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Unpacking Agility in a Collaborative Product Innovation Process

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ABSTRACT

This research examines how agility manifests in collaborative innovation processes and how various agile activities influence the successful commercialization of innovation. The agile innovation process comprises joint strategic planning, joint problem solving, joint improvisation with collaborative partners, and community sensing to gain market insights. Using qualitative comparative analysis of survey data from 138 collaborative innovation processes in the Swedish video game industry, the study probes the conceptual framework and explores complex causal pathways. The results indicate the importance of embracing the unexpected in the innovation process and suggest that problem solving and improvisation with a key collaborative partner are conducive to successful innovation commercialization. Joint strategic planning does not always lead to positive innovation commercialization, as it must be combined with other agile activities to create synergies. Similarly, community sensing does not always facilitate innovation commercialization, and the synergistic effects of the other three agile activities may substitute for community sensing. This research extends theory on the agility–innovation performance link by identifying distinct patterns of the agile activities, relationship-focused agility, and open agility, in collaboration with external actors. Specifically, it shows that firms can leverage either relationship-focused agility or open agility to achieve successful innovation commercialization.

1 | Introduction

Innovation processes are considered complex, uncertain, and volatile (Millar et al. 2018), a situation aggravated by the prevalence of digital technologies with their inherent openness, affordance, and generativity (Nambisan et al. 2019). In this context, it is insufficient to rely on predefined, structured, and intraorganizationally focused strategic planning of the innovation process and outcome (Benitez et al. 2020; Moschko et al. 2023; Pesch et al. 2021). Achieving commercial success requires that the innovation process should be *agile* (e.g., Brock et al. 2020), a concept reflecting the adaptive process of innovation and an approach to managing the uncertainty and unpredictability of this process (Lill and Wald 2021; Troise et al. 2022). While the concept of agility in innovation management has recently received attention (e.g., Annosi et al. 2020; Bechtel et al. 2021; Sharma et al. 2022), how it is implemented in the innovation process remains relatively unknown (Grass et al. 2020).

Mitigating and leveraging the uncertainty and unpredictability of an agile innovation process requires three prerequisites (Grass et al. 2020; Khanagha et al. 2022). First, the

Managerial Summary

- Our research offers two distinct templates, relationship-focused agility and open agility, that managers can adopt, depending on firm size, indicating resource availability.
- These two templates provide insights for managers to decide how to prioritize and direct resources across various agile activities with collaborative partners and user communities during the innovation process.
- By distinguishing between core and peripheral activities, indicating the level of investment, firms can better balance their collaborative innovation efforts with the resources at hand.
- Key managerial implications are (1) managers must be mindful that strategic planning has its place in the innovation process, but it may not always be conducive to the intended innovation outcome. (2) Joint problem solving and improvisation are shown to be instrumental to innovation commercial success regardless of firm size. (3) Smaller firms should focus attention and investment to implement relationship-focused agility in their innovation process to work closely with their collaborative partners for innovation commercialization success. (4) Larger firms are better placed to adopt an open agility approach in their innovation process, which should embrace community sensing in addition to joint problem solving and improvisation with collaborative partners.

innovation focus shifts from undertaking internal activities to collaborating with specific external partners (e.g., suppliers and customers) possessing specialized competencies (Parida et al. 2019; Vial 2021). These collaborations can also occur on a more ad hoc basis (Parida et al. 2019), for example, with customers in user communities (Altman et al. 2022). Second, the collaboration allows partners to learn, mobilize, and utilize existing knowledge in their relationships as well as to develop new knowledge (e.g., Annosi et al. 2024; Kohtamäki et al. 2020). Third, adaptability is key to addressing emerging problems and opportunities in the innovation process (e.g., Brock et al. 2020). Agility enables firms to act on opportunities, as well as counter problems, by mobilizing market and technical knowledge outside the firm (Cowan et al. 2007; Wang et al. 2014), as such critical insight rarely resides entirely within a single firm (Powell and Brantley 1996).

Despite ongoing debate on how firms can utilize and incorporate resources across organizational boundaries, it remains unclear how firms interact with external collaborators during the innovation process to solve problems and act on opportunities to achieve commercial success (Altman et al. 2022). By addressing this research problem, our study advances theory development concerning agile product innovation processes contextualized in a rapidly changing digital environment. This line of research is still nascent (Appio et al. 2021; Pesch et al. 2021), with an emphasis on how it differs from a conventional view of innovation management (Nambisan et al. 2019). Innovation of this kind is manifested, for example, in a video game, resulting from the use of digital technologies, and in the involvement of external collaboration and the wider user community (Nambisan et al. 2017; Wang et al. 2022).

Our research responds to the call for alternative ways of understanding the changing innovation phenomenon by attending to the openness and flexibility of the innovation process (Nambisan et al. 2017). It focuses on collaboration by building on insight into the complementarities and synergies between planned and unplanned innovation activities undertaken between a focal firm and a specific collaborative partner (Pesch et al. 2021). The planned activities are based on microplanning (Boehm and Turner 2005; Cooper and Sommer 2016a), consisting of episodes of iterative and incremental "sprints" when specific activities have been predetermined and are completed in an adaptable way. This requires joint decision-making, information sharing, and flexibility from both parties (Salmela and Huiskonen 2019). Furthermore, an agile innovation process involves collaborative partners undertaking activities as unexpected situations dictate, activities such as joint problem solving (Lazer and Friedman 2007) and joint improvisation (Levallet and Chan 2022). These key activities help match and orchestrate resources in the relationship (Sjödin et al. 2020). To capitalize on the diverse, rich, yet unstructured information provided by loosely coupled external actors (Balducci and Marinova 2018; Bremner and Eisenhardt 2022), a firm must sense what could be relevant to act on to ensure market feasibility and the successful commercialization of the innovation. This activity is herein conceptualized as (user) community sensing (Day and Schoemaker 2016; Ho-Dac 2020). Therefore, an agile innovation process is conceptualized as including both planning and adaptation (e.g., Pesch et al. 2021), entailing three main activities performed by the firm and its key partner: (1) joint strategic planning, (2) joint problem solving, and (3) joint improvisation, as well as a fourth activity whereby the firm through (4) community sensing gains insights from product users.

As such, an agile innovation process has multiple facets that coexist, are interdependent, and interact to provide synergies for innovation commercial success, in line with configurational thinking (Fiss 2011; Ketchen et al. 1997; Meyer et al. 1993). As we are interested in patterns of causal conditions, that is, agile activities, that lead to an innovation outcome, the conventional approach that examines independent variables and their net effects may mask the causal complexity inherent in the studied phenomenon (Ragin 2014). Adopting a configurational approach as an inquiry mode allows for interrogating multifaceted phenomena with complex patterns of causation (Park et al. 2020). Qualitative comparative analysis (QCA) is a method based on configurational thinking and has been employed for theory development to clarify complex phenomena (Salonen, Zimmer, and Keränen 2021). It is gaining traction in innovation research (e.g., Barlatier et al. 2023; Juntunen et al. 2019; Lehoux et al. 2021; Tekic et al. 2023; Thornton et al. 2019) due to its underlying assumptions and capacity to analyze multiple causal paths, leading to an outcome of interest, in terms of combinations of conditions (combinatory effects), as opposed to explaining outcome variation in terms of a single solution (net effects). QCA is, particularly, suited for theory elaboration (Ketchen et al. 2022; Park et al. 2017) when there is a need to rely on preexisting concepts to further

conceptualize the structure of the theoretical relations and empirically investigate them in order to extend the theory (Fisher and Aguinis 2017; Lee et al. 1999), that is, agility in the innovation process and its outcome.

Consequently, our research aims to shed light on a collaborative agile innovation process, thereby examining the role of the four integral constituent elements of agility and how they influence innovation commercialization. Furthermore, to extend the theory by elaborating on different configurations of agility, we examine the structure of the four elements of agility, that is, the combinations and relative importance of different agile activities, in relation to innovation commercialization success. Specifically, our research addresses two knowledge gaps, identified through an extensive literature analysis (see Appendix A). First, despite the influential roles played by institutions (Annosi et al. 2024; Castro-Lopez et al. 2023), market turbulence (Meier and Kock 2024), and customer interactions (Cubillas-Para et al. 2024; Grass et al. 2020), there is a lack of empirical research on activities performed in collaboration with specific collaborative partners during the innovation process. Second, scant research, with the exceptions of Bianchi et al. (2022) and Lill and Wald (2021), have specifically examined the link between the nature of the agile innovation process (including collaborative partners, sensing, and responding to opportunities and problems) and innovation performance, such as innovation commercialization success.

Three theoretical contributions are offered against the backdrop of the gaps in the literature. First, our research contributes to the nascent research field of agile innovation contextualized in a collaborative process in a rapidly changing digital environment (Pesch et al. 2021; Wang et al. 2022) by analyzing how agility is manifested in a collaborative innovation process to create a commercially successful product innovation. Second, our research contributes to emerging theory on the agile innovation process (e.g., Cooper and Sommer 2016b; Ghosh and Wu 2021; Grass et al. 2020) by adopting a configurational approach to considering the synergistic and simultaneous effects of four agile activities with a partner. Finally, we contribute to theory development by analyzing how the four agile activities are related to the commercial success of an innovation, considering their combinatory effects, or equifinality (i.e., multiple "recipes" that all lead to innovation commercial success) (e.g., Leischnig et al. 2016). Practically, this research has implications for managers practicing in a rapidly moving and changing digital environment. They must understand the importance of the agile collaboration with their partners and how best to strategically plan and organize innovation activities, including when to engage their user communities to solicit important market insights.

2 | Theoretical Background and Conceptual Framework

2.1 | Literature Review

The roots of agility in innovation can be traced back to the Agile Manifesto formulated by a group of software developers (Beck et al. 2001). This manifesto emphasizes values such as collaboration with external partners, responsiveness to change, and iterative development, enabling firms to respond swiftly to emerging opportunities and address problems that may arise during the iterative process. The agile approach to innovation has subsequently expanded beyond software development to encompass various industries and technologies (Bianchi et al. 2022). Given that agility has been researched in widely diverse research fields and contexts, we conducted an extensive literature review and analysis of agility in innovation management to delineate the knowledge gaps and further conceptualize agility in the context of this research.

We specified four terms, that is, "agile," "agility," "innovation," and "product development," and searched for them in the titles and/or abstracts of journal articles. Only high-quality top-tier journals from the Academic Journal Guide (Levels 3, 4, and 4*), consistently featured from 2010 to 2021, were included. We confined the search to the business and management subject areas, using reputable databases, namely, Business Source Premier, JSTOR, Scopus, and Web of Science. Articles were excluded if they (1) were not empirical, (2) did not use agility as a core construct in the theoretical framework, or (3) were not contextualized in innovation management. After initially identifying and reviewing 50 relevant articles, our final sample comprised 31 articles. Each article was coded based on eight themes that capture (1) agility as a construct, (2) theoretical development, and (3) research design.

Three streams of research were identified (shown in Tables A1–A3 in Appendix A) investigating how agility is applied in innovation and to some extent relating to economic outcomes, such as firm performance and innovation performance. The first stream (Table A1) conceptualizes agility as an organizational capability enabling firms to adapt to environmental changes and respond to opportunities, thereby providing competitive advantage and heightened performance (Rialti et al. 2019; Škare and Soriano 2021). The unit of analysis is the organization, which does not have an explicit focus on innovation management. It fosters efficiency and effectiveness in resource utilization aimed at prioritized strategic activities for value creation and capture (Teece et al. 2016). For example, Doz and Kosonen (2008) conceptualized agility as top management's ability to make decisions by being sensitive and attentive to market changes and their ability to reconfigure internal capabilities. Agility enables firms to innovate competitively (Kohtamäki et al. 2020) by rapidly changing and rearranging operations according to shifting requirements, opportunities, and trends in dynamic, fast-moving markets (Battistella et al. 2017).

The second stream (Table A2) is primarily found in innovation management research, with the unit of analysis being innovation teams or pre-planned processes such as Scrum (Schwaber 2004) or Lean (Ghezzi and Cavallo 2020). Here, agility is instrumental, as it enables the innovation units to recognize external opportunities and threats and act accordingly in the process. This can relate to technological advances and changing customer preferences that require adjustments in deploying and configuring resources to create and capture value (Castro Soeiro et al. 2016; Sambamurthy et al. 2003). This stream investigates concepts such as empowerment, management control, and peer pressure (e.g., Grass et al. 2020;

Khanagha et al. 2022) to explain innovation performance. The conceptualization of agility in the first and second streams is predominantly based on an internal organizational perspective (e.g., Lu and Ramamurthy 2011; Morton et al. 2018; Park et al. 2017; Sambamurthy et al. 2003). Such a conceptualization is restrictive, mainly in view of the increasing prevalence of digital technologies (Nambisan et al. 2019) and the spirit of an agile approach to innovation that embraces openness and collaboration (Beck et al. 2001).

The third research stream (Table A3) views the innovation process as the unit of analysis and investigates how opportunities and problems emerging during the process are managed (e.g., Brock et al. 2020). The innovation process in this stream has evolved from a closed, internal approach into a collaborative framework (Altman et al. 2022; Bremner and Eisenhardt 2022), as business partners, customers, suppliers, and user communities have emerged as external actors contributing to the performance of innovation. External counterparts provide insights into needs, preferences, and emerging market trends (Thornton et al. 2015). This knowledge increases the market fit of the innovation and reduces the risk of failure (Lüthje et al. 2005).

2.1.1 | Theoretical Perspective

As can be seen from Table A1, the vast majority of the studies in Research Stream 1 adopted the theoretical perspective of dynamic capabilities, emphasizing the ability to sense and respond to changes. Agility has various guises, such as intellectual agility (Dabić et al. 2021), organizational agility (AlNuaimi et al. 2022; Cubillas-Para et al. 2024), supply chain agility (Al-Omoush et al. 2023), time and task agility (Franco and Landini 2022), knowledge-based agility, behavioral agility, and organizational agility (Hutton et al. 2024). The environment is faceless in this tradition, and the innovation process is perceived to be largely structured. Other theoretical perspectives are used to a lesser extent, such as institutional theory, entrepreneurship theory, various learning theories, and business model theories. Agile methods (e.g., Annosi et al. 2024; Salvato and Laplume 2020) and agile teams (e.g., Grass et al. 2020; Khanagha et al. 2022) feature mostly in Research Stream 2 (Table A2).

2.1.2 | Environment and Market

The context outside the organizational boundaries is part of the definitions of agility in the three research streams, and some studies propose various concepts to capture this externality, such as the importance of institutions (Annosi et al. 2024; Castro-Lopez et al. 2023) and market and/or environmental turbulence (Guo et al. 2023; Kock and Gemünden 2016; Meier and Kock 2024; Zhou et al. 2019). External actors embedded in the ecosystems and networks are part of the focus in some studies, indicating that external collaboration to some extent influences innovation. We identified only four studies that explicitly capture the collaborative aspect of agility in relation to consumers and customers (Cubillas-Para et al. 2024; Grass et al. 2020; Guo et al. 2023; Rummel et al. 2022). However, no study explicitly considers collaborative partners' active involvement in the innovation process, where the learning between the two partners and resource pooling and sharing occurs.

2.1.3 | Outcomes

Most studies treat innovation as an outcome, such as circular product innovation (Castro-Lopez et al. 2023), digital innovation (Brock et al. 2020; Del Giudice et al. 2021), product and process innovation (Franco and Landini 2022), and environmental innovation among supply partners (Bouguerra et al. 2024). However, a few studies analyze the performance of a specific innovation process in terms of, for example, cost, speed, quality (Bianchi et al. 2020), and project performance (Lill and Wald 2021). While some studies analyze performance as an outcome of the innovation process, others investigate the success of new product development (Hajli et al. 2020; Hutton et al. 2024; Meier and Kock 2024). Strikingly, relatively few articles analyze the financial performance of the firm as a consequence of agility in innovation, considering, for example, firm performance (Bhatti et al. 2021), firm profitability (Kohtamäki et al. 2020), and general financial performance (Zhou et al. 2019). Some research has adopted a case study research approach based on qualitative data, most of which do not focus on an outcome/performance (e.g., Rummel et al. 2022).

2.2 | Defining the Agile Innovation Process

We identify three aspects constituting the nature of an agile innovation process. First, specific external counterparts play an influential role, as a focal firm adapts to a rapidly changing environment with uncertain technological developments, market demands, and preferences. Second, adaptability during the innovation process is essential due to unexpected and unforeseen problems and opportunities that must be handled swiftly to advance the process. Therefore, an agile innovation process incorporates actions based on opportunities and problems both within and between organizations. Third, learning and soliciting insights from the market to facilitate the innovation process and its outcomes is essential. To develop a theoretical framework capturing the key aspects of the agile innovation process, concepts involving consumer (user) collaboration, partner interaction, and the ability to sense and respond to opportunities and problems during the process are essential. In addition, we contend that the second and third elements—adaptability and learning—do not occur in isolation but are integral to collaboration with specific partners. The combination of agile joint activities makes adaptability and learning possible as they differ in nature and extent. Unlike most research emphasizing turbulence and uncertainty in the environment, market, or technology, agile methods research assumes that it is the process that is uncertain and unpredictable, and that must be managed accordingly.

Drawing on the existing innovation literature on agility and embracing its spirit of adaptability, we conceptualize the constituent elements to capture agility in the innovation process, including both the planned and unplanned activities (Wang et al. 2022). When embarking on an innovation process, a focal firm and its partner need a clear direction and a shared vision of their goals (Song et al. 2011), which likely leads to

joint strategic planning. This, in turn, results in a common plan for the innovation project, guiding the project and specifying how the innovation work should be shared and executed. This can only be efficiently carried out if the plans are formalized and codified to be communicated to all involved parties (Salomo et al. 2007).

Joint problem solving is a concept inspired by the classical innovation literature (Newell and Simon 1972). We view it as an activity performed by the firm with its key partner, in which they openly discuss problems arising during the process by utilizing each other's competencies and skills. This requires a mutual and genuine interest in supporting each other to solve problems (Laureiro-Martinez et al. 2023). One element is the exchange of information, which, in turn, requires that both parties take initiatives to solve the problem.

Joint improvisation, in contrast, captures flexibility and creativity in developing new ways to seize emerging opportunities in the innovation process (Audretsch et al. 2023). The partners work together to advance the innovation process (Kyriakopoulos 2011), often "thinking outside the box" and organizing extensive joint brainstorming sessions. These elements of cooperative creativity are essential for novel discoveries. As improvisation is often defined as the simultaneous and instant development of plans and execution of actions (Magni et al. 2013), the temporal aspect is crucial. Thus, acting on opportunities and problems swiftly, and finding new ways to address them are essential.

A critical concept in the framework is the extent to which a firm utilizes the diverse insights and knowledge of users or consumers in the innovation process (Dahlander and Frederiksen 2012; Rummel et al. 2022). Firms may engage with user communities in which users can share experiences and opinions. Community sensing allows firms to sense and respond to emerging trends and changing market conditions (Jeppesen and Frederiksen 2006). By engaging in debate in these communities, firms may be better equipped to sense and act on emerging opportunities and develop knowledge of possible solutions to problems. Given that digital industries and digitally enabled and/or enhanced environments are characterized by rapid dynamics and development, responding quickly to developments within user communities is a key aspect of innovation process.

2.3 | Hypothesis Development

Joint strategic planning is defined as a process in which two partners jointly define the objectives to be achieved, and set out and specify alternative strategies with clear implementation and monitoring plans (Armstrong 1982). Prior research asserts that strategic planning provides firms with a direction and focus for achieving objectives (Song et al. 2011), which is essential for firm performance across varying environmental conditions (Andersen 2000; Ansoff 1991; Brews and Hunt 1999; Rhyne 1986). However, similar to the mixed impact of strategy on firm performance (Pearce et al. 1987), empirical evidence in the context of innovation shows that rigid strategic planning hampers the creativity needed for innovative ideas, leading to unfavorable innovation outcomes (Song et al. 2011). It has been found that an incremental approach is vital to the success of strategic planning in turbulent environments (Brews and Hunt 1999). In such contexts, a predefined linear plan with specific goals and targets for achieving innovation commercial success is inadequate; instead, goal-setting during the innovation process becomes less definite and more negotiable, and planning tends to be shorter term and less rigid (Wang et al. 2012).

Joint strategic planning between two partners in an agile process takes dynamism and temporal uncertainty into account, allowing flexibility within an overall strategic direction in the innovation process by allowing latitude for iterations, feedback, and learning during the process. This dictates that collaborative partners should undertake strategic planning in which they jointly and regularly negotiate and predict the future by specifying the activities needed for reaching current predetermined goals on a shorter-term basis. Therefore, joint strategic planning must be flexible enough by including aspects of creativity and experimentation to handle dynamic and unexpected discoveries (Cooper and Sommer 2016a). Given the fluidity of the innovation process in a changing environment, simply executing the plan may not ensure the desired commercial success, and firms may need other forms of agility to complement their overall strategic actions. Hence:

Hypothesis 1. *Joint strategic planning alone does not lead to product innovation commercialization success.*

Joint problem solving refers to the sharing and utilization of collaborative partners' knowledge and skills to create synergies needed for the problem at hand (Lazer and Friedman 2007). This approach emphasizes finding solutions to problems during the innovation process, facilitated by the capabilities gained through the relationships with collaborative partners (Posen et al. 2020). It includes aspects of problem identification and problem resolution (Simon 1988) and entails acquiring the necessary information and abilities to solve the problem (Von Hippel 1994). In the innovation literature, problem solving is often treated as an internal activity (Atuahene-Gima and Wei 2011) dependent on specific employees' or units' knowledge or behavior (e.g., Alavi et al. 2022; Felin and Zenger 2014; McDonough III and Barczak 1992). However, it can also be linked to external collaboration with partners (e.g., Bodas Freitas and Fontana 2018; McEvily and Marcus 2005).

The ability to solve problems in the innovation process is crucial for reaching the goal, for example, successful commercialization (e.g., Mayer 2014; Thomke and Fujimoto 2000; Verganti et al. 2020). While joint strategic planning focuses on defining how to achieve a goal, problem solving focuses on the incremental steps required to reach the strategic goal as problems arise, which are often unforeseen during planning. Joint problem solving is an ongoing activity in the innovation process (Levallet and Chan 2022; Van de Ven 1980). Partners recognize shared responsibilities to maintain the relationship as challenges arise and together resolve any problems arising through ongoing interactions (Heide and Miner 1992). Joint problem solving contributes to the success of innovation commercialization as it provides mechanisms for the partners to overcome difficulties and advance in the innovation process.

Joint improvisation refers to a strategy to address unexpected or changing contextual developments (Hadida et al. 2015). The innovation process is often characterized by surprises and serendipity, especially in rapidly changing industries in which past experiences may not align with present conditions and in which circumstances change rapidly, diminishing the value of predicting the future. Creativity and flexibility are thus especially relevant in dynamic industries (Sarasvathy 2001) in which the future is largely unknowable and there is no strong link between rigid planning and action (Ford et al. 2008). In such markets or technological conditions, a non-predictive course of action (Wiltbank et al. 2006), such as joint improvisation, is more likely to be successful (Sarasvathy 2001) than are predefined actions, particularly, in the long term. Joint improvisation embraces opportunities by highlighting the need and ability to quickly think, act, structure, and adapt activities during the innovation process (Miner et al. 2001; Wilson and Doz 2011).

Emerging opportunities may require new methods, and firms cannot always apply old knowledge. Joint improvisation serves as a way to embrace opportunities in uncertain processes that are difficult to predict. First, it represents an important competency that stimulates value development (Eisenhardt and Tabrizi 1995; Moorman and Miner 1998). Second, it implies capturing opportunities by being flexible and fast, positively affecting the outcomes (Akgün et al. 2007) due to time-related advantages, such as time to market (Autio et al. 2000; Hult et al. 2008). Third, joint improvisation means doing things in new ways and leveraging existing resources (Ahi et al. 2017), such as identity, knowledge, networks, and technological opportunities (Sarasvathy et al. 2014), for new purposes to create efficiencies.

Compared with problem solving, joint improvisation relies on creativity (Csikszentmihalyi 1988), enabling the firm and its partner to jointly act in the moment when facing unknown and unexpected situations. Acting creatively on these potential opportunities can involve quickly modifying potential products, production processes, and/or routines. Hence, when improvising there is no predefined problem to solve. Instead, the collaborative partners work proactively and quickly together, based on hunches or insights to adapt the innovation process and increase the potential for commercialization success. Joint improvisation can be a series of interactions with collaborative partners (Evers and O'Gorman 2011). The partners can swiftly address potential opportunities emerging during the innovation process, for example, by "thinking outside the box" (Hmieleski and Corbett 2006), leading to brainstorming sessions aimed at finding new ideas and methods. This implies that partners will seek new methods that may not have been tested before, and will need to find ways to implement required changes quickly (Hilmersson et al. 2022; Vera and Crossan 2004).

Joint problem solving and joint improvisation are distinct activities underpinning agility in an innovation process and are intended for dealing with unplanned situations. However, firms need to manage their planned and unplanned activities simultaneously in an innovation process with varying degrees of stability and fluidity (Pesch et al. 2021; Wang et al. 2022). This implies that the innovation process includes activities whereby collaborative partners jointly plan how to capitalize on opportunities, achieve goals, and resolve problems. It also implies that the agile innovation process contains elements of joint improvisation and problem solving, which necessitate activities that the firms jointly plan and perform. Hence:

Hypothesis 2. *Joint strategic planning in combination with joint problem solving and joint improvisation are sufficient for product innovation commercialization success.*

Community sensing refers to a firm's ability to engage the user community to obtain market intelligence and insight, gaining advantages from interactions with user community members (Day and Schoemaker 2016; Ho-Dac 2020). This is important in dynamic markets where trends and preferences are constantly changing. Insights from the user community provide firms with potential avenues to quickly respond to new trends and opportunities. They offer a contextualized understanding of the market and technology that extends beyond the collaborative relationship. Community members, including users, developers, and experts, interact and exchange ideas and knowledge about products, such as video games, on various forums and platforms, forming a diverse and rich pool of resources (Franke and Shah 2003).

The shared interest of community members is primarily driven by solving problems related to their own needs or expressing their problems through their user experiences in relation to a product (Brem et al. 2019). Firms can monitor and engage with the community, thereby gauging sticky information (Von Hippel 1994) that can be utilized in the innovation process (Day 2020). This often requires interaction with users to tap into the knowledge needed for innovation, as user communities possess a wealth of domain-specific knowledge and expertise (Ehls et al. 2020). Engaging user communities in the process provides a platform for customers and users to influence product development (Lüthje et al. 2005).

Implementing user-centric solutions, especially in the early stages of the innovation process, arguably ensures market fit (Bogers et al. 2010), reduces the risk of innovation failure, and increases the likelihood of user satisfaction (Franke and Schreier 2010; Lüthje et al. 2005). Prior research has shown that user community innovation sometimes outperforms producer innovation (Hienerth et al. 2014). A user community consists of heterogeneous actors, such as experts, lead users, and experienced users, who together can be a powerful tool and rich resource for problem solving (Hienerth et al. 2014). Therefore, leveraging community sensing can enhance the responsiveness of the innovation process (Füller et al. 2009), as user communities can be a valuable resource for identifying problems and potential solutions, increasing the likelihood of successful commercialization in the marketplace. Community sensing provides critical input for market feasibility and technical solutions, working hand in hand with other agile activities in the innovation process. Hence:

Hypothesis 3. *Community sensing in combination with other agile activities is sufficient for product innovation commercial success.*

3 | Research Design

3.1 | Research Context

To understand the phenomenon of innovation processes in a fast-changing environment, the empirical research was conducted in the collaborative process of innovation projects in the Swedish video game industry. Such projects represent a company's working mode in which set activities occur to address both challenges and opportunities to accomplish an innovation goal (Henfridsson et al. 2018; Moschko et al. 2023). The Swedish gaming industry represents a growing sector, propelled by the transformative nature of digital technologies (Verhoef et al. 2021) and the volatility of the market, which is fragmented and competitive. The revenue of Swedish gaming firms, including foreign subsidiaries, was EUR 5.8 billion in 2021, a 75% increase over the previous year (The Swedish Games Industry 2022). With at least a quarter of gamers around the world having played a game developed by Swedish firms, Swedish games regularly top the download and sales charts (The Swedish Games Industry 2022).

The video game industry is a fitting research context when it comes to investigating agility in innovation processes, particularly, those involving external collaboration. This inherently international industry is diverse and open in terms of the supply of skills, globally dispersed partners, and the gaming communities. In this context, game developers, big or small, must innovate not just for novelty, but to be timely, captivating for users, and competitive in the marketplace. Therefore, they must adapt the innovation process according to the changing context so that the new product can exceed the imagination and expectations of the target customers in an ever demanding and changing market.

3.2 | Sampling and Data Collection

The study is based on data collected through an interviewer–administered questionnaire. As a sampling frame, we used a Swedish trade association database, which covered 449 Swedish game developer firms (The Swedish Games Industry 2020). Firms not directly involved in game development (84) were excluded, as were firms that have not yet released or developed any actual games (67). These choices led to a sample of 298 firms. Potential respondents were then identified through company websites, game development events (e.g., Sweden Game Conference), and professional networks (e.g., LinkedIn). The questionnaire was completed by each respondent together with the interviewer, enabling explanations and contextual clarity. The average time for each response was 30–60 min. In total, 176 managers were interviewed; after a data quality check (e.g., for missing data on substantive variables), we obtained a usable sample of 138.

3.3 | Construct Measurements

We used a structured questionnaire as a data collection instrument to measure respondents' perceptions of the key constructs under study, as such perceptions lead to managerial decision-making and possible behaviors (Powell 1996). We conceptualized an agile innovation process as encompassing activities occurring during a specific innovation project with an external actor. Following this, all questions were asked on the basis and in the context of a specific video game innovation process in which a focal company and its most important external partner (specified by the informant) worked together (Henfridsson et al. 2018; Moschko et al. 2023). We used preestablished scales in the literature whenever possible, measured on a 7-point Likert-type scale, anchored at 1 (*completely disagree*) and 7 (*completely agree*). Table 1 lists all the items used in this study.

Innovation commercialization success was measured by a single item: the sales volume of a codeveloped game (implying the size of user base), benchmarked against other innovation projects of the focal firm. The game had to have been launched at least 5 months previously. The time lag was to allow the outcome to give rise to ensuing organizational actions (e.g., Bridoux et al. 2013; Luoma et al. 2017). Although innovation commercial success has been measured as an objective outcome, for example, any sales of products, services, and processes as a binary variable (Link and Scott 2010) and as subjective perceptions, for example, innovation performance in relation to competitors' innovations (Eggers et al. 2020), these measures were unsuitable for this study. The video game industry is dominated by a few extraordinarily successful games, and when benchmarking against these, most others would appear to be failures. In addition, the exact sales figures vary dramatically depending on the genres, making exact sales comparisons across cases problematic. In this context, benchmarking against the performance of past innovations provides a suitable approach (e.g., Gruner et al. 2019), in line with the literature on competitive dynamics (Chen and Miller 2012). Managers often benchmark against past outcomes to structure their future actions in an attempt to achieve better performance, because their decision-making toward the actions and resource allocation needed in order to compete in the market is often based on unclear, limited information and without completely understanding how the strategy is to be translated into future performance (Chen and Miller 2012). Following this reasoning in the case of this study, the focal firm's motivation for collaborating with other parties was to achieve progressive expansion of the user base (e.g., sales volume) in the marketplace, possibly by leveraging their collaborating partners' market presence and expertise in certain genres of games and/or market segments.

Joint strategic planning was measured by four items capturing the extent to which a focal company planned with its most important partner (Armstrong 1982). These items were adapted from Song et al. (2011), as they emphasized that the nature of strategic planning is a formal process that the partners carefully implement and that specifies the goals and activities in order to realize the plan. *Joint problem solving* was measured by four items, which were developed based on the theoretical meanings expressed in the literature (e.g., Alavi et al. 2022). They capture problem solving jointly performed by the firm and specific partner in the innovation process, which reflects the cooperative nature of cognitive search (Bodas Freitas and Fontana 2018; McDonough III and Barczak 1992; Nickerson and Zenger 2004).

TABLE 1 | Measurement items.

Constructs		Factor loadings
Agile activities		
Joint strategic planning ($\alpha = 0.84$)		
STRPL1	Together with our partner we planned very carefully before any significant action was taken	0.83
STRPL2	Together we did an extensive common plan of the project	0.81
STRPL3	We specified together carefully which activities should be carried out and when they should take place	0.74
STRPL4	We established together clear formal and written plans for the project	0.62
Joint problem solving ($\alpha = 0.91$)		
PROBS1	When problems came up in the development process, we discussed the problem with the partner openly	0.78
PROBS2	When problems came up in the development process, both parties genuinely interested in solving the problems	0.93
PROBS3	When problems came up in the development process, both parties undertook big efforts to exchange information in order to solve the problems	0.85
PROBS4	When problems came up in the development process, both parties took initiatives to the problem solving	0.82
Joint improvisation ($\alpha = 0.86$)		
IMPRO1	In order to drive the project ahead, the partner had to think outside of the box	0.86
IMPRO2	In order to drive the project ahead, the partner joined extensive, common "brainstorming" sessions	0.79
IMPRO3	In order to drive the project ahead, the partner was solving a big share of the problems immediately	0.86
IMPRO4	We tried oftentimes new solutions to problems	0.62
Community sensing ($\alpha = 0.87$)		
CSEN1	We took advantage of game community	0.79
CSEN2	We were scanning for new trends in game communities	0.70
CSEN3	The Game communities made us more aware of changing market conditions	0.66
CSEN4	The project team was prepared to listen to opportunities coming from player communities	0.85
CSEN5	We related quickly to conversation within game communities	0.75
Innovation outcome		
Innovation commercial success (α = n.a.)		
ICS	In relation to company's other games, the game is very successful in terms of sales volume[a]	—
Firm characteristic		
Firm size		
Size	Number of employees (in 2018)	—

[a]This game must be launched at least 5 months ago.

Joint improvisation was measured by four items, inspired by a body of literature (Hilmersson et al. 2022; Hmieleski and Corbett 2006; Vera and Crossan 2005), capturing improvisation jointly performed in the innovation process. Finally, *community sensing* was measured by five items, drawn mainly from the work on market sensing (Day 1994, 2020; Mu 2015) and organizational sensing (Teece 2007), to capture how firms utilize their user community for market insights.

The measurement model, consisting entirely of multi-item constructs, was assessed based on confirmatory factor analysis, using Mplus (ver. 7.4). All multi-item constructs were operationalized as reflective constructs, following the conceptualizations from relevant studies. The results show that the measurement model has a good model fit based on the guidelines in the literature (Hair Jr. et al. 2007), with χ^2 (113) = 155.53 ($p = 0.005$), $\chi^2/df = 1.38$, comparative fit index (CFI) = 0.97, Tucker–Lewis index (TLI) = 0.96, root mean square error of approximation (RMSEA) = 0.052, and standardized root mean square residual (SRMR) = 0.058.

Convergent validity was assessed and deemed satisfactory, following Hair Jr. et al. (2007). First, the factor loadings of the items in all multi-item constructs are between 0.62 and 0.93,

exceeding the threshold of 0.5, and Cronbach's α is between 0.86 and 0.91 (Table 1), indicating good internal consistency (above 0.8) (Nunnally 1978). Second, Table 2 shows that the composite reliability (CR) of the four constructs ranges from 0.84 to 0.91, well exceeding the suggested threshold of 0.6–0.7. Average variance extracted (AVE) values are all above 0.5, ranging from 0.57 to 0.72. The discriminant validity is also deemed satisfactory, as the squared root of AVE for each construct is greater than its pairwise correlation with any paired constructs (Fornell and Larcker 1981).

As the responses of all variables were collected from one source, that is, the managers, we assessed the potential common method biases, using two commonly used methods in the literature (Podsakoff et al. 2003; Podsakoff and Organ 1986). First, Harman's one-factor test was performed through an exploratory factor analysis, including all measurement items of the multi-item constructs. The test suggests no evidence of potential biases, as no one single factor explains the majority of the variance and the first factor accounts for under 50% of the variance (34%) in these items (Podsakoff and Organ 1986). Second, two confirmatory factor analyses were performed to compare the model fits of a one-factor model (with all items loaded onto a single factor) with the fits of the theoretical model (with items loaded onto the corresponding theoretical constructs). The result suggests no potential biases, as the difference test based on log likelihood indicates that the one-factor model has a far worse model fit, that is, $\chi^2(119) = 671.94$ ($p = 0.000$), $\chi^2/df = 5.65$, CFI = 0.48, TLI = 0.41, RMSEA = 0.183, SRMR = 0.167, than does the theoretical model.

4 | Analytical Approach and Results

4.1 | QCA: Probing Complex Causal Pathways

In line with the research aim, QCA provides an analytical method for teasing out a nuanced picture of the multiple ways in which the combinatory effects of agile activities manifest themselves to explain innovation commercial success (Leischnig et al. 2016). The complex interplay of relevant conditions gives rise to multiple pathways by which organizations can achieve an outcome of interest, that is, equifinality, depending on how the conditions are combined to produce complementarity or substitution effects, so there is no "one-size-fits-all" solution (Fiss et al. 2013). QCA embraces the premise that organizations comprise interconnected activities and structures, and that "organizational phenomena can best be understood by identifying distinct, internally consistent sets of firms and their relationships to the environment and performance outcomes" (Ketchen et al. 1997, 224). QCA investigates set relations, resulting in equifinality with multiple possible pathways to the outcome (Ragin 2008). Figure 1 depicts the conceptual framework in a Venn diagram. It shows that the agile activities and firm size, expressed in different spheres, are combined to form configurations that explain innovation commercialization success.

TABLE 2 | Statistics for convergent and discriminant validity.

	CR	AVE	1	2	3	4
1. Joint strategic planning	0.84	0.57	**0.76**			
2. Joint problem solving	0.91	0.72	0.45	**0.84**		
3. Joint improvisation	0.89	0.61	0.51	0.56	**0.79**	
4. Community sensing	0.86	0.60	0.13	0.08	0.18	**0.75**

Note: The square root of AVE is shown in bold on the diagonal; the correlations between constructs are below the diagonal.

Following the QCA literature, we performed three sequential phases of analysis, using the fs/QCA (ver. 4.1) software. First, as each case is characterized by its membership in the conditions and outcome, each condition and outcome must be calibrated to indicate its membership score. Before the calibration, a mean for each multi-item construct was calculated to represent an overall score of a condition for the subsequent calibration. We used the direct method, following the recommendations from prior QCA literature (Fiss 2011; Park et al. 2017; Ragin 2008) to transform each condition and outcome into membership scores, ranging between 0 and 1, with 0 indicating a case fully out of the set, 1 fully in, above 0.5 more in than out, and below 0.5 more out than in. The anchor points for non-membership, the crossover point, and full membership are set at 2, 4, and 6, respectively, based on a 7-point Likert scale with 1 being the lowest (i.e., completely disagree), 4 being the mid-point, and 7 being the highest (i.e., completely agree). These anchor points were chosen based on theoretical anchors indicating respondents' extent of agreement in each condition and were in line with good practices found in existing studies (e.g., Frösén et al. 2016; Lee et al. 2019; Park et al. 2017; Salonen, Terho, et al. 2021; Thornton et al. 2019), with 2 indicating a position short of completely disagree, 4 a neutral position, and 6 almost completely agree. Firm size was calibrated using the European Union's classification of enterprise sizes, with firms having 250 or more employees considered large-sized, 50–249 medium, 10–49 small, and below 10 micro (full membership = 250, crossover point = 50, full non-membership = 10). As a membership of 0.5 indicates maximum ambiguity (i.e., neither in nor out of the set) in determining the theoretical meaning of a construct, a constant of 0.001 was added to all membership scores under 1, following the guidelines of Fiss (2011).

The next phase is to perform an analysis of necessity to determine and understand whether or not any of the conditions is necessary for an outcome to occur. To do this, consistency and coverage scores are calculated for all conditions, including their negations (indicating by ~ = logical NOT). Consistency indicates the proportion of the antecedent conditions and the outcome set, while coverage evaluates how empirically relevant or trivial the antecedents are (Goertz 2006). A necessary condition is identified when the outcome set, that is, innovation commercial success, is a subset of a condition, indicated by its consistency score reaching or exceeding 0.9 (Ragin 2008; Schneider and Wagemann 2012). As indicated in Table 3, there are no necessary conditions for the outcome as no consistency scores exceed the recommended threshold of 0.9.

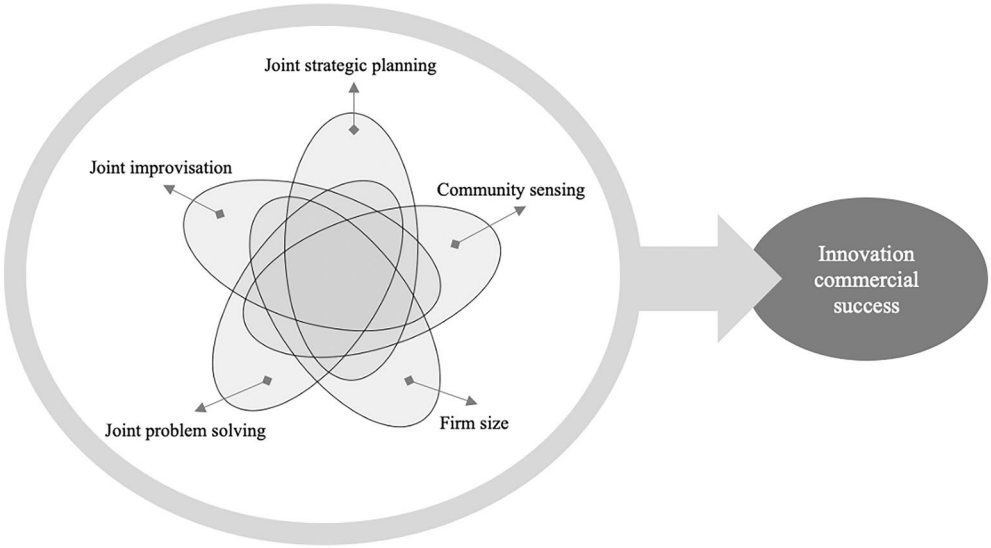

FIGURE 1 | Configurational framework of agile activities, organizational characteristic (i.e., size), and innovation commercial success.

TABLE 3 | Analysis of necessity.

Conditions	Consistency	Coverage
Joint strategic planning	0.36	0.69
~Joint strategic planning	0.76	0.69
Joint problem solving	0.81	0.66
~Joint problem solving	0.27	0.68
Joint improvisation	0.55	0.73
~Joint improvisation	0.55	0.63
Community sensing	0.50	0.70
~Community sensing	0.60	0.66
Firm size	0.19	0.83
~Firm size	0.88	0.63

Note: ~ = logical NOT; necessity consistency threshold = 0.9.

The final phase is an analysis of sufficiency in which configurations of conditions (i.e., solution terms) can be identified as sufficient to explain the outcome. This consists of first constructing a truth table in which all logically possible combinations of conditions leading to the outcome are formulated. The truth table is then subject to a series of refinements and a logical minimization. First, a frequency cut-off of 3 is applied, indicating that those combinations of conditions with at least three empirical cases remain in the analysis, and the rest are treated as logical remainders. To assess whether the combinations of conditions are consistently linked to the outcome, the raw consistency threshold of 0.8 is used as a rule of thumb to guide the selection (Ragin 2008). Accordingly, configurations with a minimum of 0.81, based on rounding to the second decimal place, were selected in the truth table (Appendix B). In addition, it is important to consider proportional reduction in inconsistency (PRI) in the fuzzy set analysis, and it should also be of a high value—as close to 0.7 as possible—with values below 0.5 indicating considerable inconsistency (Greckhamer et al. 2018). Upon reviewing the descending PRI values, the closest value to 0.7 after 0.79 was 0.69 (rounded to two decimal places). We therefore applied a PRI threshold of 0.69 for selection.

Next, the refined truth table is then transformed through a logical minimization process to generate solution terms. This process can produce complex, intermediate, and parsimonious solutions by varying assumptions as to the logical remainders (Schneider and Wagemann 2012). The complex solution is based on no assumption as to the logical remainders and therefore produces the most conservative solution term, whereas the parsimonious solution accounts for all logical remainders, that is, difficult counterfactuals, resulting in the most parsimonious solution term (Schneider and Wagemann 2012). The intermediate solution is situated between the complex and parsimonious solutions as it is based on easy counterfactuals. The intermediate solution strikes a balance between the inclusion and exclusion of theoretical possibilities between the antecedent conditions and an outcome (Schneider and Wagemann 2012). Following the recommended practice, the causal conditions were assumed to be present or absent for the intermediate solution based on theory (Pappas and Woodside 2021). Therefore, the intermediate solution is identical to the complex solution in this instance. We conducted the recommended robustness tests, including altering parameters in calibration, frequency, and consistency to ascertain the robustness of the configurations as well as to assess their predictive validity (see Appendix C).

Table 4 summarizes the results of combining the complex and parsimonious solutions to indicate the core (larger circle) and peripheral (smaller circle) conditions, allowing the identification of the more important conditions (i.e., core conditions) and less important conditions (i.e., peripheral conditions) for the outcome (Fiss 2011). The presence of a condition is indicated by a filled circle, whereas the negation is depicted by a cross in an unfilled circle. The overall solution consistency is 0.84 and the coverage is 0.27.

Two configurations are identified as consistently sufficient to lead to the outcome with consistencies of 0.93 and 0.81 (> 0.8) and raw coverages of 0.14 and 0.19, respectively, indicating nontrivial

TABLE 4 | Sufficiency for innovation commercial success.

Conditions	Configurations	
	Open agility	**Relationship-focused agility**
Agile activities		
Joint strategic planning		●
Joint problem solving	●	●
Joint improvisation	●	●
Community sensing	●	⊗
Organization characteristic		
Firm size	●	⊗
Consistency	0.93	0.81
Raw coverage	0.14	0.19
Unique coverage	0.08	0.13
Overall solution consistency	0.84	
Overall solution coverage	0.27	

Note: Filled circles indicate the presence of a condition; unfilled circles with "X" indicate the negation of a condition; blank spaces indicate that a condition has a subordinate role in a configuration; large circles indicate core conditions; small circles indicate peripheral conditions.
Analytical thresholds: frequency = 3; raw consistency = 0.8.
All conditions were allowed to be either present or absent.

empirical relevance (Ragin 2006, 2008). One configuration encapsulates *open agility* in the innovation process, showing that larger firms (as a core condition) worked with their collaborative partners in problem solving and improvisation while engaging with their user community to achieve successful innovation commercialization (Hypothesis 2). Interestingly, joint strategic planning is not present (indicated by the empty space) in this configuration, implying that this condition can be disregarded. This means that whether or not larger firms undertake joint strategic planning extensively with their partners does not explain their innovation commercial success (Hypothesis 1). Open agility highlights that larger firms benefit from drawing critical insights from their wider user community sensing to create synergies with joint improvisation and problem solving with their collaborative partners (Hypothesis 3).

The second configuration shows the other distinct agile innovation process approach, namely, *relationship-focused agility*. This suggests that a core condition for smaller firms is to refrain from engaging with their user communities. For smaller firms to achieve commercial success, they should engage with their collaborative partners in strategic planning, problem solving, and improvisation. In contrast to the open agility approach, joint strategic planning and joint improvisation are core conditions for relationship-focused agility. This shows that joint strategic planning alone cannot lead to commercial success (Hypothesis 1) and that it must be combined with other agile activities to ensure the desired outcome (Hypothesis 2). This also underlines the importance of the collaborative partner with which a focal firm undertakes strategic planning, problem solving, and improvisation.

4.2 | Interpretation and Synthesis

The QCA results indicate two separate "recipes" for innovation commercial success. The commonality in both configurations is that joint problem solving and improvisation, both present as parts of the configurations, are sufficient for achieving a positive outcome (Table 5). The distinction between the two configurations is the role played by joint strategic planning and community sensing. Open agility represents larger firms that reach out to their user communities for critical market insights and inspiration for problem solving (Ehls et al. 2020; Hienerth et al. 2014). A good reputation and high visibility in the industry as well as established processes and investment are required in order to engage the user community meaningfully and effectively (Altman et al. 2022; Bremner and Eisenhardt 2022). In contrast, relationship-focused agility captures how, when constrained by limited resources compared with their larger counterparts, smaller firms rely more heavily on their collaborative partnerships in the innovation process. This means that joint strategic planning becomes important as a core condition, as opposed to the case for larger firms. In this case, joint strategic planning needs to be combined with joint problem solving (a peripheral condition) and joint improvisation (a core condition). Strikingly, smaller firms should not use community sensing (a core condition) in this instance, since the additional investment and effort may not pay off as it discounts the effectiveness of the collaboration and subsequently impedes the commercialization success of the innovation.

Three major insights can be drawn from the results. First, embracing the unexpected in the innovation process is key to commercializing innovation successfully. This insight suggests that regardless of firm size, problem solving and improvisation with a key partner are essential activities in an innovation process. Second, joint strategic planning alone does not always lead to innovation commercialization success but needs to be combined with other agile activities to create synergies for achieving the outcome. Third, community sensing does not always facilitate innovation commercialization, and the synergistic effects of the other three agile activities may compensate for the lack of community sensing. Community sensing plays an important role in enhancing the mechanism of problem solving to facilitate the success of innovation, especially in the case of larger firms. In contrast, the fact that smaller firms should not utilize community sensing may relate to resource constraints, and these firms should instead focus and place greater emphasis on collaboration with a specific partner. Thus, it is likely that the closeness and intensity of joint planning determine to what extent community sensing is needed. Smaller firms can therefore mobilize and leverage their collaborative partners' knowledge and resources instead of engaging user communities.

We further illustrate the two approaches to the agile innovation process based on explanations and contextual information gained during the data collection. Open agility can be exemplified by a large gaming firm that uses "development diaries" to communicate with its user community and stakeholders about the innovation development of a new game. This open agility approach helps the firm build legitimacy and engage its community in various aspects of the innovation development, from ensuring historical accuracy to bug fixing

TABLE 5 | Summary of results.

Research aim	To determine the different combinations and relative degrees of importance of agile activities that are sufficient for innovation commercialization success
Key findings	– Agile activities need to be used and combined in context, depending on the firm size. – All four activities are sufficient for achieving innovation commercialization success in different combinations (configurations) and extents (core or peripheral).

Agile activities	Large firms	Small firms
Joint strategic planning	Either/or	**Yes, core**
Joint problem solving	Yes, peripheral	Yes, peripheral
Joint improvisation	Yes, peripheral	**Yes, core**
Community sensing	Yes, peripheral	**No, core**

and updates after the launch. This example underscores the importance of open agility for larger gaming firms, as a way to continuously communicate and engage user communities in specific game innovation projects. This agile activity during the innovation process is crucial for building the new game's legitimacy, engaging the community for further development, and securing external funding. Relationship-focused agility can be exemplified by a small gaming firm that strategically initiated collaboration with a 3D visualization firm to develop a new game. The gaming firm had to create a detailed game proposal, that is, joint strategic planning with its partner, to obtain financial support from external funding. Due to budget constraints, improvisation (e.g., using existing resources to create new applications) became one of the key agenda items in collaborating for cost efficiency. A clear vision of the game also allowed the partners to solve problems based on the anticipated outcomes to ensure the innovation progress.

5 | Discussion

The literature has recognized agility in its various guises as an important factor in addressing the unpredictability and uncertainty of the innovation process. Our research examines this preexisting concept and takes a step further, elaborating on the theory of how agility manifests itself in a collaborative innovation process. It conceptualizes and empirically investigates how the four agile activities performed with an external collaborator contribute to innovation commercial success. Our research findings provide a more nuanced picture of how joint activities can be combined to achieve innovation commercial success in the form of open agility and relationship-focused agility.

Overall, the results support the hypotheses and illustrate the complementarity and synergies between planned and unplanned agile activities undertaken between a focal firm and its collaborative partner (Pesch et al. 2021), as no single activity alone can ensure a favorable innovation outcome. They further affirm the crucial role that agility plays in an innovation process and support the importance of adaptation when situations arise (Grass et al. 2020; Kock and Gemünden 2016; Nambisan et al. 2017).

5.1 | Theoretical Contributions

The literature recognizes agility as an essential component of innovation management (Annosi et al. 2024; Grass et al. 2020; Khanagha et al. 2022), and agile methods have become a focal point in ensuring the effectiveness of the fluid and dynamic innovation process (Bianchi et al. 2022; Brock et al. 2020; Granato et al. 2022). Our research advances theory by considering and empirically investigating the unpredictability and uncertainty of the innovation process, which is characterized by emerging problems and opportunities. While collaboration with external actors has been recognized as an important element of the innovation process (Rummel et al. 2022), our research further conceptualizes and investigates agility in a collaborative innovation process. In addition, our research extends theory on the agility–innovation performance link (Bianchi et al. 2022; Kock and Gemünden 2021; Lill and Wald 2021) by specifically examining the nature of the agile innovation process, concentrating on the agile activities performed with external actors, and innovation commercialization success.

Our research helps advance the theory of agility in innovation management in three major ways. First, it contributes to the nascent research field of agile innovation in a rapidly changing digital environment by analyzing how agility is manifested in a collaborative innovation process to create a commercially successful innovation. The conceptualization of the four agile activities is based on the notion that stability and fluidity must be balanced (Pesch et al. 2021), and that both planned and unplanned activities are essential in innovation management (Wang et al. 2022). The finding points to the notion that agile activities, planned and unplanned, should be embedded and intertwined in the innovation process, working simultaneously between two collaborative partners. We argue that it is not a matter of finding the strongest determinants that drive the innovation commercial success. Instead, it is about the synergistic effect of agile activities: no one activity outperforms the synergies of combined essential activities, as they are inherently interdependent.

Second, by responding to the call to examine the complex and changing innovation phenomena (Nambisan et al. 2017), our research contributes to emerging theory on the agile

innovation process that embraces the fluidity of innovation, particularly, in a digitally enhanced and/or enabled environment (e.g., Cooper and Sommer 2016b; Ghosh and Wu 2021; Grass et al. 2020). We argue that agility underpins the innovation process in which a focal firm utilizes and incorporates resources across organizational boundaries to ensure a positive innovation outcome (Chesbrough et al. 2018; Gemser and Perks 2015; Ko et al. 2022). This finding is largely in line with the literature showing the critical importance of being adaptable under time pressure in the innovation process, the outcome of which is hard to predict (e.g., Audretsch et al. 2023; Kamoche and Cunha 2001). It also highlights the role of joint strategic planning, depending on how it is combined with other agile activities and the importance of which differs between larger and smaller firms.

Finally, our research contributes to theory development by providing a finer-grained picture of the ways in which agile activities can be deployed (how and how much) in the innovation process, all of which are sufficient and equally valid in explaining innovation commercial success. We identify two distinct approaches to agile innovation processes: (1) open agility and (2) relationship-focused agility. These two configurations differ in whether market insights gained through community sensing are used as part of the agile innovation process. While both configurations underline the importance of interorganizational collaboration for a commercially successful innovation outcome, the extent of external collaboration must be carefully considered based on firms' strategic focus. Our research shows that smaller firms should be open to a specific counterpart and heavily involved in the collaborative relationship, whereas larger firms should open their innovation process to engage their user community in addition to working with their collaborative partners.

5.2 | Practical Implications

This research offers four implications for managers practicing in a rapidly moving digital environment. First, there is no such thing as "one size fits all" when it comes to implementing agility in innovation processes. Our research offers two distinctively different templates for managers to consider, mainly depending on the size of their firms, implying resource availability. These two templates provide insights for managers on how best to plan and direct their resources across different agile activities with their partner and the user community during the innovation process by considering whether a particular activity is core or peripheral, indicating investment levels.

Second, building on the two configurations, innovation commercialization is the result of the interplay of multiple conditions or "ingredients." Of these ingredients, joint improvisation with a specific counterpart emerges as an important facilitator, although this should not be the sole focus. Hence, managers should always recognize its importance while utilizing it alongside other agile activities to create synergies. Joint problem solving has a subordinate role, which diverges from traditional management ideas when it comes to achieving innovation success. Overall, the need for joint problem solving appears less important than that for joint improvisation and joint strategic planning in the case of smaller firms. Thus, when applying agility in the innovation process, there is a need to redirect attention from largely joint problem solving toward embracing opportunities through joint improvisation.

Third, managers need to be mindful that while joint strategic planning has its place in the innovation process, it may not always be conducive to the intended innovation outcome. We found that joint strategic planning is only effective for smaller firms in rapidly changing innovation processes when it is combined with other agile activities, such as joint problem solving and improvisation. For smaller firms, joint strategic planning is one of the core conditions for ensuring commercial success, whereas it does not matter for larger firms.

Finally, firms must carefully decide whether to incorporate community sensing into their innovation process and when it is most likely to be effective, considering the resource implications. We found that community sensing was useful and complementary for joint problem solving and joint improvisation, advancing the potential for innovation success. Therefore, managers should include external sources, such as user communities, to facilitate joint problem solving during the innovation process and for opportunity sensing. However, community sensing is only conducive to commercial success in the case of larger firms, as they are more likely to possess the means and resources to undertake this potentially resource-intensive agile activity. Engaging user communities should be avoided by smaller firms as it has been shown to be ineffective as part of an agile innovation process. Instead, smaller firms should forge close collaboration with their partners and leverage their resources and knowledge.

5.3 | Limitations and Future Research

This study has limitations that also offer promising avenues for future research. First, the synergistic effects of the agile activities contributing to innovation commercialization success in the computer gaming industry might not be applicable to other industries. Even though digitally enabled games have existed for several decades, the institutional rules governing this industry are still somewhat emerging and open, and such openness might not be applicable to other industries. Future research could compare our findings with those from contrasting industries with differing levels of digital maturity and different governance structures, such as the healthcare sector, which is increasingly embracing digital transformation (Berlin et al. 2017).

Second, while our research specifically highlights agility in a collaborative innovation process, this may also limit the applicability of agility in an innovation process without external collaborators. Future research could further develop and extend the set of agile activities conceptualized here in a context lacking external collaborators. For example, this can be applied to agile teams of innovation projects, thereby contributing to the literature in this research field, that is, Research Stream 2 (e.g., Annosi et al. 2024; Grass et al. 2020; Khanagha et al. 2022).

Third, we examined the agile innovation process at the level of an innovation, that is, a new game, so future research could broaden the organizational scope by considering the process both within a focal organization and between collaborating

organizations. In so doing, valuable cross-organizational insights might emerge both within and between firms, revealing other important constructs that may be relevant to further understanding what leads to favorable innovation outcomes (Cubillas-Para et al. 2024; Rummel et al. 2022). Consequently, this could advance theory development by uncovering the micro-foundations of the two configurations identified here. For example, resource availability, commitment, and other factors could influence the strategic intent and implementation in joint innovation processes with external partners.

Finally, just as an agile innovation process is crucial for innovation commercial success, we anticipate that it may also be essential for firm performance (e.g., Bhatti et al. 2021). Future research could broaden the scope and examine different performance implications including production cost, time-to-market, and other performance indicators. Future research could objectively measure the performance as well as create further meaningful subjective outcome measurements of agility in the context of innovation management.

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Ethics Statement

The authors have read and agreed to the Committee on Publication Ethics (COPE) international standards for authors.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Research data are not shared.

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Appendix A

Three Research Streams Addressing Agility in Innovation Management

TABLE A1 | Research Stream 1: agility as organizational capability.

	Agility as a construct			Theoretical development			Research design	
Studies	**Focus**	**Role**	**Focus on innovation**	**Theoretical perspective**	**Other constructs**	**Outcome/ performance**	**Method/ analysis**	**Unit of analysis**
AlNuaimi et al. (2022)	Organizational agility	As driver of digital transformation	Implicit	Institutional theory	– Digital transformational leadership – Digital strategy	Digital transformation	Survey/PLS	Organization
Al-Omoush et al. (2023)	Supply chain agility	As driver of value co-creation	Implicit	Dynamic capabilitie	– Collaborative innovation – e-supply chain collaboration	Value cocreation	Survey/PLS	Organization
Battistella et al. (2017)	Strategic agility	As outcome of capabilities	Implicit	– Business models – Dynamic capabilities	– Strategy innovation capabilities – Resource capitalization capabilities – Networking capabilities	Strategic agility	Case study/ within-case and cross-case analysis	Organization
Bhatti et al. (2021)	Organizational agility	As driver of business model innovation	Implicit	– Absorptive capacity – Business model innovation	– Knowledge absorptive capacity – Top management mindfulness – Business model innovation	Firm performance	Survey/SEM	Organization
Bouguerra et al. (2024)	Strategic agility	As driver of collaborative environmental innovation	Implicit	Resource-based view	– Organic organizational structure – Regional innovation initiatives	– Environmental innovation among supply partners	Survey/ regression analysis	Organization
Castro-Lopez et al. (2023)	Organizational agility	As driver of circular product and recycling	Implicit	– Dynamic capabilities – Institutional theory	– Institutional pressures – Circular business model – Circular product innovation – Circular product practices – Recycling practices	– Circular product innovation – Circular product practices – Recycling practices	Survey/PLS	Organization
Crupi et al. (2022)	Agility	As driver of social innovation	Implicit	– Social innovation – Social entrepreneurship	Social bricolage	Social innovation	Case study/ thematic analysis	Organization
Cubillas-Para et al. (2024)	Organizational agility	As driver of digital transformation	Implicit	Dynamic capabilities	– Regenerative unlearning – Collaboration with customers	Digital transformation	Survey/PLS	Organization

(Continues)

TABLE A1 | (Continued)

Studies	Agility as a construct			Theoretical development			Research design	
	Focus	Role	Focus on innovation	Theoretical perspective	Other constructs	Outcome/ performance	Method/ analysis	Unit of analysis
Dabić et al. (2021)	Intellectual agility	As driver of innovativeness	Implicit	Dynamic capabilities	– Future orientation – Building community	Innovativeness	Survey/SEM	Organization
Del Giudice et al. (2021)	Organizational agility	– As driver of digital innovation – As outcome of organizational ambidexterity	Implicit	Dynamic capabilities	– Organizational ambidexterity – Organizational adaptability	Digital innovation	Survey/SEM	Organization
Franco and Landini (2022)	Workforce agility	As driver of innovation	Innovation process	Dynamic capabilities	– Firm characteristics – Innovation activities – Firm capabilities – Workforce characteristics	– Product innovation – Process innovation	Secondary data/regression analysis	Organization
Ghezzi and Cavallo (2020)	– Strategic agility – Operational agility	As driver of business model innovation	Business model innovation process	Business model innovation theory	– Environmental dynamism – Lean startup approaches	– Value creation – Value delivery – Value capture	Case study/ inductive analysis	Organization
Guo et al. (2023)	Organizational agility	As driver of innovation performance	Implicit	Dynamic capabilities	– "Coopetition" – Environmental turbulence	Innovation performance	Survey/ regression analysis	Organization
Hajli et al. (2020)	Customer agility	– As driver of new product success – As outcome of effective data usage	Implicit	Dynamic capabilities	– Effective use of data aggregation tools – Effective use of data analysis tools	New product success	Case study/ content analysis and thematic analysis	Organization
Zahoor et al. (2024)	Strategic agility	– As driver of value creation – As driver of collaborative innovation	Collaborative innovation	Dynamic capabilities	– Responsible collaborative innovation – Gender diversity	Value creation for grand challenges	Survey/SEM	Organization
Zhou et al. (2019)	Marketing agility	– As driver of innovation capability – As driver of financial performance	Implicit	Dynamic capabilities	– Innovation capability – Market turbulence	Financial performance	Survey/SEM	Organization

TABLE A2 | Research Stream 2: agility in organizational structure.

	Agility as a construct			Theoretical development			Research design	
Studies	**Focus**	**Role**	**Focus on innovation**	**Theoretical perspective**	**Other constructs**	**Outcome/ performance**	**Method/analysis**	**Unit of analysis**
Annosi et al. (2024)	Agile method	As driver of teams' innovation performance	Innovation team	Institutional theory	– Institutional context – Sense-making through response routines – Collective knowledge processes	General product innovation	Case study/inductive analysis	R&D unit
Bianchi et al. (2020)	Agile method	As driver of performance	NPD	– Agile – Stage-gate	Stage-gate	– Speed – Cost – Quality	Survey/regression	Process
Brock et al. (2020)	Agile	As part of stage-gate	Digital innovation	Intrafirm transaction	– Transfer management – Synchronization – Transfer scope	Digital innovation	Case study/inductive and abductive analysis	Project
Granato et al. (2022)	Agile/stage-gate hybrid methods	As part of NPD process	NPD	– Agile method – Stage-gate	Alignments and misalignments of designers' and users' perspectives	No specific outcome	Case study/content analysis	Process
Grass et al. (2020)	Agile team	As driver of teams' adaptability	Essential capability for innovation	Team adaptation	– Agile team activities – Leader activities – Customer activities – Organizational environment	Team adaptability	Case study/inductive and abductive analysis	Individuals in teams
Khanagha et al. (2022)	Agile team	As driver of team innovative output	Team innovation	Management control	– Managerial control systems – Peer pressure – Emotions, cognition	Team innovative output	Survey/confirmatory factor analysis	R&D unit
Rummel et al. (2022)	Agility	Combined with stage-gate in digital business model innovation	Business model innovation	– Business model innovation – Agile development	– Rapid prototyping – Collaboration – Ecosystem – Scaling	No outcome	Case study/case descriptions	Process
Salvato and Laplume (2020)	Agile method	– Applied in agile stage-gate management	NPD	– Agile – Stage-gate	– Speed to market – Innovation enabling – Increased resource utilization	No outcome	Case study/content analysis	Process
Sarangee et al. (2022)	Agile method	– Applied in agile stage-gate management	NPD	– Agile – Stage-gate	No other concepts	No outcome	Case study/inductive analysis	Process

TABLE A3 | Research Stream 3: agility as an innovation process.

	Agility as a construct			Theoretical development			Research design	
Studies	**Focus**	**Role**	**Focus on innovation**	**Theoretical perspective**	**Other constructs**	**Outcome/ performance**	**Method/ analysis**	**Unit of analysis**
Hutton et al. (2024)	– Knowledge-based agility – Behavioral agility – Organizational agility	As driver of NPD in open innovation	NPD	Open innovation theory	No other constructs	NPD	Case study/ abductive analysis	Project
Kock and Gemünden (2016)	Agility	As outcome of decision-making quality	Innovation portfolio management	Decision-making	– Turbulence – Strategic clarity – Process formality – Controlling intensity – Innovation climate – Risk climate – Decision-making quality	Agility in innovation portfolio management	Survey/SEM	Portfolio
Kock and Gemünden (2021)	Agility	As driver of portfolio success	Innovation portfolio management	– Entrepreneurial orientation – Portfolio management	– Stakeholder involvement – Strategic clarity – Business case monitoring – Innovativeness – Risk-taking propensity	Portfolio success	Survey/ regression analysis	Portfolio
Kohtamäki et al. (2020)	Strategic agility (three innovation practices)	– As aggregate of three practices – As driver of firm profitability	Entrepreneurial innovation	Practice theory	– Entrepreneurial orientation – Absorptive capacity	Firm profitability	Case study/ cluster analysis and thematic analysis	Process
Lill and Wald (2021)	Agility	– As driver of project performance – As moderator	Structure and process of agile projects	Innovation project management	– Diagnostic control – Interactive control – Boundary systems – Belief systems	Project performance	Survey/PLS	Process
Meier and Kock (2024)	Agility	– As driver of front-end success – As outcome of agile R&D unit organization (ARDO)	NPD	Dynamic capabilities	– ARDO – Front-end success – Market turbulence – Technology turbulence	NPD success	Survey/SEM	R&D unit

Appendix B

See Table B1

TABLE B1 | Truth table (illustrative under the frequency = 3).

CSEN	STRPL	PROBS	IMPRO	SIZE	number	ICS	Raw consist	PRI consist	SYM consist
1	0	1	1	1	7	1	0.961939	0.932912	0.932912
1	1	1	1	1	3	1	0.893142	0.791226	0.791226
0	1	1	1	0	10	1	0.806558	0.688779	0.68878
1	1	1	1	0	10	0	0.805722	0.68026	0.703689
1	0	1	1	0	12	0	0.794584	0.686272	0.700032
1	0	1	0	0	15	0	0.783514	0.675761	0.68495
0	0	1	1	0	13	0	0.780314	0.662886	0.678269
0	0	0	0	0	10	0	0.746753	0.624585	0.673129
0	0	1	0	0	13	0	0.743614	0.630173	0.633423
1	0	0	0	0	6	0	0.685779	0.464893	0.476525
0	1	1	0	0	6	0	0.68191	0.477878	0.477878

Appendix C

TABLE C1 | Results of robustness tests.

	Higher frequency		Calibration change		Lower consistency		
Conditions	**1**	**2**	**1**	**2**	**1**	**2**	**3**
Agile activities							
Strategic planning	⊗	●		●		●	⊗
Problem solving	•	•	•	•	•	•	•
Improvisation	•	●	•	●	•	●	●
Community sensing	•	⊗	•	⊗	•	⊗	●
Organization characteristic							
Firm size	●	⊗	●	⊗	●	⊗	
Consistency	0.96	0.81	0.90	0.76	0.93	0.81	0.82
Raw coverage	0.12	0.19	0.16	0.20	0.14	0.19	0.26
Unique coverage	0.06	0.14	0.09	0.13	0.02	0.08	0.10
Overall solution consistency	0.85		0.79		0.80		
Overall solution coverage	0.25		0.29		0.37		

Note: Filled circles indicate the presence of a condition; unfilled circles with "X" indicate the negation of a condition; blank spaces indicate that a condition has a subordinate role in a configuration; large circles indicate core conditions; small circles indicate peripheral conditions. Analytical thresholds: frequency = 3; raw consistency = 0.8. All conditions were allowed to be either present or absent.

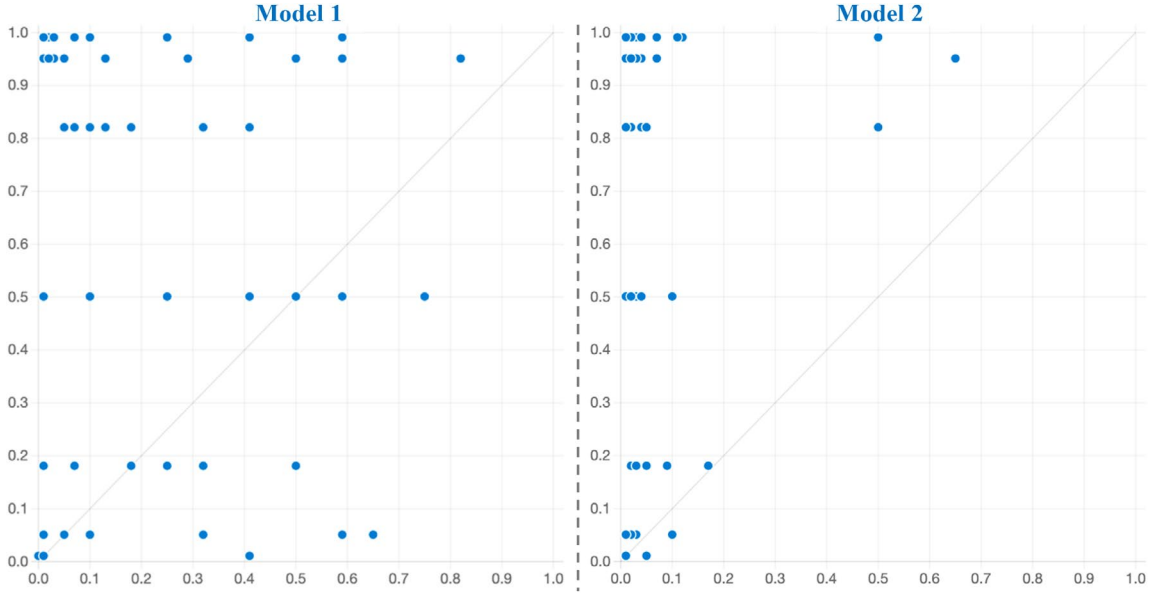
Robustness Tests

Following the guidelines for assessing the robustness of QCA results (Schneider and Wagemann 2012), we conducted the recommended analyses by altering the parameters of calibration, frequency, and consistency to investigate whether the configurations are robust, covering similar conditions and maintaining similar parameters of fit, such as consistency and coverage. Table C1 displays the results of these analyses, which show either unchanged or slightly altered configurations compared with the original results in Table 4. First, a higher-frequency cut-off was set at 6 (while other analytical parameters remained unchanged), resulting in largely unchanged solution terms and fit parameters with two configurations describing and interpreted as open agility (1) and relationship-focused agility (2). Second, a different calibration principle was applied to the outcome by raising the crossover point to 5 with full membership and non-membership points remaining unchanged. This specification produced two configurations identical to the original configurations. Third, a lower raw consistency threshold of 0.79 was applied, using the

TABLE C2 | Predictive validity test.

	Models from Subsample 1			Test of models from Subsample 1 using data from Subsample 2	
Solutions for innovation success	**Raw coverage**	**Unique coverage**	**Consistency**	**Raw coverage**	**Consistency**
Model 1 STRPL*PROBS*IMPRO*~LSIZE	0.28	0.21	0.83	0.26	0.76
Model 2 CSEN*~STRPL*PROB*IMPRO*LSIZE	0.14	0.07	0.96	0.10	0.97

Abbreviations: * = logical AND, ~ = logical NOT, CSEN = community sensing, IMPRO = improvization, LSIZE = large firm size, PROBS = problem solving, STRPL = strategic planning.



same frequency threshold as in the original analysis. Three configurations were found, two of which are identical to those in the original analysis and the third described a size-free configuration, that is, independent of company size. As expected with a lower consistency threshold, the solution consistency decreased compared to the original analysis, while the coverage increased. Overall, the configurations identified across the different analyses exhibit either identical or highly similar compositions. As a result, the interpretations and the parameters of fit remain consistent with those of the original analysis, in which open agility and relationship-focused agility were identified.

Although explaining the failure of innovation commercialization is not the theoretical purpose of our study, as part of QCA good practices, understanding this could possibly provide additional insight into the logic of the causal conditions of the outcome (Schneider and Wagemann 2010). One of the key tenets of QCA is causal asymmetry, meaning that the opposite of what causes the presence of the outcome may not necessarily explain its absence (El Sawy et al. 2010; Goertz 2020). We performed a sufficiency analysis for the absence of the outcome, that is, innovation commercialization failure, and found no consistent configurations. In addition, following the procedure set out by Pappas and Woodside (2021) and Sukhov et al. (2023), we assessed the predictive validity of the configurations to ascertain the extent to which they can predict the outcome in additional samples. First two randomized subsamples were created from the sample. Second, a sufficiency analysis was carried out in Subsample 1, and two configurations were found (in line with Table 4). Finally, the two configurations were modeled as two aggregated variables, each of which was then plotted against the outcome in Subsample 2 in two respective *X*–*Y* plots. The consistency and coverage of these two analyses are not substantially contradictory to those of the first analysis performed in the Subsample 1, showing satisfactory predictive validity. Table C2 summarizes the test results, including the *X*–*Y* plots of the two models, using data from Subsample 2.

Biographies

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