. This aligns with prior IMP work emphasising the socio-material nature of resource interaction and the importance of relational mechanisms for innovation (Håkansson and Waluszewski 2007; Baraldi et al. 2012; Waluszewski et al. 2024). In this sense, behavioural economics and NIA jointly explain why compliance initiatives evolved into innovation processes: suppliers and focal firms moved beyond formal contracts to co-develop adaptive solutions under uncertainty.

Compliance and innovation were reinforced through iterative feedback mechanisms as monitoring platforms and vendor rating systems created accountability loops that shaped conditional cooperation and gradual adaptation over time (Gigerenzer 2018; Thaler and Sunstein 2008). These dynamics reflected group-based accountability norms (Cialdini 2007; Thaler 2016) that ensured behaviours improved incrementally as actors adapted to regulatory and market pressures. Decision-making was characterised by adaptive heuristics: actors used availability heuristics (focusing on visible issues such as packaging waste), satisficing strategies for incremental improvements, and iterative learning to refine practices (Simon 1957; Kahneman 2011). Rather than pursuing a one-off optimisation, Alpha Pharma and its partners engaged in ongoing socio-material adaptation where technological innovations (e.g. 3D printing, recycling platforms) were continuously adjusted by networked interaction. This finding extends the notion of ecological rationality (Gigerenzer and Gaissmaier 2011) to sustainability contexts by showing that heuristics are not merely cognitive shortcuts but adaptive strategies co-shaped by inter-organisational collaboration (Håkansson and Waluszewski 2007; Baraldi and Wagrell 2022).

6 Conclusion

The present study has examined how behavioural economics mechanisms shape sustainability compliance and innovation within business-to-business networks, drawing on an in-depth case study of Alpha Pharma. Overall, the findings answer the research question by showing that behavioural economics mechanisms shape sustainability compliance and innovation not as individual cognitive deviations but as interactional responses to interdependence, uncertainty, and resource constraints in business networks. Rather than treating compliance as the outcome of linear optimisation or purely

regulatory enforcement, the analysis demonstrates how adaptive responses emerge from interaction under bounded rationality, where heuristics, reciprocity, and trust guide collective decision-making under conditions of uncertainty.

Its first contribution concerns the integration of behavioural economics with industrial network research. The findings provide empirical confirmation that behavioural mechanisms such as reciprocity, trust-based expectations, and satisficing logics play a central role in sustaining collaboration and compliance in regulated network contexts, in line with earlier IMP research (Guercini 2019; Guercini et al. 2014; Aarikka-Stenroos et al. 2022). Adaptation appears as a function of formal incentives but also as a negotiated process embedded in long-term relationships.

The second contribution lies in its extending behavioural economics beyond individual or dyadic settings. By documenting how anchoring, loss aversion, status quo bias, and framing effects operate in inter-organisational interaction, the study demonstrates that departures from rational optimisation are not anomalies but rather constitutive elements of networked decision-making (Jolls et al. 1998; Thaler 2016; Gigerenzer 2018). Behavioural mechanisms emerge as relational and context-dependent and are shaped through repeated interaction rather than isolated cognition.

The third contribution concerns the systemic aggregation of behavioural mechanisms. By organising the empirical material with an interaction-based analytical lens, the study shows how micro-level heuristics and relational norms accumulate into network-level adaptations over time (Baraldi et al. 2012). Sustainability compliance and innovation thus appear as emergent outcomes of interconnected adjustments in developing, producing, and using settings rather than as centrally designed solutions.

From a managerial perspective, the findings suggest that sustainability compliance cannot be addressed solely with control systems or contractual enforcement. Managers operate in contexts characterised by uncertainty, interdependence, and cognitive limitations where recognising the role of heuristics and relational norms is crucial. The case illustrates how trust-based relationships, reciprocity, and shared problem-solving practices facilitate supplier engagement and reduce resistance to change. Managing sustainability therefore involves cultivating interaction patterns that support gradual alignment rather than attempting to impose uniform solutions on heterogeneous partners.

The analysis also carries implications for policy design. Regulatory frameworks enter business networks through interpretation and negotiation, mediated by bounded rationality and uneven resource capacities among firms. Policies that ignore such conditions risk reinforcing exclusion or superficial compliance. Designing regulatory instruments that acknowledge behavioural constraints and relational dynamics can support more inclusive and durable forms of adaptation, particularly in networks characterised by asymmetries between focal firms and smaller suppliers.

The use of a single case study allowed a rich, process-oriented analysis of behavioural mechanisms in a regulated industrial context while limiting statistical generalisability. Future research could extend the present insights with comparative multi-case designs in different industries or institutional settings or by combining qualitative network studies with experimental or quasi-experimental approaches. Further investigation is also required to examine how heuristics evolve over time and how alternative network configurations condition the balance between compliance

and innovation. Such work would deepen understanding of how behavioural mechanisms, interaction processes, and systemic pressures jointly shape pathways towards sustainable value creation in business networks.

Appendix: Abductive thematic analysis

See (Table 3).

This appendix summarises the main themes emerging from the data: regulatory pressure and compliance, supply chain collaboration, innovation for sustainability, cultural and organisational shifts, and economic trade-offs. Each highlights behavioural dynamics—such as risk aversion, reciprocity, satisficing, and framing effects—that conditioned Alpha Pharma's strategic and operational decisions.

This thematic synthesis provided the basis for the subsequent NIA lens, which revealed how these dynamics unfold in developing, producing, and using settings where frictions, adaptations, and resource reconfigurations occurred.

Table 3 Abductive thematic analysis Source: Authors' elaboration based on Thompson (2022)

Theme	Code	Illustrative quote	Behavioural economics mechanisms observed	Implications
Regulatory pressure and compliance	Impact of CS3D and REACH Regulations	"Compliance requires a systematic approach to supplier monitoring and reporting."	Risk aversion; bounded rationality; compliance heuristics (checklist rules-of-thumb) (Simon 1957; Jolls et al. 1998)	Firms frame compliance as risk reduction but rely on simplified heuristics, leading to inefficiencies in resource allocation
	Data Collection Challenges	"Smaller suppliers lack the resources to meet data requirements."	Free-riding; resource scarcity bias; status quo bias (Kahneman and Tversky 1974; Thaler 2016)	Smaller suppliers risk exclusion, as limited capacity and inertia prevent them from adapting to new reporting demands
Supply chain collaboration	Co-creation with Suppliers	"Sustainability goals need collaboration; we can't act alone."	Reciprocity norms; trust-building; conditional cooperation heuristics (Ostrom 1990; Thaler and Sunstein 2008)	Relational mechanisms substitute for formal controls, enabling joint adaptation but requiring coordination investments
	Vendor Rating Implementation	"The vendor rating system incentivises suppliers to meet ESG criteria."	Framing effects; reputational heuristics; conditional cooperation (Tversky and Kahneman 1981; Gigerenzer 2018)	Transparent metrics align incentives but may bias attention towards measurable ESG criteria, thus neglecting softer dimensions

Table 3 (continued)

Theme	Code	Illustrative quote	Behavioural economics mechanisms observed	Implications
Innovation for sustainability	Technological Integration	"We've introduced 3D printing to reduce waste, but it's a collaborative effort."	Innovation adoption heuristics; iterative learning; optimism bias (Rogers 2003; Kahneman 2011)	Joint investments drive innovation diffusion, though actors overestimate ease and speed of scaling technologies
	Circular Economy Practices	"Reusing medical-grade plastics has been a game-changer."	Loss aversion; cost–benefit heuristics; ecological rationality (Kahneman and Tversky 1979; Gigerenzer and Gaissmaier 2011)	Firms adopt circular practices to avoid waste and penalties, but upfront costs create behavioural resistance
Cultural and organisational shifts	Sustainability as a Core Value	"Employees now see sustainability as integral to our operations."	Norm internalisation; social proof; identity heuristics (Cialdini 2007; Thaler 2016)	Embedding sustainability in culture ensures long-term alignment, as decisions are guided by norms rather than mandates
	Cross-functional Collaboration	"The task force integrates inputs from procurement, R&D, and logistics."	Bounded rationality; group decision-making heuristics; satisficing (Simon 1957; Gigerenzer 2007)	Cross-functional teams expand perspectives but settle on satisficing solutions due to complexity and information overload

Table 3 (continued)

Theme	Code	Illustrative quote	Behavioural economics mechanisms observed	Implications
Economic trade-offs and decision-making	Cost of Sustainability Compliance	"Investing in monitoring systems is costly but unavoidable."	Present bias; short-termism; discounting future benefits (Laibson 1997; Thaler and Sunstein 2008)	High upfront costs make firms undervalue long-term sustainability gains, requiring external incentives to realign decisions
	Balancing Efficiency and Innovation	"Sustainability often disrupts operational efficiency, especially for smaller suppliers."	Cognitive dissonance; satisficing heuristics; inertia bias (Festinger 1957; Gigerenzer 2018)	Firms manage tensions through compromise solutions, balancing immediate efficiency with uncertain innovation payoffs

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Declarations

Conflict of interest We have no conflict of interest to disclose.

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