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An Agile Approach to Sourcing Solutions: Embracing Uncertainty for Strategic Relevance

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ABSTRACT

This study examines agile sourcing, an emerging approach to procurement that deliberately incorporates uncertainty to address business challenges. Guided by a critical realist ontology and framing agile sourcing as an information-processing issue, this study explores the generative mechanisms that enable organizations to manage the deliberate escalation of sourcing uncertainty and its implications. The empirical phenomenon of agile sourcing is theorized by identifying mechanisms at three key sourcing steps through an in-depth analysis of three case studies. These mechanisms include top-down attention-directing schemas, rich information processing, redundancy in supplier innovation, maximization of access to novel information, comparative acquisition of collaboration experience, experience-based supplier selection, simple and flexible input-based compensation, and flexible reorientation and situational adaptation through relational governance. The findings reveal interdependencies among the identified mechanisms, thereby suggesting complexity in managing the sourcing process and also suggesting the antifragile nature of the agile sourcing approach. Furthermore, employing the critical realist approach, the research generates theoretical knowledge on the causal mechanisms of agile sourcing.

1 | Introduction

The effective sourcing of products and services typically assumes that the buyer understands what is required and can clearly articulate specifications (van Weele 2010). In the traditional sourcing process, a clear specification provided by the internal customer is the foundational starting point (Ellram and Tate 2015). While services and innovations are particularly challenging to source, as they often defy efforts for precise early specification (O'Connor and Rice 2013; Stanko and Calantone 2011; Wynstra et al. 2018) and entail several challenges in the sourcing process (Hoetker 2005; Luzzini et al. 2015; Van de Vrande et al. 2009), the challenge of specification uncertainty concerns all kinds of items. While the literature seeks to address the problem of managing uncertainty in specification—for example, through early involvement (Van der Valk and Rozemeijer 2009) or socialization with suppliers (Arvidsson et al. 2022)—alternative perspectives argue that uncertainty regarding specifications should be accepted (Gelderman et al. 2015) or that the focus must be placed on arriving at what is considered a sufficient understanding of requirements (Hawkins et al. 2015; Heinis et al. 2022).

However, an emerging sourcing practice goes beyond acceptance to embracing and even deliberately choosing a high level of specification uncertainty (Aoufi et al. 2021; Jamieson et al. 2006). Known as agile sourcing, this approach draws on the agile project management paradigm for software development, which is particularly suited to situations where "it is really impossible for a client ... to specify completely, precisely, and correctly the exact requirements of a ... product before trying some

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version of the product" (Austin and Devin 2009, p. 463). This deliberate lack of early specification fundamentally challenges sourcing and complicates decision-making.

Deliberately embracing uncertainty by not precisely specifying requirements early in the sourcing process leads to an interesting theoretical dilemma. Organizations, often unavoidably, need to draw on external complementary resources and capabilities from markets (Argyres and Zenger 2012; Drees and Heugens 2013). In such situations, uncertainty must be avoided to minimize transaction costs (Williamson 2008). However, the lack of initial specifications leads to an increased associated uncertainty, thereby complicating the answers to the following questions: What is needed? How to select a suitable supplier and with which criteria (Joshi 2009)? How to access the best supplier resources (Schiele 2010)? How to enter into contracts under uncertainty (Williamson 2008)? This may prohibitively increase transaction costs for sourcing (see Hoetker 2005). Therefore, deliberately increasing uncertainty with the agile approach appears to be folly in a situation where superior external resources can be accessed with sourcing; managing such a situation appears to be challenging.

There are reasons for deliberately aggravating this dilemma of dealing with the combination of superior external resources and high uncertainty in accessing them. First, procurement is—to a large extent—now being linked to strategic decision-making and problem-solving—both at the top management level and cross-functionally—which increases the level of expectations regarding procurement's value contribution. Second, priorities—such as sustainability and the uptake of new digital technologies—can challenge existing business and operating models (Salmi et al. 2023). Together, these trends imply higher expectations from procurement to help resolve various complex problems at the strategic level, within budget and lead time constraints, and with internal customers requiring solutions that only external suppliers can provide. Often, such problem-solving involves ambiguity regarding the nature of the item or the solution, thus introducing uncertainty to the sourcing task, particularly regarding specification. As this article demonstrates, the deliberate choice for higher uncertainty may enable an organization to achieve better outcomes or higher value.

We seek to understand how the theoretical dilemma of accessing external resources under high uncertainty can be resolved with agile sourcing. We argue that the phenomenon of uncertainty in sourcing can be usefully framed using the information processing theory (IPT) (Galbraith 1974; Tushman and Nadler 1978), which recommends a fit between information processing requirements, which are driven by uncertainty, and information processing capacity, which is provisioned by managerial mechanisms for the completion of tasks, such as organizing (Tushman and Nadler 1978) or, in our case, sourcing. Furthermore, the granularity of the analysis may be increased by examining the information processing fit across the typical steps of the sourcing process: determining specifications, selecting suppliers, and contracting (van Weele 2010). This approach suggests that completing the associated tasks of the process can be viewed as causal outcomes generated by the underlying mechanisms. Therefore, we articulate the following research question to guide our analysis: *What are the generative mechanisms for managing uncertainty across the steps of the agile sourcing process?*

Drawing on the stratified onto-epistemological assumptions of critical realism (Bhaskar 2016), our IPT-guided empirical analysis enables us to interpret the underlying causal mechanisms. Critical realism provides a toolkit for tracing causal chains from causes to outcomes, with generative mechanisms acting and causing particular outcomes or events (Easton 2010) pertaining to effective sourcing. Furthermore, we seek to interpret these mechanisms through various theoretical lenses.

Employing the critical realist approach to analyze three agile sourcing projects—a medical emergency product, an innovative mobile app, and a combined IT infrastructure and user-service package—we advance the theoretical discourse on sourcing uncertainty and the understanding of the dilemma of combining superior external resources with high uncertainty.

In the next section, we establish the IPT as the theoretical framework of our study. We then investigate the drivers and nature of uncertainty in the three sourcing steps. Before introducing the research framework, we consider agile as an approach for managing uncertainty.

2 | Theoretical Foundations and Framework

2.1 | The Information Processing Theory

According to the IPT, uncertainty is defined as the difference between the amount of information required to perform a task and the amount of information already possessed by the organization (see Galbraith 1974). Various *drivers* of uncertainty are identified and grouped into dimensions, such as task characteristics (predictability and complexity), task environment (complexity and dynamism), and task interdependence (Trautmann et al. 2009; Tushman and Nadler 1978). In the supply chain context, elaborations on the origins of uncertainty include the task, partnership, and environment (Bensaou and Venkatraman 1995). Daft and Lengel (1986) extended the uncertainty-based IPT framework to include task equivocality, which captures the information processing requirements arising from ambiguity, ill-defined problems, and a lack of clarity and understanding (Daft and Lengel 1986).

Mechanisms are used to manage information processing requirements and, ultimately, the attainment of "fit," either by reducing the need or increasing the capacity for information processing (Galbraith 1974; see Premkumar et al. 2005). The former may be achieved via management of the environment, the creation of slack resources, and self-contained tasks (Galbraith 1974), or supply chain modification and stakeholder collaboration in the sustainability context (Busse et al. 2017; Foerstl et al. 2018; Trautmann et al. 2009). In terms of increasing capacity, low uncertainty contexts call for decision rules, hierarchies, planning, narrowing the span of control, and mechanistic design of organizational subunits; in contrast, high uncertainty contexts require information systems, lateral relations, organismic design of subunits, and frequent and formalized interorganizational information exchange (Bensaou

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and Venkatraman 1995; Galbraith 1974; Trautmann et al. 2009; Tushman and Nadler 1978). Finally, high equivocality contexts call for direct personal contact, boundary-spanning integrator roles or team meetings, task forces, and committees for opinion exchange and learning (Daft and Lengel 1986). To summarize, mechanisms that provide high volumes of data and broad "channel bandwidth" (Aral and Van Alstyne 2011), based on interaction and "rich" information flows, are a good fit with high uncertainty and equivocality contexts.

2.2 | Uncertainty in the Sourcing Process

Drawing on the IPT perspective and the classic sourcing process model by van Weele (2010), we identify task uncertainties associated with each of the three strategic sourcing steps: determining specifications, supplier selection, and contracting. The van Weele (2010) model is selected due to its fit-for-purpose simplicity and its established role in the sourcing literature (Bäckstrand et al. 2019).

First, regarding *determining specifications* for sourcing, we note that sourcing for solutions calls for the buyer and supplier to interact and resolve the problem in a more or less open solution space, potentially involving several functions on both sides. Therefore, the task of specifying a solution, first functionally and then technically (Schotanus and Grandia 2023), may likely be *complex*—that is, require several elements (Duncan 1972)—be *difficult to analyze* (Bensaou and Venkatraman 1995), and demonstrate a high degree of *novelty* (Busse et al. 2017) as well as high *interdependence* among its elements (Bailey et al. 2010). Thus, the sourcing task can be characterized as potentially involving high levels of information processing due to *specification uncertainty* or *equivocality*.

Second, the literature explicitly proposes techniques for dealing with the complexity of multiple criteria and the lack of data for assessment in *supplier selection* (e.g., Riedl et al. 2013). The associated task uncertainty is defined as "decision-makers' perceived difficulty in predicting the outcomes concerning supplier performance" (Riedl et al. 2013, p. 24).

The selection task can become *complex* due to multiple elements (Duncan 1972), such as criteria and candidate suppliers (Luo et al. 2009); *interdependent* due to conflicting stakeholder goals in terms of, for example, cost and quality (cf. Tushman and Nadler 1978); and *uncertain* due to the lack of access and visibility for thoroughly evaluating complex capabilities across interorganizational boundaries (Galbraith 1974). When selecting suppliers, it is difficult to pre-assess the complementarity of buyers' and suppliers' capabilities, which causes high levels of uncertainty in cases where relational practices and capabilities play an important role (Joshi 2009; Zimmermann and Foerstl 2014).

Third, *contracts* provide safeguards against the counterparty's self-interest-driven opportunism, but at the same time, the nature of human beings as economic actors endowed with only bounded rationality suggests that "all complex contracts will be incomplete—so there will be gaps, errors, omissions and the like" (Williamson 2008, p. 6). Contracting may indeed be difficult, particularly in complex situations that require alignment between supply chain parties (Selviaridis and Spring 2018). Here, Bensaou and Venkatraman (1995, p. 1474) refer to task uncertainty, which arises "due to a specific set of tasks carried out by the organizational agent responsible for the interorganizational relationship"; its drivers are task analyzability, variety, and interdependence. Such task uncertainty has direct implications for contracting; in fact, Yan et al. (2018) consider the complex case of involving suppliers in new product development projects and suggest that designing optimal contracts for aligning buyer–supplier incentives in joint projects is difficult.

2.3 | Agile Principles as Mechanisms for Managing Uncertainty

The agile sourcing approach draws on the agile project management paradigm, which has been offered as an alternative to the traditional plan-based waterfall approach in, for example, developing software. It is associated with the general principles of the lean approach (Cusumano et al. 2021). When the starting conditions for developing a solution are uncertain, flexible methods may be needed. The agile approach suggests "cyclical structures that right from the start move quickly and frequently to code, creating new versions of the software often and replanning each time to incorporate requirement changes, adjust to unanticipated problems, and include new ideas generated by the work itself" (Austin and Devin 2009, p. 463).

Indeed, the agile paradigm embraces uncertainty using "continual readiness … to rapidly or inherently create change, proactively or reactively embrace change, and learn from change" (Conboy 2009, p. 340) as well as "the capability to address changes in project requirements rapidly, iteratively and incrementally during project execution" (Mishra et al. 2020, p. 283) (see also Austin and Devin 2009). From the IPT perspective, the agile approach may be framed as a set of mechanisms for managing information processing capacity (Glaiel et al. 2014). For example, lateral relations in the form of teams and task forces (Daft and Lengel 1986; Galbraith 1974), organismic networks of problem-solvers (Tushman and Nadler 1978), and boundary-spanning integrators for customer feedback (Daft and Lengel 1986) appear to be included in the agile toolbox (Glaiel et al. 2014). Therefore, it may be expected that the application of agile principles in sourcing enables the embracing of uncertainty.

2.4 | Research Framework for Investigating Agile Sourcing

As with the need to redefine core processes for agile making (Cohendet and Simon 2016; Lieberum et al. 2022), the traditional sourcing process may have to be redefined by incorporating suitable mechanisms for managing the high requirements of information processing. Essentially, it is important to understand how sourcing can embrace uncertainty in the context of sourcing for solutions, which is similar to the process of "making" the solution (see Conboy 2009, p. 340). Each of the three steps of strategic sourcing, prior to the making, may require different mechanisms depending on the level of uncertainty or

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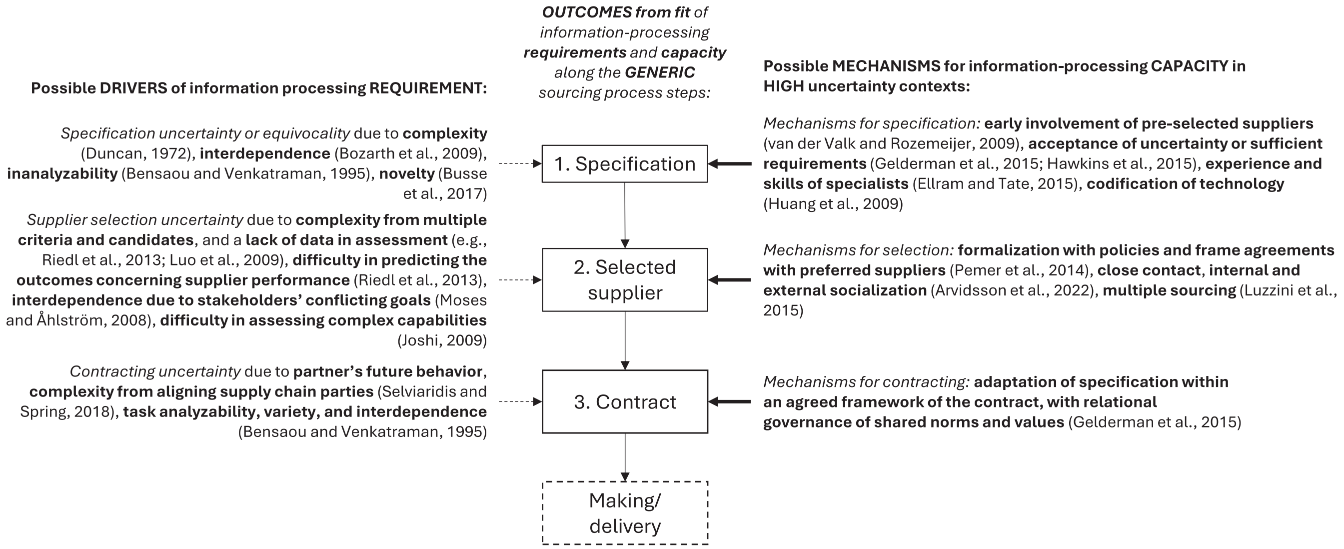

FIGURE 1 | Research framework with a summary of previous literature.

equivocality. To fully capture the phenomenon, we specify the research framework that guides our empirical efforts to answer the research question (Figure 1). The framework includes the high-level process steps of strategic sourcing and a priori identified knowledge regarding the IPT elements for each step (i.e., the drivers of uncertainty and the associated mechanisms for capacity). This knowledge is drawn from the literature on sourcing services and innovation, as these are associated with particularly high uncertainty because of their inherent characteristics, such as intangibility and heterogeneity. Service sourcing is plagued by uncertainty due to difficulties in pre-purchase evaluation and value assessment (Van der Valk and Rozemeijer 2009), a lack of supply market experience and internal cost benchmarks, high service complexity (Selviaridis et al. 2011), and unforeseen contingencies (Gelderman et al. 2015). Sourcing for innovation may imply further uncertainty, for example, in terms of the novelty of the item (Legenvre and Gualandris 2017), the outcome or payoff from the market (Zsidisin and Smith 2005), as well as the technical and operational variables of the project (Huchzermeier and Loch 2001).

The research framework indicates the three causal relationships that are investigated here (bold arrows). Aligned with the generic sourcing process steps, three sourcing outcomes need to be achieved: specification, selected supplier(s), and a contract. In contrast to previous efforts, this research focuses on understanding *how specific mechanisms lead to these outcomes*, given the considerable uncertainty in each step because of the agile approach, thus aiming at strategic value contribution. In the next section, we consider the CR approach to examining the causal relationships between agile sourcing mechanisms and sourcing process outcomes.

3 | Methodology

Our onto-epistemological assumptions align with critical realism, which seeks to provide causal explanations for certain events and behaviors for which there is limited empirical knowledge (Bhaskar 2016) by identifying the generative mechanisms and structures that produce observable events (Eriksson and Engström 2021). Critical realism emphasizes context-bound explanations, where mechanisms operate only under specific conditions (Welch et al. 2011). Since these mechanisms are not directly observable, they must be identified through an abstract research process (Beach and Pedersen 2019). Further, critical realism distinguishes among three ontological domains: real, actual, and empirical (Bhaskar 2016; Sayer 2000). The empirical domain comprises events as experienced and interpreted by individuals (Sayer 2000). The actual domain includes all events that occur, regardless of observation or interpretation. The real domain refers to the deeper structures and entities that possess causal powers (i.e., generative mechanisms) that give rise to observable phenomena (Sayer 2000).

3.1 | Research Setting

This study employs a multiple case study approach, which enables an in-depth exploration of generative mechanisms (Wynn and Williams 2012). Our research included three cases (see Table 1). A typical critical realist research design is "an intensive study, with a limited number of cases, where the researcher systematically analyses the interplay between the ontological layers" (Bygstad et al. 2016, p. 85).

In line with critical realism, we utilized the contextualized sampling strategy (Welch et al. 2011), in which context is used to provide a causal explanation. Our goal was to identify sourcing projects in a context with high uncertainty and unclear specifications. Specifically, we set out to identify sourcing projects (1) in which the organization *used agile sourcing to respond to sourcing uncertainty*, (2) *had unclear specifications*, and (3) *achieved a successful outcome*. This can be viewed as positive case selection, as we searched "for cases where the cause, outcome and potentially causally relevant conditions for operating a given causal mechanism are all present" (Beach 2020, p. 711). This strategy is advised by Beach (2020) to be suitable for theory building, as aimed in our study. To identify suitable cases, we searched for sourcing projects in which organizations explicitly

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TABLE 1 | Details of the selected organizations, projects, and data sources.

Case organization	Sourcing project, with context	Main primary data source (interviewees)	Other sources of primary data	Secondary data
Case 1: UK government (public)	*Health care ventilators*: Extreme time pressure and uncertainty due to COVID-19, no existing capabilities or production capacity for required ventilators, urgent innovation need under crisis conditions	—Chief buyer for the government —Representative of the regulatory body —Head of consortium —CEO of a large automotive firm —Consortium's communications director *Total: 5*	—Participation in a webinar with four participants, 1 year after project completion —Two validation meetings –12 supporting interviews	Industrial reports, webpages
Case 2: Finnair (private)	*Mobile app* Strategic focus on customer service via a digital touchpoint, high visual and functional expectations, innovation in user-centered design amidst evolving digital standards	—IT director —Head of sourcing, ICT (four interviews) *Total: 5*	—Three informal meetings with the head of sourcing, ICT, and an external consultant —Discussions of the findings with the head of sourcing, ICT —Three presentations of the sourcing process by the head of sourcing, ICT	Project plan, app requirements documents, webpages, supplier webpages, video presentation by supplier
Case 3: Retailer (private) *Remains anonymized as the authors did not obtain permission to disclose the company's name*	IT end-user services High competition in a saturated market, urgency to develop digital capabilities through sourcing EUS, innovation aimed at transforming IT infrastructure with automation, self-service, chat/call bots, limited supplier innovativeness, high stakes, and complexity, as EUS was the largest sourcing item	—Head of sourcing, ICT (three interviews) —IT manager —IT sourcing manager —Director, indirect sourcing *Total: 6*	—Two meetings with the director, indirect sourcing —Participation in procurement strategy days —Sourcing project presentation	Workshop material, sourcing documents

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reported using agile principles and evaluated whether these projects fulfilled the criteria through several discussions with the organizations.

We did not purposefully sample for variation in terms of the item or solution or the nature of the innovation. As is indicated in Table 1, the case projects demonstrate a varying degree of service and tangible product elements, while the solution development service is included in all of them. Moreover, in terms of innovation, the extent of novelty varies; certain designs are unknown to all parties, while others are novel or unfamiliar to the buyer but exist in the market. In line with critical realism, the unit of analysis in this research is the causal mechanism (see Bygstad et al. 2016) employed to manage sourcing uncertainty in the three sourcing steps.

The sample consists of one public procurement project (Case 1) and two private projects. While public procurement is governed by regulations and traditionally operates on the basis of tenders, new procurement modes have been introduced that enable co-operative relationships for developing public solutions (Stentoft and Vagn Freytag 2012). In this vein, we suggest that there is sufficient room for collaborative innovation in both public and private sourcing contexts.

3.2 | Data Collection

Semi-structured interviews were the primary source of data collection; additionally, we relied on workshops, meetings, project presentations, and other secondary sources, such as project material (see Table 1 and Supporting Information S1). For all three cases, we interviewed the individuals responsible for the sourcing project. The objective of the interviews was to obtain a deep understanding of the applied agile sourcing process, including the rationale underlying different activities, the potential challenges associated with them, as well as the underlying uncertainties and structures that aimed to address the uncertainties. All interviews were conducted between 2021 and 2024 and were recorded and transcribed verbatim. The interviewers took notes during the interviews and while engaging with other primary data. The interview guide is presented in Supporting Information S2.

The number of interviews varied depending on the project's complexity and the number of relevant stakeholders. Case 1 was a large, complex project that involved many stakeholders. Hence, a large number of respondents were necessary to obtain an in-depth understanding. In Cases 2 and 3, multiple interview rounds were conducted. During data analysis, additional information needs emerged, which prompted the decision to reinterview the same respondents. In these two cases, other primary data sources played a more prominent role. The researchers held several informal meetings with the aim of obtaining a comprehensive understanding of the context and motivations underlying adopting agile sourcing. For Case 3, two researchers attended the retailer's internal procurement strategy day, which provided valuable contextual information on the firm's agile sourcing practices. Presentations by company representatives further enriched the primary data. Case 2 was notably well documented and, thus, yielded extensive secondary data.

Supporting Information S1 details the data sources and their use in this research. In line with critical realist ontology, our aim was to attain theoretical saturation, the point at which additional data collection no longer contributed meaningfully to the identification of new generative mechanisms and where sufficient commonalities across cases indicated that core mechanisms were recurrent rather than case-specific.

3.3 | Data Analysis

Our research process to identify generative mechanisms was based on retroduction (Rouse et al. 2025). We defined mechanisms as the means by which uncertainty-driven information processing requirements are matched with the capacity to achieve specific outcomes at each step of the sourcing process. Supporting Information S3 summarizes our analysis process.

Our analyses began with the *resolution*, which is a theory-free classification of the empirical data that corresponds to the actual domain (Bhaskar 1994). The data were uploaded into NVivo software; we crafted rich write-ups using the respondents' own language and identified phases of the sourcing process as perceived by the respondents. Next, we coded empirical observations in NVivo with a priori critical realism constructs as a guiding framework: observed actors (Ao), activities (Ai), resources (R) (ARA model–based empirical entities) (see Easton 2010), and values (V) as well as the ontological components, events, and conditions (Wynn and Williams 2012). Table 2 presents the definitions of the codes and constructs as well as example quotes. Table 3 presents the complete list of first-order codes, categorized by case and process steps. Coding was conducted iteratively by two researchers. Initially, both researchers independently coded the data based on these predefined definitions. Thereafter, they met for several rounds to compare interpretations and resolve discrepancies through discussion until consensus was achieved. Short case write-ups are presented in the section entitled "Within-case descriptions." These within-case descriptions also present all the first-order codes.

Next, we moved to *theoretical redescription*, which implies "the representation of the empirical data through the prism of a particular theory, to facilitate an explanation of the collected empirical evidence" (Rotaru et al. 2014, p. 120). Redescription is abductive by nature (Danermark et al. 2019) and belongs to the actual domain. We first represented the data through the IPT framework, summarized in Figure 1, which helped in "defining the relevant entities, understanding the implicit causal logic, and mapping the (theoretically defined) relationships between the entities" (Bille and Hendriksen 2023, p. 730).

The subsequent step, *retroduction*, which was iteratively combined with redescription, focused on identifying the causal chain and most powerful generative mechanisms within the real domain. Retroduction is the inference of necessary generative mechanisms and underlying structures in the real domain that could account for the redescribed phenomena (Danermark et al. 2019). In this process, the researcher moves backwards from the outcome to the related mechanisms and engages in a process of reasoning to find the most powerful explanation (Wynn and Williams 2012). Here, we applied *process tracing*

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TABLE 2 | Main constructs and codes.

Main construct	Definition	Codes and definitions in this research	Example quotes
Entities	Human, social, and physical entities (Bygstad et al. 2016).	Observed Actors (Ao), Activities (Ai), and Resources (R), based on the ARA model (cf. Easton 2010). Actors: The individuals, groups, or organizations that perform Ai and control R. Resources: The tangible and intangible assets that actors control and combine in network relationships. These include physical, human, and organizational resources. Activities: The tasks and processes through which resources are developed, exchanged, or combined by actors.	R1: Performance specifications as the point of departure, Case 1: "Engineers love having specifications, so if someone needs a product, this could be used." Ai9: Experimentation with a minimum viable product, Case 2: "The current project methods were unsuitable, and there was a desire to make it [progress] quickly visible over time and to verify that the project was going in the right direction." R14: Prior experience of partner, Case 3: "In this kind of transformation phase, with both working in a more modern or agile manner, having prior experience working with the partner, this is most likely significant."
Values (V)	V reflect the choices or preferences of actors	V: Guide or influence actors' decisions during the sourcing process	V11: Desire for innovation, Case 3: "We want to transform EUS services for next-generation digital workplace services, to better support business processes, including self-service, automation, and high user satisfaction—for example, by using chat/call bots." V12: Supplier encouragement to share new ideas, Case 3: "We created expectations and said: Please do not come with only standard company presentations ... be open-minded, we do not have the answers .... This is no theater; we are serious about this."
Conditions	Factors that, in combination with mechanisms, produce outcomes (Welch et al. 2011)	Conditions (C): Uncertainty drivers affecting each sourcing step.	C9: Outcome uncertainty, Case 1: "Multiple projects started in parallel, and no one knew which failed at which stage ... so they had to suck up and accept failure .... The early favorite prototype went into production (200) and unexpectedly failed the test."
Events (E)	"A specific happening or action resulting from the enactment of one or more mechanisms" (Wynn and Williams 2012, p. 792), or outcomes we want to explain (Bygstad et al. 2016).	Outcome of matching information-processing capacities with information-processing requirements (cf. Tushman and Nadler 1978, p. 622) in each of the three sourcing steps. Definitions: Step 1 = completion of the task of specifying a solution or an item; step 2 supplier selection = completion of the task of selecting a supplier; step 3 contracting = completion of the task of formulating/negotiating a contract that fits the purpose.	E16: Condensed list of relevant requirements, Case 3: "Here we had a traditional requirement of an Excel file, in which there were over a thousand requirements regarding different areas, and this was unavoidable." E20: Tight contract based on requirements, Case 3: "Having learned the hard way, we wanted to have a tighter, more accurately specified, and more fixed contract."

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TABLE 3 | Case-by-case first-order codes.

Sourcing step	Ontological components	Case 1: Ventilators for the UK government	Case 2: Mobile app for Finnair	Case 3: End-user services for Retailer
1. Determining specification	*Events*	E3: Fast development of prototypes E4: Fast product development and delivery	E8: IP from sprints to customer E13: High-quality design and functionality	E16: Requirement clarity E23: Condensed list of relevant requirements E21: Capability modernization E22: High implementation effort
	Entities and values	R1: Performance specifications as the point of departure R2: User stories as a guide Ao1: Interorganizational teams Ai1: Iterative development Ai2: Parallel development Ai3: Hackathons Ao2: Teams with diverse capabilities R3: Digital technologies for fast decision-making Ao3: Consultancies as compliance advisors	V1: High strategic thrust for customer service V2: Top-notch visual appearance V3: Purposefully customer-driven V4: Not constrained by existing platforms V5: Supplier participation through customer openness to solutions Ai7: Design thinking R2: User stories Ai8: Supply market pitch Ai9: Experimentation with a minimum viable product R6: Framework and roles according to agile Ai10: Development by means of sprints	R8: Project name emphasizing innovation R9: Service descriptions R10: Innovation-driven principles for sourcing Ai17: Clear supplier communication Ai18: Development and implementation of the service package V9: Desire for item novelty V10: Off-the-shelf solution V11: Desire for innovation Hindsight: Ai19: Incremental sprints
	Conditions	C1: Uncertainty of project success C2: Stringent medical regulations C3: High risk of using a single supplier C4: High/sudden demand C5: Lost production capability C6: Time pressure C7: Prompt requirement for new and safe design C11: Regulator adaptation to iterative development		C14: Significant item C15: Lack of supplier incentives to offer innovation

(Continues)

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TABLE 3 | (Continued)

Sourcing step	Ontological components	Case 1: Ventilators for the UK government	Case 2: Mobile app for Finnair	Case 3: End-user services for Retailer
2. Supplier selection	*Events*	E1: Competent supplier consortium	E5: Long list of suppliers E6: Short list of suppliers E7: Two suppliers for the first sprints E9: Tested supplier selected	E14: Long list of suppliers E15: Supplier self-selection E17: Fast selection of suppliers E18: Supplier shortlist E19: Supplier selection based on price Hindsight: E24: Supplier selection for agile development
	Entities and values	Ai4: Pre-market screening Ai5: Familiarity and trust-based supplier screening	Ai11: Supplier pitching and discussion Ai12: Parallel sprints by candidates R15: Separate physical premises for developmental work R7: Data and financial resources for candidates Ai13: Competition between the candidates Ai14: Acquisition of experience in working with suppliers V6: Recognition of the importance of candidates' sales cost V7: Desire for a competitive setting	Ai20: Market scanning R11: Supplier communication materials Ai21: Workshops with candidate suppliers Ai22: RFP Ai23: Market dialogue R12: Selection criteria V12: Supplier encouragement to share new ideas Hindsight: R13: Proof of supplier capability R14: Prior experience of partner
	Conditions	C8: Supplier unfamiliarity with product	C12: Intangible selection criteria	C16: Solution customization required
3. Contracting	*Events*	E2: Contract compensating for resource use	E10: Risk-sharing contract, with compensation based on input and output E11: Reorientation toward input-based compensation E12: Contract supporting streamlined implementation	E20: Tight contract based on requirements Hindsight: E24: Flexible contract based on service description and degrees of freedom in production
	Entities and values	R4: Clause for open data R5: Centralized ERP for data sharing Ai6: Multiple competing prototypes	V8: Desire to control supplier opportunism (shared risk) Ai15: Frequent recontracting Ai16: Reevaluation of contract	V13: Desire to control based on past projects Ai24: Post-contract discussions and disagreements
	Conditions	C9: Outcome uncertainty C10: Contractual complexity due to multiple suppliers	C13: Numerous diverse sprints	C16: Solution customization required

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(Beach 2020; Beach and Pedersen 2019), a method focused on "understanding the processes whereby causes contribute to producing outcomes, opening up what is going on in the causal arrow in-between" (Beach 2020, p. 699).

We began by analyzing the causal chain in terms of how the entities (Ao, Ai, and R) worked together under specific conditions and V to generate an event (see Table 2 for definitions). This was based on discussions among the researchers. In practice, the process began by assigning the first-order codes in the form of digital sticky notes to each of the three sourcing steps for each case on the Miro platform. Subsequently, these codes were organized into conceptually coherent categories; thereafter, we sought to make sense of the causal chain. Using a Miro board, we discussed potential causalities, drew lines between the logically grouped codes, and rearranged the codes if needed. An example of a Miro board, depicting the first version of the causal chain of the Finnair app, is presented in the Supporting Information S4. This process led to the preliminary identification of the causal chain, ranging from causes to events.

Next, we discussed the potential theoretical approaches that could explain the causal logic through constant comparison between empirical data and theory (O'Mahoney and Vincent 2014). Here, we abductively mapped the causal explanations against multiple theoretical lenses. This step can be classified as redescription. We found that the IPT explained only part of the phenomenon, thus leading us to consider alternative theoretical frameworks, including transaction cost economics and the social exchange theory. Ultimately, the agency theory (AT) provided the most valuable explanatory insights. Supporting Information S5 presents examples of this analysis.

We also observed several "surprises" during the analysis process that required further exploration. For example, we initially observed the importance of parallel prototype development as an agile practice, recognizing its critical role in determining specifications. However, during discussions, we discovered that the practice lacked explanatory power despite being referenced in the literature. Through iterative discussions and moving between empirical data and literature, we recognized that redundancy in supplier innovation driven by competitive rivalry (Andersen and Drejer 2009) could stimulate competing suppliers to create innovations (Tandon et al. 2024).

Furthermore, we observed that because parallel prototype development commences supplier selection, it also provides valuable insights into suppliers' collaboration capabilities. Thus, parallel prototype development connects to two distinct generative mechanisms: one affecting specifications through "redundancy in supplier innovation" and another influencing supplier selection through "experience-based supplier selection." At this stage, the causalities were refined and mechanisms with limited explanatory power were eliminated (Rotaru et al. 2014).

In this manner, we moved iteratively between abduction and retroduction. We initially utilized the IPT framework (Figure 1) to guide (abductive) our redescription of the empirical data. We then applied retroductive inference, using process tracing to develop a causal chain and preliminary mechanisms. Finally, we interpreted and validated these mechanisms by mapping them against relevant theoretical frameworks (abduction).

To ensure the trustworthiness of our findings, we followed Lincoln and Guba's (1986) criteria in designing and performing the data collection and analysis. We also addressed their (Lincoln and Guba 1986) authenticity criteria by highlighting fairness in representation, encouraging participant and researcher reflection, and supporting the potential for action. The research team comprised three academic researchers and one industry practitioner with direct experience in agile sourcing. This composition enabled both theoretical grounding and practical sensitivity. All authors were well connected within industry practitioner communities, thus facilitating access to relevant cases and maintaining a balance between insider knowledge and critical distance (see Lincoln and Guba 1986). Details of these strategies are provided in Supporting Information S7.

4 | Findings

4.1 | Resolution: Within-Case Descriptions

The following case descriptions provide an overview of the three sourcing projects and also include partial and workhorse quotes from data supporting the narratives (Rockmann and Vough 2024). This section utilizes the following codes in terms of the resolution phase of the study: C (condition) and E (events) denote ontological components; Ao (actors), Ai (activities), and R (resources) denote the ARA model–based empirical entities; and V (values) denotes the choices of actors. Table 3 summarizes all such first-order codes across the cases and sourcing process steps.

4.1.1 | Case 1: Ventilators for the UK Government in the COVID-19 Context

The COVID-19 pandemic resulted in an unprecedented demand for ventilation devices, and the UK government responded to this demand through agile sourcing. The main reasons for this approach were the uncertainty of project success [C1], the need to comply with stringent medical regulations [C2], and the high risks of allocating the order to a single supplier [C3]. The demand for ventilators skyrocketed to 1500 units per week [C4], which was well beyond existing production capacity. Furthermore, the ventilator model needed for hospital use was discontinued and was no longer being produced [C5]. Meeting such a high demand required a national effort to reduce the time usually spent on product procurement [C6]. The Chief Buyer for the government recalled, "[The] agile approach for product design and development [was perceived to be] completely wrong in the medical world, where the best practice is not to iterate product design on the fly."

4.1.1.1 | Phase 1: Specification and Pre-Market Planning. The government procurement team had to arrange sourcing for a medical device that was not produced in the United Kingdom and quickly obtain approval for this. A director of a medical authority remembered the trade-off between getting "products to patients in this area as quickly as possible ...

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but to get them safely" [C7]. The Medicines and Healthcare Products Regulatory Agency (MHRA) openly published technical performance specifications and data on ventilators, which could be used as a point of departure for designing a new device. The MHRA representative remarked, "Engineers love having specifications, so if someone needs a product, this could be used" [R1]. High levels of expectation were set in the form of user stories to guide suppliers' design efforts [R2].

4.1.1.2 | Phase 2: Supplier Selection for Development. Supplier selection began with a pre-market phase in which the regulator (MHRA) could understand and mitigate risks by inviting more firms to compete [Ai4]. Over 5000 companies applied to help produce ventilators; an initial screening reduced this number to 33 eligible companies. The main facilitator of the sourcing project retained companies that were known and trusted in the context of the UK Manufacturing Catapult, thereby ensuring that the best people could "step into the unknown" [Ai5]. To ensure the right fit between the skills of the supplier consortium members, a Formula 1 team, a leading aerospace manufacturer with free capacity, a leading medical manufacturing firm, and local incumbent producers of medical devices were included as potential suppliers [C8, E1].

4.1.1.3 | Phase 3: Contracting. The consortium established contracts with the participants, which—in addition to an NDA—focused on specifying a payment scheme, thus compensating participants based on their resource use [E2]. The contract also included the clause of open data as "one version of the truth" across the consortium [R4], shared via a centralized ERP system. This enabled the buyer to see all the problems and their resolution efforts during the development and production phases [R5]. The chief buyer emphasized the importance of supporting multiple competing prototypes due to inevitable failures and the contractual commitment to cover the resulting costs in the following manner: "Multiple prototypes to select from (from 28 to 8, then 4 in production) … multiple projects started in parallel, and no one knew which failed at which stage … so they had to suck up and accept failure …. The early favorite prototype went into production (200) and unexpectedly failed the test" [C9, C10, Ai6].

4.1.1.4 | Phase 4: Prototyping of the Design. Unlike typical medical device development with long design cycles, the consortium grouped experts into interorganizational teams [Ao1] and promoted development iterations for quick prototyping and testing [Ai1]. With the parallel development approach [Ai2], the participant teams needed only weeks to iteratively upgrade several minimum viable prototypes [E3]. For example, to address production bottlenecks, hackathons were organized [Ai3]. In these events, individuals with diverse capabilities grouped themselves into several teams to collectively tackle challenges [Ao2]. Plant simulations enabled the examination of potential solutions in the digital space; moreover, with additive manufacturing, a prototype of the solution was designed on the same day [R3].

4.1.1.5 | Phase 5: Facilitation of Development. To maintain independence and avoid conflicts of interest, the regulator (MHRA) engaged consultants to communicate critical medical device requirements to suppliers [Ao3]. Furthermore, instead of following standard procedures that necessitated paperwork, the regulator adopted a risk-management approach to specification compliance. Hence, the regulator enabled agile approaches by responding positively, thereby increasing the number of teams that iteratively approached the subsequent compliance checks [C11]. Consequently, a consortium of automotive, aerospace, and MedTech firms successfully delivered the equivalent of 20 years' worth of ventilators in merely 12 weeks [E4].

4.1.2 | Case 2: Mobile App for Finnair

Finnair's mobile app was expected to play a crucial role in customer service and engagement along all touchpoints in the customer journey [V1]. The buyer's team felt that "the current project methods were unsuitable, and there was a need to make it [progress] quickly visible over time and verify that the project was going in the right direction" [Ai9], and an agile approach was adopted. Traditionally, most projects had been executed using the waterfall model.

4.1.2.1 | Phase 1: Internal Organization and Planning. Meeting these high expectations required a top-notch visual appearance, as the airline brand is known for its Nordic design preferences [V2]. Furthermore, the app needed to be purposefully customer-driven (e.g., using design thinking in its development and user stories) [V3, Ai7, R2] and technically and visually unconstrained by existing application platforms [V4]. Accordingly, the team wanted to ask potential developers how they could meet Finnair's needs and deliver a turnkey solution without a predetermined list of app functionalities [Ai8, V5]. An agile framework was created, which defined different roles, such as the internal product owner and the Scrum Master who managed the sourcing [R6].

4.1.2.2 | Phase 2: Supplier Screening. Next, the team focused on creating a comprehensive list of software developers active in the Finnish market. Secondary data on these suppliers were collected, including their financial profiles and customer references. The data were analyzed, thereby yielding a long list of potential suppliers [E5]; finally, four companies were shortlisted [E6]. These companies were invited to pitching sessions and asked to provide information on how they would proceed with the development, relevant reference cases, and preliminary price indications [Ai11]. This phase was deliberately kept short to keep suppliers' sales costs down [V6].

From these pitching sessions, two suppliers were selected to complete the first two sprints of mobile app development [E7, Ai12]. Thus, the team sought "to create a competitive setting at this point," which was akin to a "Finnish championship for coding" [V7]. The procurement team at Finnair used the following criteria for selecting the two contenders: technical solution, visuals and design, principles of work (culture), ease of collaboration, and flexibility in contracting [C12].

4.1.2.3 | Phase 3: Supplier Selection With the First Two Sprints. At the beginning of the sprints, both candidates were given the same data from consumer research. Both were asked to work simultaneously at Finnair's premises, in separate rooms

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with Kanban tables and project plans, and had access to the same resources [R6]. Finnair also required the candidates to continue with the same team after the first two sprints; the candidates were given a fixed budget [R7]. Furthermore, the procurement team explicitly asked the candidate companies to surrender the resulting intellectual property rights to Finnair. The results of the competitive, direction-defining three-week sprints from both teams served as input for subsequent project sprints [E8]. The procurement team felt that members of the competing teams were excited about the sprints and the rivalry [Ai13]. This approach was considered useful for evaluating the teams' working styles, culture, and personnel; moreover, the procurement team "acquired first-hand experience regarding what it would be like to execute the whole project with any of the suppliers" [Ai14].

After these two sprints, the winning supplier was selected [E9] and the final contract was negotiated. "Here, all parties felt that we got immediately out of the gates to full gallop." Pricing was defined based on the maximum price for each of the three-month time boxes (pre-agreed number of hours or story points; moreover, for those exceeding the pre-agreed amount, the supplier would lose any profit margin) (E10) as well as the achievement of the determined goals and outputs to share the risks [V8].

4.1.2.4 | Phase 4: Additional Sprints and Supplier Management. The project commenced with additional sprints [Ai10]; however, it encountered challenges with the pricing model. The initial model was too difficult to sustain; it necessitated a planning sprint that would serve as the basis of a new contract for the following 3 months and a precise agreement on the deliverables [Ai15, C13]. Thus, a shift was made toward a time- and material-based pricing model driven by input specifications [Ai16, E11], which better supported the streamlined agile project [E12].

Toward the end of the project, the product owner and the supplier experienced some conflict regarding the prioritization of work. Additionally, the complexity of integrating two suppliers for back-end and front-end work "may have caused some delays at the beginning of the project." Despite these challenges, the associated delays, and high development costs, the project was considered successful. The mobile app was awarded the Red Dot Design Award in 2016, and the number of downloads exceeded pre-project targets [E13].

4.1.3 | Case 3: IT End-User Services (EUS) for Retailer

Retailer is a Nordic retail and service industry business group. Facing growing pressure from leaner price-driven competitors and needing to remain relevant in the highly competitive market, Retailer had to continue developing its digital capabilities. Retailer's sourcing project encompassed EUS, including all front-end IT infrastructure and systems in the company, as well as a help/service desk for point-of-sale personnel. The EUS package was likely the most significant and largest possible item for sourcing [C14] in the company. The goal of the sourcing project was "to transform EUS services to next-generation digital workplace services, to better support business processes, including self-service, automation, and high user satisfaction," for example, by using chat/call bots [V11]. Retailer perceived that traditional sourcing methods would not cater to their needs; therefore, an agile approach was adopted. The following case analysis draws on both actual practice and hindsight-based observations regarding more preferable practice, as discussed by the informants.

4.1.3.1 | Phase 1: Planning. The title of the sourcing project, "Next Generation End User Services," was designed to emphasize Retailer's desire to find something new and innovative [R8]; thus, the team strongly emphasized novelty in the planning phase [V9]. Nevertheless, the buyer wanted to procure a solution without extensive customization and the associated complexity [V10]. The buyer emphasized clear and comprehensive communication with candidate suppliers, thus promoting innovation-driven sourcing principles and service descriptions [R9; R10] to minimize the number of queries [Ai17].

4.1.3.2 | Phase 2: Supplier Screening With Workshops and RFP. The sourcing team scanned the market for potential suppliers [Ai20] and identified 13 candidates—all global players with representation in Finland [E14]. After short conference calls to determine interest, briefs were sent to the interested candidates, including the background of the sourcing project, targets, schedules, and next steps [R11]. Interested candidates were invited to a workshop to provide insight and solutions related to the challenge set by the sourcing team. The team emphasized open dialogue and expressed a sincere desire to obtain insights and learn from each candidate [Ai21]. In its communication, the team showed its openness to new ideas in the following manner: "We created expectations and said 'Please don't come with only standard company presentations … be open-minded, we don't have the answers …. This is no theatre; we're serious about this'" [V12].

Communication of the workshop agenda resulted in self-selection among the candidates [E15], as a few suppliers admitted to lacking the required capabilities. The workshops enabled the sourcing team to refine their understanding of what the market had to offer, and the team revisited and clarified their requirements [E23]. The team also noted that the intensive one-week period invested in the workshops enabled the process to proceed faster than expected [E17]. In contrast, a unilateral request for proposal (RFP) would have resulted in a lengthy dialogue for corrective adjustments to requirements. Finally, the RFP was sent to four potential suppliers [Ai22]. Having learned from the supply market [Ai23], the team replaced the old legacy list of requirements from the tendering phase with a new list. "Here we had this kind of traditional requirement Excel file, in which there were over a thousand requirements regarding different areas, and this was unavoidable."

4.1.3.3 | Phase 3: Supplier Selection and Contracting. Guided by the RFP, two supplier candidates were shortlisted [E18]. Apart from the total cost of the service package—which was the main selection criterion—the final selection was based on contract compliance, terms of agreement, and risks [R12]. There was very little difference between the two candidates in terms of service solutions, and the process culminated in the selection of a supplier based on price [E19]. The final phase of the process followed more traditional sourcing

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principles, as "in all honesty, agility gradually disappeared … it was all just tough negotiation." Given their past experience with unexpected costs and discussions on service package content, the buyer's team wanted to adopt a more rigid approach to contracting: "Having learned the hard way, we wanted to have a tighter, more accurately specified, and more fixed contract" [V13, E20].

4.1.3.4 | Phase 4: Transformation. The final phase involved developing and implementing the components of the service package or transformation of the EUS [Ai18]. Despite the buyer's desire to procure a proven solution, the bot solutions provided by the supplier required customization [C16]. Looking back, the buyer felt they should have sought more references and proof of demonstrated capability [R13]; for the supplier, the bots proved to be a difficult business case. Additionally, the list of requirements did not ensure a deeper understanding of how the services needed to be delivered, thus leaving much to be discussed after the agreement [Ai24]. Despite these challenges, Retailer was able to transform its capability and modernize the service area [E21]; however, this involved a higher-than-expected effort from the buyer's personnel [E22].

In hindsight, the buyer suggested that they could have executed the transformation phase in a more agile manner. In fact, current similar development efforts in Retailer call for sprints in two-month cycles with incremental outcomes on a faster schedule [Ai19]. This contrasts with a situation where "we wait for 6 months for the supplier to bring something to us, and we notice that it is all botched up." The buyer concluded that a more flexible manner of working in the transformation phase required a more flexible contract that was adaptable to the situation [E24]. A buyer team member also suggested, "In this kind of transformation phase, with both working in a more modern or agile manner, having prior experience working with the partner, this is most likely significant" [R14, E24].

4.2 | Redescription and Retroduction: Identifying Generative Mechanisms

This section discusses the findings across case projects, with the key aim of identifying theoretically oriented *generative mechanisms* for achieving the events as the outcomes in each of the three sourcing steps. Anchor quotes are used to support the claims regarding identifying the mechanisms (Rockmann and Vough 2024).

4.2.1 | Determining Specification

In the three cases, several causes contributed to a high level of uncertainty (see Figure 2): time pressure, the novelty of the production task (discontinued production), the constrained solution space (strict safety regulations; Case 1), the novel and sophisticated design for strong customer orientation (Case 2), and strong emphasis on the innovativeness of the solution due to the lack of supplier incentives for innovation (Case 3). Thus, the extent of novelty varied from designs that were unknown to all parties to those that were novel or unfamiliar to the buyer but existed in the market. The apparent openness of specification was driven by buyers' lack of information or a deliberate avoidance of precisely defining the solution.

Alleviating this uncertainty, we observed the use of several guiding elements—such as user stories, functionalities as a starting

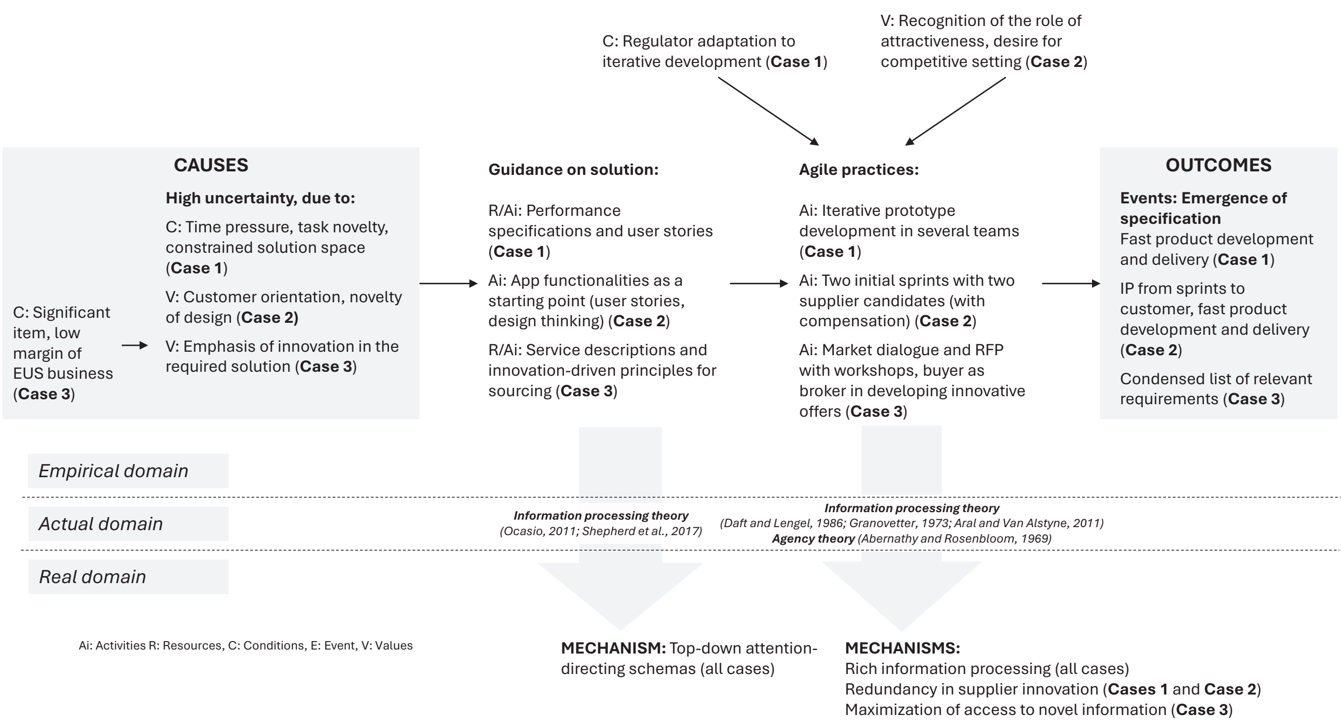

FIGURE 2 | Causal structure: determining specification across cases.

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point, and sourcing principles for innovation—directing attention to the most important issues (Ocasio 2011; Shepherd et al. 2017) and, thus, reducing the need for extensive information processing (Galbraith 1974). Furthermore, such guiding schemas alleviate low task programmability (Eisenhardt 1989; Zsidisin 2022).

As these guiding schemas appear open in nature, agile development practices were adopted across the cases for iterative prototype development, thus indicating the embracing of uncertainty and the low task programmability of tasks as sprints (Conboy 2009; Zsidisin 2022). The agile practices included close collaboration within interorganizational teams and regular consultation with the customer in shared physical premises. Coinciding with the agile activities, parallel development was also observed in terms of multiple prototypes (Case 1) or with two rival suppliers competing to complete two initial sprints, thus leading to the origination of product specification (Case 2). In Case 3, the buyer engaged in market scanning and market dialogue through workshops, which involved direct interaction with supplier candidates.

Further, the use of agile practices suggests a high information-processing capacity, yielding rich, opinion-changing information that enables the management of high uncertainty and equivocality regarding specifications (Daft and Lengel 1986). Furthermore, parallel development produces high information-processing capacity, as it "enables information to flow through the organization quickly and effectively" (e.g., the consortium in Case 1) and facilitates "debate, clarification, and enactment" (Koufteros et al. 2001, p. 97). In Case 3, the buyer employed market scanning, thus enhancing the diversity of the supplier network and the potential for accessing novel information while also expanding communication through workshops (Aral and Van Alstyne 2011). This facilitated the development of the capacity for processing rich information and improving understanding of the potential for innovative solutions (Daft and Lengel 1986).

With regard to retroduction, we suggest that in conditions of high information-processing requirements, the combination of several *generative mechanisms* provides a matching level of information processing capacity for determining functional and technical specifications (Schotanus and Grandia 2023). First, *top-down attention-directing schemas* (e.g., user stories) reduce the need for information processing and guide the development of solutions and specifications in the appropriate direction (see Ocasio 2011). This is exemplified in the following anchor quote:

> "The user stories were used to describe for the suppliers what the app should be able to do or how it should work. The way we'd done the service design project beforehand had a really big impact. We already understood quite a lot about consumer behavior and the different emotional states at various points of the journey, as reflected in user stories; thus, we were able to respond to concerns during the development process."
>
> (Head of sourcing (IT), Finnair)

Second, collaborative workshops and agile sprints provide increased capacity and a medium for *rich information processing*, thus facilitating learning and innovation, which is a theoretical match for the equivocal conditions observed in the cases (Daft and Lengel 1986). Furthermore, parallel development (Abernathy and Rosenbloom 1969) with rival suppliers—as an agency theoretical structure for managing uncertainty through the alignment of incentives (Zsidisin 2022) and employed even prior to final supplier selection—enables the buyer to ultimately reduce the risk of project failure. Indeed, redundancy in external R&D resources (cf. Tandon et al. 2024)—or in terms of supplier innovation due to rivalry (Andersen and Drejer 2009)—may encourage competing suppliers to create innovations with high firm-specific value (Tandon et al. 2024). In other words, as the total information processing capacity increases, the outcome likely becomes more aligned with customer requirements through the competitive development and emergence of specifications, which are generated through the mechanism of *redundancy in supplier innovation* (see Tandon et al. 2024). Additionally, we note that such parallel development activity also reduces the risk of selecting an incapable supplier through the mechanism of *comparative acquisition of collaboration experience* (Matinheikki et al. 2022; Zsidisin 2022) prior to supplier selection, as is discussed later in the article. Finally, the *maximization of access to novel information* with market dialogue and feedback to RFP with workshops also contributes to high information-processing capacity. In the words of the Head of Sourcing at Retailer.

> "We definitely used it—if someone brought up an interesting perspective, we'd follow up on it. If something seemed good, we'd ask others about it too. With people we'd already had workshops with, we sometimes followed up later by email. It was really about collecting every bit of insight. The whole thing was pretty iterative—after each meeting, we learned something new and used that going forward."

Thus, the events in the causal chain ranged from actual value-contributing delivery (final event) to intermediate events, such as intellectual property from the initial sprints or a condensed list of requirements that enabled development and implementation. The intermediate events demonstrate the continual emergence of specification, first in terms of functional specifications and then in terms of technical ones (see Schotanus and Grandia 2023).

4.2.2 | Supplier Selection

In supplier selection, there were several causes for a high level of uncertainty across the three cases (see Figure 3). In Case 1, discontinued production capacity implied supplier unfamiliarity with the product and production process. In Case 2, the uncertainty stemmed from the buyer's choice for a value position: openness to new solutions and a desire for a novel design. In Case 3, decision-makers emphasized innovation due to item significance and limited supplier incentives for innovation, which led to an articulation of innovation-driven sourcing principles. Uncertainty increases in supplier selection when the necessary

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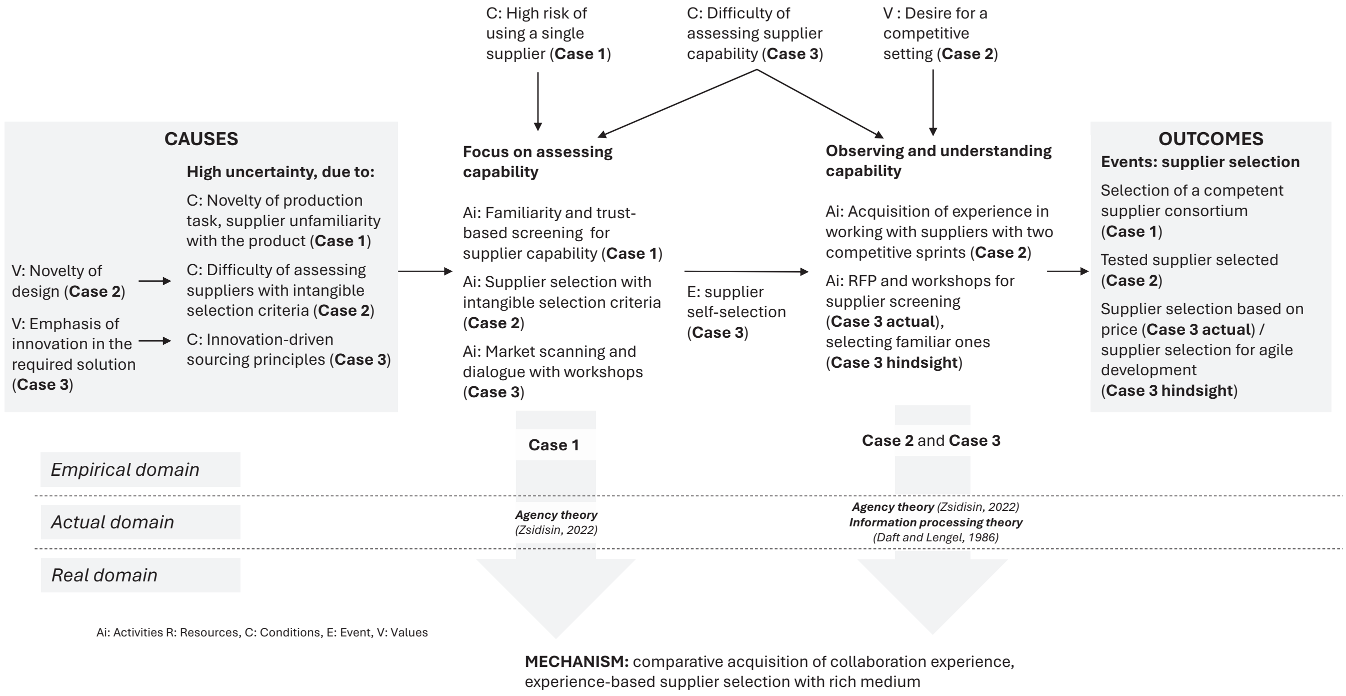

FIGURE 3 | Causal structure: supplier selection across cases.

information-processing capacity is provided to determine specifications through collaborative agile sprints.

The primary driver of high uncertainty was information asymmetry regarding the supplier's innovation and collaboration capabilities, which may be "difficult to access and may be even more difficult to discern" (Joshi 2009, p. 145) before collaboration begins. This necessitates assessing, observing, and understanding supplier capability (Figure 3)—for example, by leveraging familiarity (Case 1, Case 3 hindsight), working in competitive sprints (Case 2), or conducting workshops (Case 3 actual).

For high information-processing capacity, there appears to be a tendency to rely on *experience-based supplier selection* as the *generative mechanism* (Figure 3). In line with AT's concept of relationship duration (Zsidisin 2022), actual familiarity and perceptions of reputation (Cretu and Brodie 2007) function as proxies for experience and reduce the information-processing need for capability assessment. Testing suppliers through a rich medium for learning, such as workshops (Daft and Wiginton 1979; Matinheikki et al. 2022; Zsidisin 2022), addresses information-processing needs by providing experience of how the supplier will likely approach design challenges. The Head of Sourcing (IT), Finnair, explained this in the following anchor quote:

> "It was about seeing how suppliers actually work. We thought of the developers as artists, so getting to work with them and observing their process gave us a much better sense of their quality than merely looking at CVs. It also motivated the suppliers to really put effort into those sprints and show us what they could do—kind of like a hackathon, where you want to see what people can actually deliver. The decision was difficult because both the suppliers had different approaches, but the outcomes from both were really good. What tipped the scale was probably the visual style we preferred and their way of working and company culture. Evaluating technical skills was essential, but so was the working culture—that mattered a lot to us."

Here, we observe a potential interdependency: the use of agile sprints for addressing specification uncertainty early in the process, with parallel development, provides an enabling medium for learning about supplier capabilities for selection—if conducted in a pre-contract setting. Further, uncertainty in terms of supplier selection, particularly regarding collaboration capability, is alleviated through the earlier identified mechanism of *comparative acquisition of collaboration experience*. This mechanism enabled the selection of a competent supplier consortium (Case 1), a tested supplier (Case 2), and—in hindsight—a fitting supplier for agile development (Case 3).

4.2.3 | Contracting

In the contracting step, observations across cases indicate that the key driver of uncertainty lies in the low task programmability of the solution development (Dönmez and Grote 2013). With regard to the causes (see Figure 4), in Case 1, we observe diverse sprints due to the a priori unknown nature of tasks (see Zsidisin 2022). Case 2 also used diverse sprints and reflected a buyer's value position aimed at mitigating supplier opportunism. This led to an initial risk-sharing contract combining input-based (i.e., pre-agreed number of hours or story points) and output-based (i.e., completed features) elements (see Van der Valk and Rozemeijer 2009). In agency theoretical terms,

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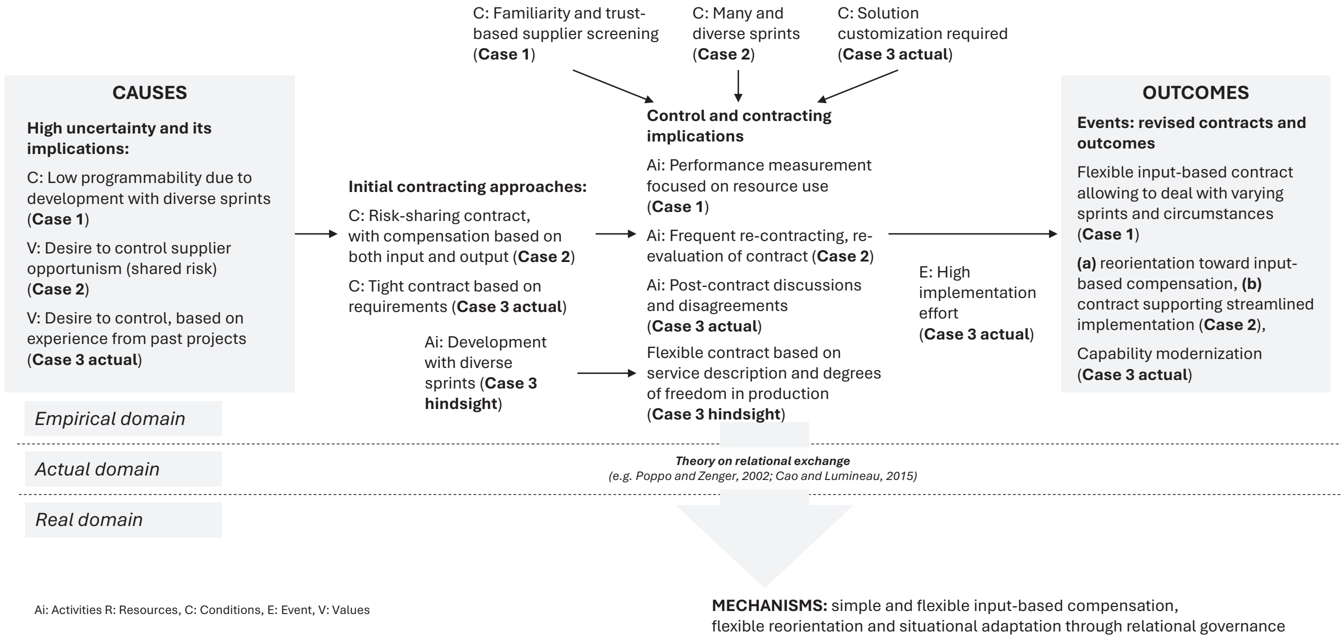

FIGURE 4 | Causal structure: contracting across cases.

the app development was governed by a combination of behavior- and outcome-based contractual elements (Zsidisin 2022; Zsidisin and Smith 2005). In Case 3, the project initially followed a tightly specified contract—emphasizing cost and control—but the hindsight-based analysis suggested a more flexible approach with service description and degrees of freedom in production due to the low task programmability in diverse sprints.

Due to the initial contract implications, the following are the consequent control activities. In Case 1, the initial contract arrangement led to a payment scheme based on supplier resource use (buyer-held risk), enabled by the condition of mutual familiarity and trust in the supplier selection step. In Case 2, frequent recontracting (every 3 months) indicated high transaction costs and inefficiencies due to repeated negotiations and approvals. This led to reevaluation and an input-based contract, which is the simplest way of behavior-based governance (Virag 2021) as compared to, for example, controlling throughput (Van der Valk and Rozemeijer 2009). The input-based contract provides the most flexibility under the uncertain conditions (low task programmability), although it lacks strong safeguards against supplier opportunism (Caniëls and Gelderman 2010). In Case 3, the tightly pre-specified contract led to discussion, disagreement, and, ultimately, high implementation effort for the buyer's capability modernization; in hindsight, a flexible contract based on service description would have facilitated the diverse sprints.

In terms of the *generative mechanism* for revised contracts, Case 1 reveals that leveraging supplier familiarity as a safeguard implies relational governance (Cao and Lumineau 2015; Poppo and Zenger 2002). The buyer also introduced a certain level of control via information systems (Eisenhardt 1989; Zsidisin 2022) and provided data on prototype progress and suppliers' resource use (inputs). Despite research indicating a poor fit between control measures and agile projects (Virag 2021), the measures appeared efficient here. Input-based compensation provided flexibility for the accommodation of low task programmability and other emerging circumstances during sprints (Poppo and Zenger 2002). In Case 2, the causal mechanism reflected relational governance through a flexible contracting approach, which implies the ability to collaboratively reorient the logic of contracting during the project; this led to a contract that supports streamlined implementation. In Case 3, the tightly specified contract was poorly suited to the unplanned customization of the solution (bots); hindsight analysis suggested the value of a more flexible approach to contracting for addressing unknown content in future sprints. The emphasis on using familiar suppliers indicates the importance of trust and known behavioral norms for relational governance (Cao and Lumineau 2015; Poppo and Zenger 2002).

In summary, the associated mechanisms of *simple and flexible input-based compensation* (with reduced burden, but with risk on buyer) (Matinheikki et al. 2022) and the *flexible reorientation and situational adaptation* toward such contracts are both enabled by *relational governance* that reduces information-processing needs and provides safeguards and flexibility (Aoufi et al. 2021; Cao and Lumineau 2015; Poppo and Zenger 2002). These contribute to achieving efficient contracts, which support agile practices. These mechanisms are demonstrated in the following anchor quote from the Head of Sourcing (IT), Finnair:

> "When you are in that time and material [input]-based [contract], you can flexibly change direction and decide to do something else first. … Because then you do not have to plan those sprints, and you do not have to make a separate agreement for each timebox. … That [previous performance-based contracting] procedure was abandoned because it was too cumbersome, from a contractual perspective, to run every three months."

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Interdependencies with other sourcing steps are evident, as low programmability implications from the first sourcing step aggravate contracting uncertainty. However, the experience-based selection mechanism in the earlier phases establishes a foundation for relational governance, thereby providing safeguards for risky input-based contracts.

We summarize the identified generative mechanisms across the three sourcing process steps in Table 4, with their respective causes and outcomes.

5 | Discussion and Conclusion

5.1 | Theoretical Contributions

This research makes the following theoretical contributions. First, we theorized the empirical phenomenon of agile sourcing along with the conditions that drive uncertainty, and called for those mechanisms to be deployed for the intended outcomes (see Figure 5). Informed by this knowledge, we defined the agile sourcing approach as the deliberate escalation of uncertainty with initial open specification and managing the associated uncertainties throughout the process. This is managed with interdependent generative mechanisms of top-down attention-directing schemas, rich information processing, redundancy in supplier innovation, maximization of access to novel information, comparative acquisition of collaboration experience, experience-based supplier selection, simple and flexible input-based compensation, and flexible reorientation and situational adaptation through relational governance.

With this definition, we contributed to the broader literature on managing sourcing uncertainty, which has been specifically addressed in the contexts of innovation and service sourcing (e.g., Huang et al. 2009; Luzzini et al. 2015; Mikkelsen and Johnsen 2019; Van der Valk and Rozemeijer 2009). While our findings are somewhat aligned with these contributions (e.g., direct interaction with suppliers for high information-processing capacity), there are also notable differences. The agile sourcing approach embraces uncertainty in the front end, instead of avoiding it; consequently, several interdependent mechanisms are required in the process for managing the escalated uncertainty instead of single, often isolated, remedial mechanisms. In contrast to an acknowledged set of principles—for example, for innovation sourcing (Pihlajamaa et al. 2019)—from which to select, agile sourcing can be considered a specific program of mechanisms for sourcing (i.e., "a plan of activities to be done or things to be achieved"; see Cambridge Dictionary 2025), with some adaptation, to make a strategic value contribution to solving business problems.

With regard to the interdependencies among the mechanisms across the agile sourcing process (see Figure 5), we note that these further increase the associated overall complexity of successfully deploying the approach. The generic steps, sequentially ordered in the traditional sourcing approach, break down and overlap with the agile approach to a certain extent (e.g., determining specification with sprints overlaps and supplier selection efforts), thus suggesting more complicated task interdependencies across the process. This escalated interdependence is fundamentally different from the sourcing process-related interdependencies identified in earlier studies, which refer to, for example, social task interdependencies with the involved stakeholders (Rai and Hornyak 2013), technological interdependence among the systems that support the sourcing process (Bailey et al. 2010), or the straightforward unilateral interdependence of sequential process steps in terms of outputs and inputs (see Bäckstrand et al. 2019).

Second, the conclusion that the agile approach to sourcing implies higher task uncertainty due to interdependencies (see Tushman and Nadler 1978)—thus necessitating a specific sequencing of the associated mechanisms for information processing capacity—is interesting from the IPT perspective. In the effort to examine multimechanism interdependencies, notable advances have been made with the utilization of simulation modelling, thus suggesting, for example, configurational logics and sequencing strategies (Siggelkow and Rivkin 2005). We contribute to this broader IPT discussion with empirical evidence, albeit in a rather specific setting, as we show the importance of a programmatic order in which mechanisms are sequenced and deployed.

Third, we elaborated on the theoretical dilemma of dealing with the combination of superior external resources and high, even deliberate, escalation of uncertainty in accessing them. As described in this research, the agile sourcing process (Conboy 2009) is markedly different from the somewhat typical uncertainty-avoidance approach of the traditional sourcing process and also from those applied in innovation and service sourcing. Indeed, the agile sourcing approach can be characterized as contributing to antifragility, which suggests that sourcing may thrive when exposed to uncertainty (Nikookar et al. 2021). By embracing high specification uncertainty, the sourcing process may yield a stronger value contribution to internal customers and the business, possibly by being better aligned with internal customers' needs and demands and getting to actual value delivery faster; thus, procurement may achieve strategic relevance. Therefore, we contribute to the discussion on accepting, embracing, and even deliberately selecting high levels of uncertainty in sourcing (Gelderman et al. 2015; Heinis et al. 2022) as well as building antifragility in the supply chain management (SCM) context.

Fourth, by aligning our ontological and epistemological assumptions with the critical realist approach, we adopted a rarely employed approach of contextualized explanation (Welch et al. 2011) which enabled us to understand the causal relationships and generative mechanisms for successful agile sourcing. While we have greatly benefited from the methodological literature and illustrative examples of critical realism (Bille and Hendriksen 2023; Easton 2010; Eriksson and Engström 2021; Rotaru et al. 2014), we hope that our study adds to this literature and further encourages methodological diversity and innovative theory development in SCM research. In our view, critical realism offers a useful perspective for developing an in-depth understanding of causal explanations through qualitative inquiry, as it enables researchers to go beyond surface-level observations (events) to uncover the underlying generative mechanisms and structures that cause them. This is particularly valuable in SCM,

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TABLE 4 | Summary of generative mechanisms.

Sourcing task	Causes (contexts and values)	Resources, activities, and actors (examples)	Generative mechanisms	Outcomes (events)
Determining specification	Novelty of design or production task; emphasis of innovation in the required solution; time pressure *Imply high task uncertainty*	Performance specifications; user stories; service descriptions	Top-down attention-directing schemas *Reduces need for information processing*	Emergence of specification (fast product development and delivery)
		Agile sprints	Rich information processing *Increases information-processing capacity for learning and innovation*	
		Parallel development (multiple rival suppliers)	Redundancy in supplier innovation *Increases information-processing capacity for higher value*	
		Market dialogue with the buyer as an information broker in developing innovative offers	Maximization of access to novel information *Increases information processing capacity*	
Supplier selection	Difficulty of assessing suppliers with intangible selection criteria (innovation and collaboration capability) *Implies high task uncertainty*	Parallel development (multiple rival suppliers)	Comparative acquisition of collaboration experience *Reduces information-processing need through experiential insight on capability*	Selection of a tested/competent supplier for agile development
		Familiarity and trust-based screening, acquisition of experience in working with suppliers, RFP and workshops for supplier screening	Experience-based supplier selection with rich medium *Reduces information processing need through experiential insight on capability*	
Contracting	Low programmability due to development with several diverse sprints *Implies high task uncertainty*	Performance measurement focused on resource use	Simple and flexible input-based compensation *Reduces information-processing need by accommodating low programmability*	Flexible input-based contract that enables dealing with varying sprints and circumstances
	Desire to control supplier opportunism, desire to control based on experience from past projects *Implies high task uncertainty*	Frequent re-contracting, re-evaluation of contract, post-contract discussions and disagreements	Flexible reorientation and situational adaptation *Reduces information-processing need through relational governance for safeguards and flexibility*	Reorientation toward input-based compensation; contract supporting streamlined implementation

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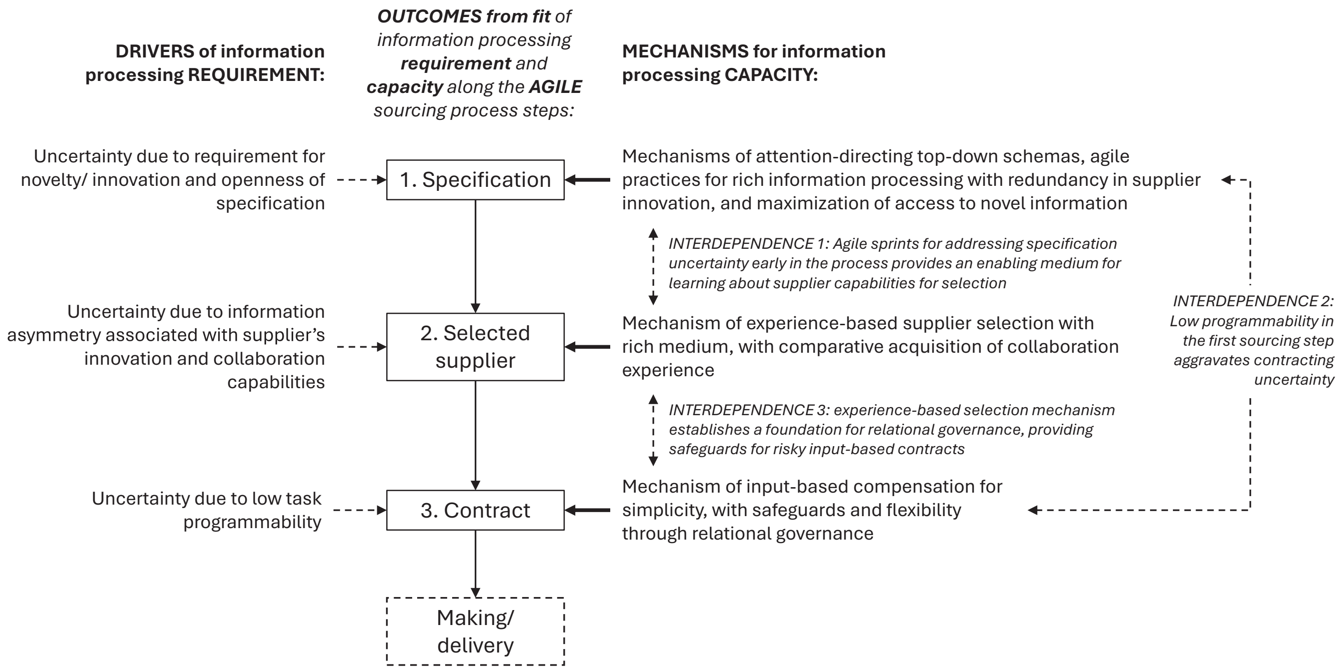

FIGURE 5 | Summary of information-processing requirements and capacity.

where complexity and interdependence are high. Further, SCM often involves uncertain, context-specific, and dynamic environments. Critical realism supports this by enabling an analysis of how context and structure interact to influence outcomes over time.

5.2 | Managerial Implications

In practice, specifications can be developed and refined over time by the collaborative agile team, with participation from both the buyer and supplier. Large and complex projects, such as IT outsourcing, imply more uncertainty and, thus, are likely to benefit from more intensive buyer–supplier dialogue for finding the best solutions. Thus, agile sourcing draws heavily on collaboration.

Therefore, in terms of supplier selection, priority should be given to competencies and references that enable a more detailed evaluation of the match/mismatch in corporate cultures, the chemistry between key people, and the level of creativity. Observing suppliers, particularly those new to the buyer, in action may increase trust in their capabilities and provide a good foundation for future work in the context of high uncertainty. This priority also enables the relational governance of supplier relationships.

In the contracting phase, to counter uncertainty, flexibility may be sought in various ways. For example, hybrid pricing models seek to distribute the delivery risk between the parties in a fairer manner. Mechanisms such as ceiling price, story point-based planning and pricing, and outcome- and performance-based pricing partially determine the flexibility of the contract. Nevertheless, simple input-based contracts coupled with relational governance may provide the best outcomes.

5.3 | Limitations and Future Research

Our research may not have fully captured the entire spectrum of variability in agile sourcing processes. Further research could seek to control the context in a more nuanced manner to address the question of when agile sourcing should be applied. Future research could also more explicitly control the physical vs. service product content in the delivered solution and observe whether such differences affect the agile sourcing practice.

Further, one limitation of this study lies in our case selection strategy, which focused on the positive sampling of successful agile sourcing projects. While this enabled a rich exploration of enabling mechanisms and favorable contextual conditions, it may also have led to bias by excluding cases where (maybe similar) mechanisms might not lead to successful outcomes. From a critical realist perspective, this might constrain the analyses of causality and limit the ability to identify counterfactuals or contextual inhibitors. Future research could purposefully include unsuccessful or mixed outcome cases to analyze contrastive explanations and facilitate deeper contextualization.

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Conflicts of Interest

The authors declare no conflicts of interest.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Supporting Information S1:** Data sources and their use in research. **Supporting Information S2:** Interview guide. **Supporting Information S3:** Summary of the research process. **Supporting Information S4:** Sample analysis of a causal chain in Miro. **Supporting Information S5:** Examples of retroduction and theoretical redescription. **Supporting Information S6:** Engagement timeline. **Supporting Information S7:** Trustworthiness and authenticity criteria of the research. **Supporting Information S8:** Sample reflexive memos. **Supporting Information S9:** Sample decision log.

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