Junior Management Science 9(2) (2024) 1384-1413

Junior Management Science

www.jums.academy
ISSN: 2942-1861

Innovation Collaboration Between Family Firms and Startups: Insights from the German Construction Industry

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Abstract

Seeking to increase their innovative strength, family firms increasingly collaborate with startups to explore new technologies, act upon trends, and rejuvenate their corporate culture. While family firms usually innovate incrementally, collaborating with startups allows them to take a more radical approach to innovation to explore new business models and enter untapped markets. The present study aims to contribute to the emerging research field around innovation collaboration between family firms and startups by providing insights from the German construction industry. Drawing on the findings of 40 interviews, comprising four exploratory case studies and 24 expert interviews, this study analyzes impediments, mitigation mechanisms, and prospects of family firm startup collaboration in the German construction industry. The findings reveal that impediments emerge before and during collaboration and are influenced by the construction industry's context. Involved organizations address these impediments by leveraging mitigation mechanisms, including trust-building, financial incentivization, stakeholder involvement, and communication. In this way, innovation collaboration with startups can help strengthen family-owned construction companies' future viability in an evolving industry.

Keywords: construction industry; family firm (FF); family firm startup collaboration (FSC); innovation collaboration; startup (SU)

1. Introduction

Amid changing market dynamics resulting from globalization, digitization, and political and economic developments, companies must develop strategies to survive and thrive in the market (Kammerlander & Prügl, 2016; Volberda, 1999). Innovation, a key enabler of corporate transformation, constitutes a significant share of these strategies and is indispensable when facing increasing competition among market participants (Llach & Nordqvist, 2010). After all, innovation has been framed as a meaningful strategic instrument for firm survival (Schumpeter, 1934). For family firms, whose core differentiators include the pursuit of continuity and cross-generational succession, innovation seems all the more important to ensure long-term success (Chua et al., 1999). Due to their unique combination of characteristics, goals, resources, and structures, family firms are internationally renowned for their innovativeness (De Massis, Frattini, et al., 2018; De Massis et al., 2013). However, given that they may face internal resource scarcity, they need to find ways to acquire resources necessary for innovation from outside the organization (Feranita et al., 2017). In this respect, open innovation is considered an effective strategy to access external resources and knowledge to increase firm performance and innovative strength (Ahn et al., 2015). An auspicious constellation in pursuing open innovation in family firms is identified in collaboration with startups (Heider et al., 2020; Leitner et al., 2019; Löher et al., 2017). Involved organizations can create win-win situations by contributing complementary ideas, skills, and resources to the collaboration (Löher et al., 2017). While startups seek access to industry knowledge, capital, resources, or reputational gains from collaboration, family firms expect to gain access to new technologies, increase their innovativeness, act upon trends, or transform existing business models (Leitner et al., 2019). These factors can significantly contribute to family firms'

DOI: https://doi.org/10.5282/jums/v9i2pp1384-1413

survival considering the market movements outlined before.

Volberda (1999) argues that "competitive changes force firms to move more quickly and boldly and experiment in ways that do not conform to traditional (...) work" (p. 5). Thus, family firm startup collaboration (FSC) can be an excellent opportunity for family firms to do so.

An industry that is not only strongly dominated by family firms but is also affected by a multitude of geopolitical shifts and emerging trends is the German construction industry. Topics ranging from digitalization and sustainability to a shortage of skilled workers and raw materials are prompting construction companies to develop innovative strategies to remain competitive in the market (Berbner et al., 2023). Since FSC has been perceived as a powerful means to ensure innovativeness and competitiveness by fellow family firms, these benefits could also apply to family firms in the construction industry. Nevertheless, the topic is still in its infancy in theory and practice. While collaborating with suppliers, clients, or fellow contractors has been highlighted as critical for innovation in construction (Bossink, 2004; Bresnen & Marshall, 2000; Rutten et al., 2009; Tidd, 2001), there is no qualified research on innovation collaboration with startups yet. Thus, to provide initial insights into this largely untapped research area around FSC in the construction industry, this study aims to answer the following research questions:

> *RQ 1: Which impediments to collaboration between family firms and startups arise in the construction industry?*
>
> *RQ 2: How can involved organizations mitigate arising impediments?*
>
> *RQ 3: What role do startup collaborations play for family-owned construction companies in preparing for (future) industry challenges?*

By answering these research questions, this qualitative study aims to contribute to contemporary literature around FSC and innovation in the construction industry and guide practical insights for future pathways into FSC in construction.

First, it seeks to enrich family business research around FSC by examining collaborative innovation in the large group of family-owned construction companies. In the process, the analysis explores generic, industry-independent behavioral patterns related to FSC while contributing to understanding how the overall context influences an FSC in the construction industry. Simultaneously, the study's findings aim to enrich the existing literature on innovation in construction by examining FSC's viability as an effective innovation strategy for construction companies. Ultimately, the results provide practical implications for family firm owners, managers, and startups to advance FSC in the construction industry.

The study begins by establishing the overall literary context. Initially, the literature section examines family firm characteristics and innovation before focusing on the construction industry, examining general industry characteristics, trends, industry dynamics, and innovation in construction in more detail. In light of the present study's research objective, the literature section subsequently reviews previous findings on FSC. Following the literature review, the study elaborates on the applied methodology and research design before concluding with the results' presentation and implication-drawing discussion.

2. Theoretical Background

To place the present study in a literary context, the theoretical background is initially elaborated. Thus, this section begins by exploring family firm characteristics and their innovation behavior before focusing on family firms in the German construction industry, investigating general industry characteristics, trends and dynamics, and construction innovation. Subsequently, innovation collaboration between family firms and startups is elaborated against the background of existing literature.

2.1. Family Firms and Their Innovation Behavior

Innovation is a widely recognized driver and enabler of organizational and economic growth (Garud et al., 2013), making it a powerful means for family firms to remain competitive (De Massis et al., 2022; Fuetsch & Suess-Reyes, 2017; Johnson et al., 2008) and pursue their cross-generational intentions (Chua et al., 1999). In this respect, family firms are internationally renowned for their innovativeness (De Massis, Frattini, et al., 2018; De Massis et al., 2013; Kammerlander & van Essen, 2017). However, many family firms face what has been framed as the "family innovator's dilemma," with their unique combination of goals, strategies, and structures influencing their innovation decisions in sometimes conflicting ways (König et al., 2013). The following chapters explain what differentiates family firms and their innovation behavior while presenting them with significant decision-making challenges.

2.1.1. Family Firms

Family firms are the backbone of the German private economic sector. Over 90% of private sector businesses are family-controlled, and 86% are owner-managed family firms (Gottschalk et al., 2019). Globally, family firms have historically been recognized as the backbone of economic growth and prosperity (La Porta et al., 1999). Thus, over the last few decades, researchers have increasingly elaborated on what distinguishes family firms (e.g., Chua et al. 1999; Miller and Le Breton-Miller 2005; Miller et al. 2011; Zellweger 2017). In this respect, Chua et al. (1999) stated that "what makes a family business unique is that the pattern of ownership, governance, management, and succession materially influences the firm's goals, strategies, structure, and the manner in which each is formulated, designed, and implemented" (p. 22). In particular, family firms can be distinguished from

non-family firms by four distinctive attributes, i.e., continuity, community, connection, and command (the 4Cs), significantly influencing their behavior (Miller & Le Breton-Miller, 2005).

- *Continuity* describes the owning family's intention to "pursue an enduring, substantive mission and create a healthy company to realize it" (Miller & Le Breton-Miller, 2005, p. 519). Thereby, continuity reflects the family firm's long-term perspective and intergenerational commitment to handing over the business to family successors (Arregle et al., 2007; Barnes & Hershon, 2004; Caprio et al., 2011; Gómez-Mejía et al., 2007; Kotlar et al., 2018; Miller & Le Breton-Miller, 2005; Pizzurno & Alberti, 2013; Zellweger & Sieger, 2012). In the context of continuity, the family firm establishes a long-term vision according to which sustainable investments are made (Arregle et al., 2007; Gómez-Mejía et al., 2007; Miller & Le Breton-Miller, 2005; Miller et al., 2009; Palmer & Barber, 2001). These investments are not purely financially driven but firmly aimed at preserving family values, their so-called socio-emotional wealth (SEW) (e.g., Chua et al. 1999; Zellweger and Astrachan 2008). SEW are "nonfinancial aspects of the firm that meet the family's affective needs, such as identity, the ability to exercise family influence, and the perpetuation of the family dynasty" (Gómez-Mejía et al., 2007, p. 106). SEW constitutes a significant part of continuity, which is why family firms strive to preserve it (Berrone et al., 2012; Gómez-Mejía et al., 2007, 2010, 2011), and even accept performance sacrifices to protect it (Gómez-Mejía et al., 2007).
- *Community* represents the family firm's commitment to "[nurturing] a cohesive, caring culture made up of committed and motivated people" (Miller & Le Breton-Miller, 2005, p. 519). The community notion is reflected in family firms' close relationships with their employees (De Massis, Audretsch, et al., 2018; Werner et al., 2018). Family firms are often prominent regional employers (Berrone et al., 2012) and are highly employee-oriented (Löher et al., 2017; Werner et al., 2018; Zellweger & Nason, 2008). Relationships between family members and employees are usually kept informal, with flat hierarchical levels and short lines of communication (Cassia et al., 2011; De Massis et al., 2022).
- *Connection* is related to the family firm's priority to "develop lasting, win-win relationships with outside parties to sustain the firm in the long haul" (Miller & Le Breton-Miller, 2005, p. 519), reflecting the family firm's endeavors to maintain benevolent relationships with their stakeholders (Cruz et al., 2010; Miller et al., 2015). One of the overriding, nonfinancial family firm goals is to build trustworthy and reliable partnerships with suppliers and customers (Gómez-Mejía et al., 2007; Zellweger & Nason, 2008), which is considered a significant contributor to their competitive advantage (e.g., Arregle et al. 2007; Ireland et al. 2002; Miller and Le Breton-Miller 2005). Thus, their culture is firmly based on customer care (Nieto et al., 2015) and emphasizes customer collaboration (De Massis, Audretsch, et al., 2018).
- *Command* allows family firms to "exploit the freedom to make courageous, adaptive decisions to keep the firm spry" (Miller & Le Breton-Miller, 2005, p. 519). The inherent unity of ownership and management allows family firms to effectively exercise command (Werner et al., 2018). They have a high decision-making speed thanks to short decision-making paths (Chrisman et al., 2015; Kammerlander & Prügl, 2016; Werner et al., 2018), direct influence on budget decisions, and reduced agency costs through close monitoring (De Massis et al., 2022). Therefore, the unity of ownership and management allows them to act flexibly, renew constantly, and stay innovative in emerging competitive landscapes (Miller & Le Breton-Miller, 2005).

The combination of these unique characteristics, goals, resources, and structures allows family firms to create long-lasting legacies and multigenerational success (Chua et al., 1999; Kammerlander et al., 2015; Nieto et al., 2015) and to display a distinct innovation behavior (e.g., Chrisman et al. 2015; Classen et al. 2014; De Massis, Audretsch, et al. 2018; De Massis, Di Minin, and Frattini 2015; De Massis et al. 2016, 2022; Duran et al. 2016; Fuetsch and Suess-Reyes 2017; Kammerlander and Prügl 2016; König et al. 2013; Miller et al. 2015; Nieto et al. 2015), which will be reviewed in the next chapter.

2.1.2. Innovation in Family Firms

While innovation is defined differently in research, it essentially involves generating a new idea, product, process, or business model and its implementation in the market or within a company (Kammerlander & Prügl, 2016, p. 3). The innovation process constitutes innovation input, activity, and output (Covin & Lumpkin, 2011; De Massis et al., 2013), whereby innovation is differentiated by its type, degree, and approach (De Massis et al., 2013). The type of innovation relates to new products (goods or services), new processes (modified ways of production), new ways of organizational structures (in terms of leadership style or organizational setup), and new business models (value-creating activities) developed by the innovating company (Kammerlander & Prügl, 2016, pp. 4-5). Thereby, the novelty's degree ranges from incremental to radical, depending on the innovation's discontinuity from existing solutions (Utterback, 1996). When considering how to innovate, firms rely on closed (in-house) vs. open (across corporate boundaries) approaches to innovation (Almirall & Casadesus-Masanell, 2010; Chesbrough & Bogers, 2014), whereby new ideas can be explored or exploited (Benner & Tushman, 2003).

Early on, researchers identified innovation as one of the main strategic instruments for the firm's survival (Schumpeter, 1934) and economic prosperity (Porter, 1980). In this respect, Fuetsch and Suess-Reyes (2017) state that "innovation seems all the more important to help family firms remain competitive in their respective market" (p. 44). Thus, researchers are increasingly focusing their attention on family firm innovation (e.g., Calabrò et al. 2019; De Massis et al. 2013; Duran et al. 2016; Filser et al. 2016; Heider et al. 2022; Hu and Hughes 2020), revealing that family firm characteristics, goals, and structures can have both positive, negative, and ambivalent effects on innovation (Calabrò et al., 2019).

When reviewing innovation in family businesses, the combination of their resources, long-term orientation, and non-economic goals can be framed into what Chrisman et al. (2015) named the ability-willingness paradox, explaining family firms' higher ability but a lower willingness to pursue innovation than non-family firms. Thereby, ability depicts the owner's freedom and power to decide upon the use and distribution of resources (De Massis et al., 2014). Thus, the ability to innovate is higher in family firms in that ownership and management are usually united in one person or family, resulting in shared goals and values (Cassia et al., 2011; Craig & Dibrell, 2006; De Massis, Audretsch, et al., 2018; De Massis et al., 2022; Sanchez-Famoso et al., 2015) and reduced agency costs as ownership and management incentives are aligned (De Massis et al., 2022; Miller et al., 2015). Furthermore, the owner's immediate decision-making authority and flexible organizational structure enable the family firm to benefit from short decision-making paths and flat hierarchies in the innovation process (Chrisman et al., 2015; Kammerlander & Prügl, 2016; Werner et al., 2018). In this way, investment decisions can be made quickly and effectively, rendering the innovation process leaner and more efficient. Moreover, the family firm's long-term orientation and cross-generational involvement enhance family firms' innovative strength (Llach & Nordqvist, 2010) by allowing them to accumulate, internalize, and reinterpret the knowledge of multiple generations, referred to as human capital (Sirmon & Hitt, 2003), empowering innovation through organizational learning (Cassia et al., 2012; De Massis et al., 2016, 2022). Altogether, the combination of these capabilities provides family firms with a powerful bundle of resources conducive to innovation (Bammens et al., 2013; Carnes & Ireland, 2013; Eddleston et al., 2008; Spriggs et al., 2013; Zahra et al., 2004).

Nevertheless, despite their ability to innovate successfully, many family entrepreneurs take an ambivalent view on innovation, especially concerning ensuring continuity and building a legacy (Miller et al., 2015). On the one hand, family firms recognize that they need to innovate to pursue this goal in the long term. On the other hand, innovation comprises activities that family firms may view as threatening to their business and SEW, causing them to refrain from projects that appear too risky (Cassia et al., 2012; De Massis, Frattini, et al., 2015). These associated trade-offs in innovation activities often lead to family firms' reduced willingness to innovate, which is primarily determined by the owner's ambitions, motives, and incentives (Chrisman et al., 2015) and highly influenced by socio-emotional concerns (Gómez-Mejía et al., 2007).

Family entrepreneurs want to preserve control of their businesses (Gómez-Mejía et al., 2007) and cautiously contemplate how much risk they want to expose their company to (De Massis et al., 2022; Werner et al., 2018). Their preference for consistency renders some family firms to favor tried and tested approaches over experimenting with new ideas (Miller & Le Breton-Miller, 2005), and given their limited (financial) resources, family firms also carefully consider what to invest in the first place (Block et al., 2013; De Massis, Di Minin, & Frattini, 2015). The propensity to invest in costly, simultaneously risky, radical new business models, for which the results are largely unpredictable, is usually relatively low (De Massis, Frattini, et al., 2015). In line with this, family firms usually refrain from accessing external sources of innovation (Nieto et al., 2015) but prefer a *closed* approach to innovation, whereby related activities happen within the company's boundaries, separated from external influence (Almirall & Casadesus-Masanell, 2010). This closed innovation approach is consistent with family firms' attitude of not wanting to disclose too much internal information to external parties in order not to expose their business and its SEW to high risk (Cassia et al., 2012; De Massis et al., 2022; Nieto et al., 2015; Werner et al., 2018). As a result, the degree to which family firms tend to innovate is rather incremental than radical (e.g., Block and Spiegel 2013; Carnes and Ireland 2013; De Massis, Frattini, et al. 2015; Nieto et al. 2015; Werner et al. 2018), with a focus on perfecting internal processes instead of producing radical product, market, or technology innovations (Classen et al., 2014; De Massis et al., 2022; Zellweger & Sieger, 2012).

Due to their preference for invisible, incremental process innovation, family businesses are frequently considered less innovative (Economist, 2009). However, they can successfully capitalize on their unique characteristics and resources and excel in process innovation (Classen et al., 2014). Thus, family firms often achieve superior innovation output regarding the number and quality of patents or citations generated compared to non-family firms (Duran et al., 2016; Matzler et al., 2015). Therefore, family firms are often referred to as *hidden champions*, representing a significant share of innovation leaders in their respective markets while being almost invisible to outsiders (Simon, 1996).

Ultimately, family firm innovation depends on various influencing factors, not least on the overall heterogeneity among the different firms (De Massis, Di Minin, & Frattini, 2015). Furthermore, the general context, i.e., local and national conditions, industry, or company size, has an equally pronounced influence on innovation activities in family firms (Röd, 2016). For instance, researchers have found that family firms exhibit a higher risk appetite and increased research and development spending in times of poor business performance (Chrisman & Patel, 2012; Gómez-Mejía et al., 2015; Patel & Chrisman, 2014), while investment propensity de-

clines in financially stable times (Hayton et al., 2013; Patel & Chrisman, 2014). Thus, family firms can be more and less innovative depending on the circumstances (De Massis, Di Minin, & Frattini, 2015).

2.2. Family Firms in the German Construction Industry

One of the industries most dominated by family firms in Germany is the construction industry, in which 97% of companies are family-controlled, and 94% are owner-managed family firms (Gottschalk et al., 2019). Construction can be broadly considered an "industrial branch of manufacturing and trade related to building, repairing, renovating, and maintaining infrastructures" (Hussain et al., 2022, p. 111). In 2020, the sector generated around € 175 billion in revenues, employed more than 961,000 people, and accounted for 6% of gross value added in Germany, making it one of the most important economic sectors (Destatis, 2023).

At the same time, construction is a complex industry influenced by many macro- and microeconomic factors, distinguishing it from other industries. Authors Gruneberg and Francis (2018) state, "The construction sector shares many of its economic features with other industries but the combination of features in the construction process makes it unique" (p. vii). Critical drivers of complexity in construction include the contractors' dependence on clients, a procurement system based on the lowest bidder principle, high fragmentation, the project-based building approach, and the plethora of regulations to comply with (e.g., Barbosa et al. 2017; Blayse and Manley 2004; Dubois and Gadde 2002; Hartmann 2006; Ribeirinho et al. 2020).

To achieve a broader understanding of the construction industry's realities and complexities, the following chapters elaborate on the industry's characteristics, highlight emerging trends and evolving industry dynamics and review innovation in construction based on existing literature.

2.2.1. Industry Characteristics

The construction industry's complexity stems from multiple sources and affects construction companies' operations. Fundamentally, construction is an industry that does not produce consumer goods or services but enables a functioning economy by building infrastructure, constructing buildings to work and live in, and creating roads to connect daily destinations (Gruneberg & Francis, 2018). Thereby, the client shapes the construction industry by deciding upon project requirements (Barlow, 2000; Blayse & Manley, 2004; Gann & Salter, 2000; Hartmann, 2006). Thus, contractors have little leeway to help shape the specifications. Instead, clients put contracts out to tender and subsequently award them based on the lowest bidder principle, i.e., the most favorable bidder in terms of price receives the contract (Barbosa et al., 2017; Barlow, 2000; Dubois & Gadde, 2002; Kehl et al., 2022; Ribeirinho et al., 2020).

This price-focused procurement system creates enormous competitive pressure within the industry, with competing construction companies trying to outbid each other under sometimes uneconomic conditions (Asgari et al., 2016; Myers, 2022). As a result, contractors often have limited budgets available (Abbott et al., 2007), rendering many companies to monetize on claims rather than good performance (Ribeirinho et al., 2020). At the same time, the industry's low entry barriers result in a highly fragmented industry with predominantly small companies entering the market and exerting additional competitive pressure (Barbosa et al., 2017; Barlow, 2000; Baumanns et al., 2016; Dulaimi et al., 2002; Fischer et al., 2014; Kehl et al., 2022; Lindblad & Guerrero, 2020; Ribeirinho et al., 2020; Winch, 1998). In 2022, companies with fewer than 49 employees accounted for 96.6% of total construction companies (Destatis, 2023).

Due to the ever-changing requirements and specifics of a construction project, the construction industry is characterized by a project-based nature (Barlow, 2000; Lindblad & Guerrero, 2020; Ribeirinho et al., 2020), presenting construction companies with varying, project-dependent actor constellations, non-influenceable externalities, and challenges due to limited standardization opportunities, impacting overall industry performance.

First, since each project is awarded to the most favorable contractor, the constellation of stakeholders differs from project to project, requiring a variety of contractors with different responsibilities to be coordinated throughout the process (Barlow, 2000; Dubois & Gadde, 2002; Kehl et al., 2022; Ribeirinho et al., 2020). Dubois and Gadde (2002) refer to this ongoing change in actor constellations across different construction projects as "loose couplings" (p. 15), impeding productivity, limiting economies of scale, and diminishing the quality of deliverables and customer satisfaction (Dubois & Gadde, 2002; Ribeirinho et al., 2020).

Secondly, each project is subject to different externalities that executing organizations can hardly influence, i.e., the natural conditions on site (Barlow, 2000; Lindblad & Guerrero, 2020; Ribeirinho et al., 2020). Therefore, construction companies operate under high levels of unpredictability and cyclicality and must always anticipate setbacks during the project resulting from external influences, including weather conditions, changes in stakeholder constellations, and other factors beyond their control (Ribeirinho et al., 2020). These non-controllable parameters limit the plannability and, thus, the projects' productivity (Dubois & Gadde, 2002). Since the project-based nature further requires on-site task execution, externalities can severely impede project progress (Lindblad & Guerrero, 2020).

Lastly, as the high individuality and project-based nature of construction projects presents few possibilities for standardization, construction work still requires a high proportion of manual labor, limiting overall productivity (Kehl et al., 2022; Ribeirinho et al., 2020). In this context, the increasing shortage of skilled workers in the construction industry, with 70,000 vacancies in 2018 (Kehl et al., 2022), is detrimental (Ribeirinho et al., 2020).

In addition to the project-specific requirements, the construction industry and its projects are subject to high safety standards and regulations that executing construction com-

panies must always ensure, which further impedes productivity (Barbosa et al., 2017; Blayse & Manley, 2004; Bygballe & Ingemansson, 2014; Gambatese & Hallowell, 2011; Kehl et al., 2022; Ribeirinho et al., 2020).

Thus, in summary, construction companies are confronted with a multitude of aspects that they need to cope with and for which they need to develop strategies to run their business successfully and competitively. As new trends and changes emerge, the need for such strategies is even more emphasized.

2.2.2. Trends and Industry Dynamics

New studies on construction transformation predict that the industry will likely look different in five to ten years (Ribeirinho et al., 2020). This transformation is driven by emerging megatrends, including digitization, globalization, sustainability requirements, changing socio-demographics, as well as geopolitical developments and general structural change (e.g., Baumanns et al. 2016; Berbner et al. 2023; Saiz and Salazar 2017; Zeitner and Peyinghaus 2015).

Due to these industry shifts, project complexity is predicted to increase (Barlow, 2000). On the one hand, more sophisticated customers increasingly consider the total cost of ownership (TCO) in their decisions rather than just the initial acquisition cost, elevating their requirements and standards (Ribeirinho et al., 2020). Thereby, the social and political pressure to ensure sustainability is further intensified, forcing construction companies to consider new materials, alternative engines, and the like (Fischer et al., 2014; Ribeirinho et al., 2020). On the other hand, the need for more skilled workers complicates complex projects' execution, increasing pressure on construction companies to establish more flexible structures within the company to perform tasks despite personnel shortages (Ribeirinho et al., 2020). Most recently, the Ukraine war has also significantly impacted the construction industry. In a new PwC study on how the industry deals with current challenges, 57% of the companies surveyed reported experiencing the war's consequences (Berbner et al., 2023). In the same study, 9 out of 10 companies noted the unpredictable price development and disruptions in their supply chain, which is particularly detrimental given the increasing cost pressure for affordable housing (Ribeirinho et al., 2020). Several companies surveyed indicated that this development would cause them to reposition themselves over the next few years (Berbner et al., 2023).

As a result, there is already an initial trend for construction companies to either consolidate or specialize in their respective field of operation to better meet changing requirements (Ribeirinho et al., 2020). In addition, they increasingly build their corporate brand to position themselves more selectively with customers and defend their market position (Ribeirinho et al., 2020). Other strategies include, above all, investing in the company's human resources by developing more sophisticated HR strategies (Ribeirinho et al., 2020) and by establishing partner networks both with suppliers and customers, as well as with so-called "innovation brokers," e.g., universities, professional institutions, or construction research bodies (Bankvall et al., 2010; Barbosa et al., 2017; Blayse & Manley, 2004; Bygballe & Ingemansson, 2014; Ribeirinho et al., 2020; Winch & Courtney, 2007). Construction companies consider such partnerships a valuable means for trial and error, enabling innovation through knowledge exchange (Ribeirinho et al., 2020).

On the part of the construction product itself, contractors are increasingly diving into new modes of operation to meet sustainability, affordability, and efficiency requirements. In this respect, construction companies are trying to pursue a product-based rather than project-based approach to construction, using industrialization to standardize the end product as far as possible (Barbosa et al., 2017; Bygballe & Ingemansson, 2014; Ribeirinho et al., 2020). The two buzzwords in this respect are serial and modular construction. Serial construction is the industrial and mass production of buildings or at least parts of them in factories. Modular construction extends serial production by assembling prefabricated components (modules) according to a building block principle (Bertram et al., 2019). These trends in component production enable construction companies to prepare construction sites more efficiently and, thus, to execute projects more leanly in light of evolving industry demands (Ribeirinho et al., 2020).

Lastly, digitizing products and processes represent one of the construction industry's most significant trends (Berbner et al., 2023; Bygballe & Ingemansson, 2014) with growing demand for simplified and digital interactions (Ribeirinho et al., 2020). Compared to other industries, e.g., the automotive or production industry, the construction industry lags digitally (Berbner et al., 2023; Ribeirinho et al., 2020). Nevertheless, companies were able to catch up significantly in 2022 compared to the previous year and are increasingly investing in their development (Berbner et al., 2023). In this sense, research and development spending has increased by 77% since 2013 (Ribeirinho et al., 2020). Along the way, companies are also investing more in technology, e.g., IoT (Internet of Things) or BIM (building information modeling), to share and utilize data more effectively in their decision-making process (Kehl et al., 2022; Ribeirinho et al., 2020).

Drawing on the PwC study's findings, the identified trends and developments will cause companies to reposition themselves or even conquer new business areas over the following years (Berbner et al., 2023; Ribeirinho et al., 2020). Thus, construction companies increasingly recognize that they need to address and pursue innovation more consciously (Dulaimi et al., 2003; Gann & Salter, 2000).

2.2.3. Innovation in the German Construction Industry

Innovation in construction is usually seen in relation to product, process, and organizational innovation, with construction companies having different opportunities for active involvement depending on the type of innovation (Anderson & Manseau, 1999; Laage-Hellman, 2015; Slaughter, 1998).

Product-related innovation mostly happens at the industry level, is comparatively visible to outsiders, and can be

relatively radical (Barrett & Sexton, 2006). These product innovations at the industry level usually involve new regulations and standards surrounding new materials or health and safety compliance (Abbott et al., 2007). Construction companies tend to refrain from actively participating in innovation at the industry level but react passively by adapting their behavior to external requirements (Harty, 2008).

Process-related innovation occurs at the project level, usually happens incrementally but impacts overall industry performance the most (Abbott et al., 2007). The innovation of processes involves adapted activity combinations for the optimized execution of these activities across company boundaries (Anderson & Manseau, 1999; Bygballe & Ingemansson, 2014). The primary aim is continuously improving day-to-day business through exchanging tacit knowledge across the project teams and drawing lessons for subsequent projects (Abbott et al., 2007; Fischer et al., 2014; Kehl et al., 2022). Although invisible to outsiders (Bygballe & Ingemansson, 2014), this type of innovation is prevalent in construction, as it helps industry players to plan and manage projects more effectively and efficiently to serve customer needs better (Bygballe & Ingemansson, 2014).

Organizational innovation demands the highest input from individual construction companies (Abbott et al., 2007). At the organizational level, innovation concerns the company's resources and capabilities, including radically or incrementally improved materials, products, subsystems, or business processes (Abbott et al., 2007). The latter can include changes in the organization's set-up, implementing new management routines, and pursuing alternative business directions (Anderson & Manseau, 1999; Bygballe & Ingemansson, 2014).

In the overall context, and compared to other industries, numerous studies have highlighted the construction industry's backwardness, labeling it as conservative, risk-averse, sluggish, and dependent on externals to stimulate innovation (e.g., Abbott et al. 2007; Gann and Salter 2000; Nicolini et al. 2001; Rosenberg 1982; Winch 1998; Woudhuysen and Abley 2003). However, Bresnen and Marshall (2000) noted that the industry's context significantly influences its participants' innovation behavior. After all, empirical research widely recognizes and supports that effective innovation management depends on several contextual variables (Damanpour, 1996; Frambach & Schillewaert, 2002; Scott & Bruce, 1994; Tidd, 2001). Thus, the fundamental contextual differences between construction and other industries are partly responsible for the observable disparities in innovation (Gambatese & Hallowell, 2011; Green et al., 2005).

Innovation bottlenecks primarily manifest at the industry and project level, i.e., concerning product and process innovation. Thereby, contextual factors influencing construction companies' innovativeness the most relate to the construction industry's overall framework and the project-based nature (Abbott et al., 2007).

- *Framework*. The construction industry's general framework proves to be an obstacle to innovation, for which the industry's fragmentation – both at the horizontal industry level and at the vertical project level – is mainly responsible (Sexton & Barrett, 2003). First, fragmentation at the horizontal level limits overall innovation because the numerous small players do not have sufficient innovation capabilities and resources to contribute to the industry's innovativeness (Winch, 1998). Second, on the vertical level, fragmentation occurs due to the many parties involved in the project. As such, any innovation activity in the construction industry involves complex interactions within and across the company's boundaries (Barlow, 2000; Blayse & Manley, 2004; Marceau et al., 1999; Seaden & Manseau, 2001). Since most approaches to innovation must be negotiated with various stakeholders within the project coalition, including governments, suppliers, designers, general contractors, workforce, owners, or certification authorities, several innovation attempts become unattainable (Winch, 1998). In addition to this horizontal and vertical fragmentation, various health and safety regulations complicate the innovation process for construction companies as part of the overall framework (Blayse & Manley, 2004; Hartmann, 2006).
- *Project-based nature*. Gann and Salter (2000) stated that the "management of innovation is complicated by the discontinuous nature of project-based production in which, often, there are broken learning and feedback loops" (p. 961). The project-based approach to construction has two interdependent drivers that are incredibly inhibitive to innovation: the system of the lowest bidder and the constant shift in actor constellations (Abbott et al., 2007; Blayse & Manley, 2004; Dubois & Gadde, 2002; Hartmann, 2006). Initially, the construction industry's procurement system, i.e., favoring the lowest bidder, leads to a situation in which companies compete on price instead of collaborating on a best-for-project basis, which severely hampers innovation (Blayse & Manley, 2004; Dubois & Gadde, 2002; Hartmann, 2006). In addition, this procurement principle leads to a constant change in actor constellations. These "loose couplings" among involved stakeholders essentially prevent the creation of network effects (Dubois & Gadde, 2002, p. 15), restraining interaction for mutual learning and, thus, innovation (Gann & Salter, 2000).

Consequently, the industry's general framework and the project-based nature significantly impact construction companies' innovation behavior, especially concerning product and process innovation.

Nevertheless, several construction companies strive for innovation despite adverse circumstances. These companies possess a set of organizational structures and apply dedicated management techniques to induce innovation at the organizational level (Blayse & Manley, 2004; Hartmann, 2006).

In this regard, highly innovative construction companies usually have an innovation strategy and actively promote

a culture of innovation (Blayse & Manley, 2004; Gambatese & Hallowell, 2011). Management techniques conducive to building this innovation capability include explicit advocacy of new ideas, conscious decision-making about the company's innovation activities' direction, and methodical and hierarchical support for the innovation process (Hartmann, 2006). Upper management support and the presence of an innovation champion within the company were found to have a particularly empowering effect in this context (Barlow, 2000; Blayse & Manley, 2004; Gambatese & Hallowell, 2011; Hartmann, 2006; Hausman, 2005; Howell & Higgins, 1990; Sexton & Barrett, 2003). As such, innovation frequently results from formal "top-down" initiatives, with senior management deciding on new working methods (Bygballe & Ingemansson, 2014). In addition, construction companies pursuing an innovation strategy usually invest more in research and development, increasing innovation capacity (Gambatese & Hallowell, 2011). Such development funding is aimed more at developing internal ideas; external innovation sources tend to be perceived as less valuable in the industry (Bygballe & Ingemansson, 2011).

Furthermore, innovative construction companies have a high absorptive capacity and knowledge-codified systems (Blayse & Manley, 2004). Absorptive capacity reflects the organization's propensity "to recognize the value of new, external information, assimilate it, and apply it (...)" (Cohen & Levinthal, 1990, p. 128). Similarly, innovative construction companies absorb and codify new knowledge and purposefully apply their lessons learned to new projects (Barlow, 2000; Blayse & Manley, 2004; Chinowsky & Carrillo, 2007; Gambatese & Hallowell, 2011; Sexton & Barrett, 2003). Thus, they foster innovation by facilitating knowledge flow between individuals and companies through interactions and transactions (Anderson & Manseau, 1999; Blayse & Manley, 2004; Dubois & Gadde, 2002; Miozzo & Dewick, 2002).

Ultimately, collaboration is vital in construction innovation (Rutten et al., 2009). Partnerships for innovation in construction have been found to significantly improve the company's performance at both the project and organizational levels by improving the planning and execution of different project phases and integrating different levels of knowledge more quickly (Barlow, 2000). Especially concerning process-oriented innovation, for which knowledge transfer between project participants is vital, collaboration can increase performance immensely (Abbott et al., 2007; Fischer et al., 2014). Therefore, partnerships can lead to higher productivity, lower costs, shorter project duration, better quality, and higher customer satisfaction (Bresnen & Marshall, 2000, p. 231).

In summary, construction innovation can be distinguished into product, process, and organizational innovation, with varying degrees of influence for the individual players within the industry. At the product and process level, the construction industry's general framework and project-based nature limit construction innovation. Therefore, construction companies seek innovation at the organizational level by establishing respective organizational structures and applying dedicated management techniques. Lastly, collaboration and partnerships for co-innovation have been referred to as enablers of innovation in the construction industry to generate performance improvements.

Against this background, collaboration with external parties, particularly startups, can be an effective means for construction companies to increase their performance and innovativeness to better cope with changing industry trends and dynamics. In this regard, researchers are beginning to examine patterns of co-innovation in construction (Bossink, 2004). However, previous research has primarily focused on collaborations with clients, suppliers, or fellow contractors. Innovation collaboration with startups has yet to be studied scientifically, providing the foundation for this study.

Thus, considering the underlying research objective, the following chapter reviews related literature on innovation collaborations between family firms and startups to obtain the first implications for answering the research question.

2.3. Innovation Collaboration Between Family Firms and Startups

As the construction industry's insights indicate, significant innovation potential exists in inter-firm collaboration. This particular type of open innovation allows involved organizations to achieve competitive advantage by sharing resources, know-how, and insights with each other (Block, 2012; Das & Teng, 2000; Gulati, 1995; Kale & Singh, 2009; Matzler et al., 2015; Muñoz-Bullón & Sanchez-Bueno, 2011; Un et al., 2010). Thereby, collaborative innovation is particularly valuable in overcoming resource and knowledge-related barriers to innovation (Feranita et al., 2017).

Recent studies suggest that innovation collaboration is even more successful when the involved parties contribute complementary skills and resources (Löher et al., 2017). Therefore, researchers and practitioners increasingly consider collaboration between established family firms and startups to be very successful in developing innovative products or services (Bannerjee et al., 2016; Heider et al., 2020; Leitner et al., 2019; Löher et al., 2017; Mocker et al., 2015).

Classified mainly by their characteristics, startups are "young and small" businesses whose structures are barely formalized and whose founders are pivotal in directing the startup's activities (Engelen et al., 2015, p. 10). Due to their low degree of formalization, they often exhibit a high degree of flexibility and independence, which allows them to quickly and radically develop and test innovations and new business models leveraging external capital (Achleitner, 2018; Engelen et al., 2015).

Although quite different in their structures and corporate cultures, family firms and startups are united by their entrepreneurial spirit, providing a solid basis for cooperation. Since both organizations are run by the entrepreneur, short decision-making paths due to flat hierarchies prevail on both sides, providing prospects for agile cooperation and, thus, increasing the chances of success (Löher et al., 2017). The involved parties' complementary strengths enhance these prospects for success. The startup's ability to

execute promptly complements the family firm's long-term thinking. Moreover, while startups have a higher risk appetite, family firms are more capable of successfully managing this risk. Startups' radical innovation approaches can complement incremental, evolutionary developments within the family firm, and respective network effects can be leveraged to benefit from one another (Leitner et al., 2019). By entering collaborations, family firms and startups can utilize these complementary strengths to overcome internal constraints they would find difficult to address on their own (Heider et al., 2020).

From the family firm's point of view, collaboration with startups can be very intriguing, as the co-development of new products and the penetration of new markets can significantly increase their innovation potential, thereby defending their market position and ensuring long-term success (Bannerjee et al., 2016; Leitner et al., 2019; Löher et al., 2017; Meyer, 2017; Prügl et al., 2019). While family firms usually prefer to innovate incrementally, startups portray an opportunity for them to take a more radical approach to innovation to diversify and conquer new markets (Bannerjee et al., 2016; Löher et al., 2017; Meyer, 2017; Mocker et al., 2015; Prügl et al., 2019). In addition, FSC represents an opportunity for family firms to gain access to new, innovative technologies and, thus, explore digitization potentials that they may not discover by themselves (Bannerjee et al., 2016; Leitner et al., 2019; Löher et al., 2017; Prügl et al., 2019). By collaborating with startups, family firms also hope to attract highly qualified personnel to complement their human capital. Similarly, they seek to benefit from intangible aspects by exploring the startup's highly dynamic corporate culture and working methods, empowering family firms to challenge entrenched processes and structures (Löher et al., 2017; Prügl et al., 2019). Ultimately, there is also an incentive for family firms to cooperate with startups in pure financial investments (Leitner et al., 2019).

Startups, on the other hand, hope to gain first-hand industry knowledge through FSC to accelerate their learning and development (Bannerjee et al., 2016; Leitner et al., 2019; Löher et al., 2017; Meyer, 2017; Prügl et al., 2019). This learning process is particularly effective when product development and testing happen under real-life conditions, which FSC could facilitate (Löher et al., 2017). In this way, startups receive immediate feedback and can draw on valuable, existing family firm resources during their development phase (Löher et al., 2017). These resources include production resources, financial capital, supplier networks required for initial product development, and access to existing customer networks to benefit prototype testing (Leitner et al., 2019; Löher et al., 2017; Meyer, 2017; Prügl et al., 2019). In the process, startups can enhance their reputation to establish their product or service in the market (Leitner et al., 2019; Löher et al., 2017; Meyer, 2017). By testing their product under realistic conditions, startups can further identify precise-fit market positions, enabling them to scale faster and accelerate their success (Löher et al., 2017). Finally, startups also hope to access financial investments by cooperating with family firms (Leitner et al., 2019; Löher et al., 2017; Meyer, 2017; Prügl et al., 2019).

Family firms and startups cooperate in varying constellations to achieve the desired results. Following the differentiation of Leitner et al. (2019), who elaborate on types of collaborations explicitly related to FSC, a fundamental distinction can be made between collaboration, investment, and acquisition. Collaboration happens purely project-based, with both parties remaining independent of each other and merely exchanging resources and knowledge. An investment exceeds the scope of a mere collaboration, with the family firm acquiring minority stakes in the startup. Similarly, the startup's acquisition includes its entire takeover by the family-owned company (Leitner et al., 2019). Depending on the FSC type, collaboration varies in duration, intensity, scope, and trust, requiring different levels of commitment from the organizations involved (Leitner et al., 2019; Löher et al., 2017; Mocker et al., 2015).

Despite the prospect of success resulting from FSC, challenges in the run-up to and during the collaboration are not inevitable. While it is not easy for either established family firms or startups to identify suitable partners in the first place (Armutat et al., 2015; Bannerjee et al., 2016; Baumgärtner et al., 2022), different characteristics, previously considered as complementary success factors, can lead to fear, prejudice, and different expectations in the process (Leitner et al., 2019; Löher et al., 2017; Wallisch & Funke, 2016).

A frequently cited hurdle is the clash of two cultures, posing reconciliation challenges for the organizations involved (Bannerjee et al., 2016; Kawohl et al., 2015; Prügl et al., 2019; Wallisch & Funke, 2016). While family firms follow a long-term strategy and usually progress incrementally, startups focus on radical innovation to enable rapid growth and scalability (Löher et al., 2017). Thus, unconventional founders meet partly conservative employees and directors, affecting communication, trust, and appreciation toward the partner company (Garbs, 2017; Leitner et al., 2019; Löher et al., 2017). For instance, family firms often criticize startups for behaving unreliably and for applying unrealistic company valuations while not even being able to guarantee fundamental requirements, such as data protection or a consistent corporate strategy (Leitner et al., 2019). Furthermore, family firms feel that startups often fail to articulate their product or service's added value to the incumbent, rendering the startup less credible from the incumbent's perspective (Bannerjee et al., 2016). These prejudices lead to increased risk aversion and the withholding of information on the part of the family firm (Bannerjee et al., 2016; Löher et al., 2017; Meyer, 2017; Prügl et al., 2019). On the other hand, startups criticize this same risk aversion, frequently resulting in overly complicated and time-consuming decision-making processes that sacrifice flexibility and speed (Heider et al., 2020; Leitner et al., 2019; Löher et al., 2017). Moreover, startups complain about potential collaboration partners not understanding what they can offer regarding technology, products, or services (Bannerjee et al., 2016), which they partly blame on the family firm's conservatism

(Leitner et al., 2019). Thus, barriers center around different expectations, prejudices, cultures, working styles, and communication issues (Bannerjee et al., 2016; Leitner et al., 2019; Löher et al., 2017; Meyer, 2017).

To overcome these barriers to reap the benefits of complementarity, researchers present mechanisms to mitigate the perceived limitations (Leitner et al., 2019; Löher et al., 2017).

Startups, for instance, should acquire industry knowledge to emphasize more explicitly what added value they could provide for the family firm (Löher et al., 2017). To get traction with family firms in the first place, it helps to make contact via the private network (Hofmann, 2016; Löher et al., 2017; Meyer, 2017). If the founders have previous experience in an established company, this will further facilitate the collaboration by providing them with more credibility (Löher et al., 2017). In addition, the founders should tolerate the more complex decision-making processes in established companies (Löher et al., 2017).

The family firm, for its part, should have a fundamental openness and willingness to make decisions and, as far as possible, shed worries about security (Löher et al., 2017). Management support is paramount, especially in preparing for possible setbacks during the cooperation (Löher et al., 2017). To further support FSC emergence, family firms should actively search for collaboration partners (Löher et al., 2017; Meyer, 2017).

Furthermore, both parties should collectively engage in initial goal setting and expectation management, allowing them to communicate concerns up front, developing sensitivity to the other company's structures, ensuring a human fit, and forming interdisciplinary teams (Löher et al., 2017). Leitner et al. (2019) further suggest pursuing shared visions and values, engaging in team-building activities, expanding the cooperation step-by-step, ensuring continuous knowledge transfer, and setting mutual milestones.

With the collaboration partners becoming aware of and applying these mechanisms, they can deploy complementary skills proficiently to create win-win situations without either company having to transform its structures or characteristics fundamentally (Löher et al., 2017). Indeed, since some FSC benefits derive precisely from these organizational differences, it is vital to preserve the different cultures despite associated adversities (Hofmann, 2016).

In summary, there is considerable innovation potential in the collaboration between family businesses and startups; both can leverage their complementary strengths and resources to create win-win situations. While family firms aim to increase their innovativeness, act upon trends, or transform their business models, startups seek access to industry knowledge, capital, resources, or reputational gains. Despite these incentives, the organizations involved encounter challenges from different cultures, structures, goals, and expectations. Therefore, to reap the benefits of collaboration, family firms and startups apply independently influenced or jointly developed mitigation strategies to overcome these challenges.

Contemporary literature concludes that almost every small and medium-sized enterprise (SME) with experience in startup collaboration would engage in an FSC again in the future (Baharian & Wallisch, 2017, S. 14). Nevertheless, the considerable potential is currently left untapped, as many established SMEs are not yet involved in FSCs (Baharian & Wallisch, 2017; Brink & Schlepphorst, 2015; Müller et al., 2016).

Family-owned construction companies are no exception to this. Therefore, the present study aims to address this deficit theoretically and practically. More specifically, it aims to uncover impediments to FSC in the construction industry and propose mitigation mechanisms. Moreover, it examines what role startup collaborations can play for family-owned construction companies in preparing for (future) industry challenges.

To elaborate on how this knowledge was obtained, the study's methodological framework is subsequently explained before the overall results are presented comprehensively.

3. Methodological Approach

Having reviewed the theoretical background, this chapter explains the methodological approach underlying the present study. The latter aims to expand the research area around FSC by examining innovation collaboration between family firms and startups in the construction industry. To this end, a theory-building case study was conducted to uncover the poorly investigated directions of FSC in construction. The following section first presents the chosen methodology and study design before explaining the data collection and analysis process.

3.1. Method, Case Study Design & Data Collection

This study aims to investigate the dynamics of innovation collaboration between family firms and startups in the construction industry, an industry heavily dominated by family firms, thus contributing to the emerging research field around FSC. Thereby, the goal is to make a theoretical contribution to existing literature and provide practical input. One form of qualitative research that allows for both theoretical and practical contribution is the case study method, developed and informed by De Massis and Kotlar (2014), Eisenhardt (1989), and Yin (1984, 2003). Case study analysis is a commonly used research method in organizational and family business research (De Massis et al., 2012; Eisenhardt, 1989), as it enables the profound examination of a phenomenon in its real-world context (Yin, 2003) by enabling an "understanding (of) the dynamics within single settings" (Eisenhardt, 1989, p. 533).

Since the topic of FSC in the construction industry has yet to be addressed scientifically, this study deploys an exploratory, multi-case approach. This approach to case study analysis is particularly well suited to describing a complex phenomenon poorly researched scientifically and for which new theories have yet to be established (De Massis & Kotlar,

2014, p. 2). Exploratory case studies are commonly used to understand organizational dynamics or processes and should be applied if the goal is to understand *how* and *why* a phenomenon occurs. Examining multiple case studies helps to cross-reference whether observations of the phenomena occurring are unique to a particular case or can be replicated across case studies (De Massis & Kotlar, 2014). This cross-case examination ensures that the newly developed theory is based on multiple foundations and does not comprise case-dependent biases (De Massis & Kotlar, 2014; Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Yin, 2003).

As proposed by Eisenhardt (1989) and De Massis and Kotlar (2014), the underlying research questions were first determined with reference to contemporary literature. In this respect, the study aims to identify impediments to FSC in the construction industry and mechanisms to overcome these impediments. Furthermore, the analysis examines what role startup collaborations play for family-owned construction companies in preparing for (future) industry challenges. Appropriate case studies were then selected to answer these questions tangibly using real-world examples. To identify relevant case studies, the researcher's existing private network in the construction industry and publicly available information, e.g., from company websites and press releases, were used as initial sources of information to determine whether a company is already engaged in FSC. In sampling respondents relevant to the case studies, cross-case variation was ensured to increase the results' generalizability (Eisenhardt, 1989; Yin, 2003). Since the study explicitly focuses on the construction industry, FSC could not be considered across industries but only in industry subgroups. Thus, the individual case studies aimed to sample different construction companies, each specializing in another sub-segment of the overall industry. Furthermore, each FSC's solution optimized a different area within the construction company. In this way, the study aimed to increase response variance and, thus, generalizability.

Against this background, four case studies were performed. Each case comprised interviews with four stakeholders to examine different perspectives and compare the claims made. In addition to the four case studies, 24 expert interviews were conducted, predominantly with owners or managing directors of family-run construction companies based in Germany. Unlike the case studies, the expert interviewees were selected solely based on their general open-mindedness toward FSC. Previous collaboration with startups on the part of the family firm was no selection criterion. This sampling scheme should help explore what prevents construction companies from engaging in an FSC in the first place as part of the first research question.

Both case and expert interviews followed a semi-structured interview guideline. In this way, sufficient comparability among the case studies could be ensured while at the same time allowing for the conversation to flourish beyond the guiding questions. Four questionnaires were prepared, each tailored to the respective interviewee category. Thus, one questionnaire was designed for family firm owners and managers (with varying questions according to whether the family firm has already engaged in an FSC), one for startups, and one for family firm employees. Thereby, questions were formulated to understand *how* and *why* patterns occur.

Depending on the respective interviewee, the questionnaire featured between 13 and 21 guiding questions, organized into leitmotifs based on the research questions:

- Overarching trends and industry dynamics
- Innovation and new business models in construction
- Motives that led to or discouraged from FSC
- FSC: Motivations and expectations, barriers and enablers, key results
- Relevance of FSC in addressing trends
- Family firm influence

Prior to each interview, secondary data about the company and the interviewees was obtained via their company websites, LinkedIn profiles, or press releases to ensure good preparation and objectivity during the interview. Notes and audio recordings were always briefly analyzed in the follow-up to slightly adapt interview questions to ask subsequent interviewees even more precisely about emerging patterns.

A total of 40 interviews, including 31 interviewees from 26 family firms and nine interviewees from five startups, were conducted between February and April 2023 either via Microsoft Teams or in person. Detailed information on the individual case studies and expert interviews can be obtained from Table 1. 38 participants consented to audio recording and processing, while two refused. The interviews lasted 48 minutes on average, resulting in 32.5 hours of audio material. The interview period was terminated when data saturation emerged. Subsequently, the audio recordings were transcribed, and the transcripts were used for interview data analysis.

3.2. Data Analysis

The next step was to analyze and reduce the data collected to obtain validated results that help answer the research questions. For this purpose, a three-step process, as proposed by De Massis and Kotlar (2014), Eisenhardt (1989), and Yin (2003), was applied to extract critical findings and conceptualize the theoretical model systematically. MAXQDA, a software specialized in qualitative research analysis, was used to support this process.

First, the case study and expert interview transcripts were read and coded. Recurring codes attributable to a particular subject were then grouped into categories. Again, categories that stood out concisely were consolidated into higher-level themes and those into aggregate dimensions, representing the highest level of abstraction in case study analysis (Gioia et al., 2013). Next, the individual cases were analyzed in single-case analyses. These analyses provided an understanding of

Table 1: Case Overview (Source: Interviews, company websites & LinkedIn profiles)

Case	Core Business Family Firm (FF)	Core Business Startup (SU)	FSC Type
Case A	Building construction, infrastructure, production	IoT solutions for SMEs (hardware & software)	Collaboration & Investment (Product & use case validation)
Case B	Real Estate	Equipment, material, and personnel management (software)	Collaboration & Investment (Product validation)
Case C	Building construction, (special) underground construction, project development	Building process management (software)	Collaboration & Investment (Idea & use case validation)
Case D	Sewer construction, earthworks, local road construction, pipeline & hydraulic engineering	Digital device and building material management (software)	Collaboration (Product validation)

what FSC looked like in each case, leading to initial elaborations of the theoretical model. In the third step, a cross-case analysis was used to uncover analogies and discrepancies between the individual case studies and refine the findings obtained thus far. Following the single- and cross-case analyses, observations and patterns were cross-referenced with the expert interviews to substantiate the findings. This process further consolidated the results and refined the theoretical model. In addition, first-order codes and second-order themes were continuously cross-checked with secondary data and literature to ensure external validity.

This three-step analysis resulted in a theoretical model with an underlying data structure that includes six aggregated dimensions related to barriers, coping mechanisms, and the future viability of FSC in construction. Figure 1 depicts the theoretical model.

4. Findings

The following section presents the case study and expert interviews' findings on innovation collaboration between family firms and startups in the construction industry. The study analyzed FSC impediments and how these can be mitigated by the organizations involved. In addition, it examined what role startup collaborations play for family-owned construction companies in preparing for (future) industry challenges. Against this background, the data was analyzed and aggregated into a theoretical model.

Drawing on the findings from case studies and expert interviews, FSC in construction can be considered in three parts. The first part concerns the impediments and corresponding mitigation strategies in the run-up to the actual cooperation. The second part relates to how involved organizations manage impediments during the FSC, leveraging tried and tested mitigation mechanisms. Finally, the third part highlights the FSC's impact on the viability of family-owned construction companies in an evolving construction industry.

Based on this three-part consideration of FSC in construction, derived from both single-case and cross-case analyses, further informed by expert interviews, the theoretical model (Figure 1) has emerged. The latter illustrates how distinct mechanisms employed by the organizations involved guide the FSC's progression from the pre-collaboration phase to future outcomes. The detailed results will be explained in the following chapters.

4.1. Shared Motivation With Impairments in Challenges and Perceptions

The analysis initially focuses on internal and external parameters to explore the observed pre-collaboration impediments' and mitigation mechanisms' causes and effects. To this end, this chapter first analyzes the internal factors, i.e., illuminates the family firms' and startups' perspectives on FSC prior to the collaboration.

Shared motivation. Across the case studies, family firms and startups fundamentally shared a similar motivation for FSC. In particular, the involved parties aimed to co-create viable solutions that benefit both parties by leveraging their respective strengths and resources. Startups aimed to draw on the incumbent's expertise to develop an optimized solution to gain broad market acceptance in the economically attractive construction industry. At the same time, family firms sought inspiration and support from startups to improve an aspect of their business, hoping to help shape the solution's particulars through collaboration.

More specifically, in Cases A, B, and C, the startups initiated the FSC. In each case, the founding team uncovered optimization potential and looked for practical partners to advance their initial idea jointly. The respective family firms were generally very open-minded towards innovation, understood the catch-up potential identified by the startup, and, thus, agreed to the FSC. In contrast, Case D involved the startup's spin-off from another family-owned construction company, whereby the founding family firm had recognized a market gap they aimed to close. Thus, they sought further collaborating partners to help validate their product, which led to FSC D. As in the other cases, FF D recognized that the solution would offer optimization potential, prompting them to collaborate with SU D. Thus, each FSC was estab-

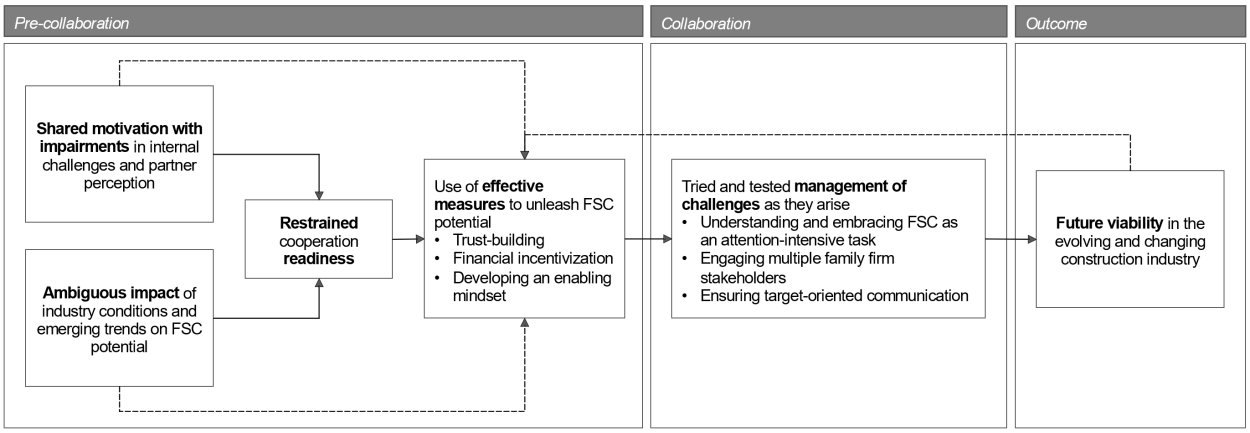

Figure 1: Theoretical Model (Source: Own illustration based on the case studies and expert interviews)

lished based on the common desire to advance an initial idea or product to create viable solutions for the construction industry, providing a common ground before the FSC.

Nevertheless, insights from case studies and expert interviews revealed that this shared motivation can initially be compromised by both parties facing *internal challenges* and family firms without FSC experience possessing *preconceived notions* about startups, impacting FSC potential on their part.

Coping with individual challenges. Case study and expert interviewees emphasized that FSC potential can initially be hampered by startups and family firms facing individual challenges. While startups reported challenges in identifying and acquiring suitable partners, family-owned construction companies noted constraints related to daily business, resource availability, and an overall lack of startup access.

According to the case studies, startups face two interrelated pre-collaboration challenges concerning knowledge and partner acquisition, translating into a "chicken-and-egg problem" in finding partners. To better tailor their solution to industry requirements, startups would need more in-depth industry knowledge, which they could gain during an FSC. However, family firms often require prior industry knowledge to enter an FSC in the first place. Case studies and expert interviews revealed that family firms without prior experience in FSC especially adopt a skeptical position if the startup lacks industry knowledge. Thus, this matter initially creates a significant challenge for startups, constraining FSC potential. Except for Case D, the spin-off, all case startups reported that their most significant pre-collaboration challenge was finding open-minded partners.

Family-owned construction companies, on the other hand, reported facing challenges concerning day-to-day business, limited resources, and the general lack of startup access. These impediments were partially confirmed by the case study family firms but were primarily identified and informed through expert interviews.

The first significant internal barrier emphasized by interviewees is day-to-day operations. Most construction companies are occupied winning contracts, participating in tenders, or executing mandates. As a result, interviewees reported that there is little time and sometimes little willingness to deal with topics that do not directly impact day-to-day business, impeding FSC opportunities.

Simultaneously, FSC requires a high level of resource commitment from the incumbent regarding human resources and time, which many family firms cannot provide. FF C, for instance, noted that they could not pursue collaborations like FSC C on a large scale because, given their size, they do not possess the necessary resources to do so. Other interviewees reported that they could only pursue FSC intentions because they have at least one other managing director who runs the operational business, ensuring that the latter is not neglected in the face of innovation. Thus, the resource element is a significant obstacle to FSC emergence in the construction industry, as Interviewee 17 summarized:

> *"The challenge is how much time to invest because the personnel capacity of medium-sized companies is not that large. And [...] the person who can say the most, i.e., a department head for structural engineering or civil engineering, is also very involved with other topics." (CEO (FF), Interviewee 17, Expert)*

The last strongly emphasized FSC hurdle for family-owned construction companies is their fundamental lack of startup access, as confirmed by most interviewees who have yet to collaborate. Despite their great interest in FSC, many interviewees did not know where and how to contact startups for an initial exchange about FSC prospects, hindering FSC emergence in the construction industry.

Thus, the startups' partner acquisition challenge and the family-owned construction companies' constraints related to daily business, resource availability, and startup access can initially limit FSC adoption in the construction industry.

Initial partner perception. Case study and expert interviewees with prior experience in FSC generally demonstrated positive perceptions of their collaboration partners. For instance, family firms described startups as unconventional, intelligent, fast, and eager, capable of challenging the traditional market to find interesting, new approaches to solving

problems. Startups, on the other hand, considered family-owned construction companies honest and open collaboration partners who sometimes work chaotically but allow suggestions for improvement.

Nevertheless, initial perception is not always as positive. Some case study and expert interviewees with prior FSC experience even acknowledged that some of their positive perceptions have only emerged during the FSC. Initial partner perception – especially among family firms that have yet to cooperate – can be much poorer, negatively affecting initial FSC potential.

Some interviewees, including FF D, perceived startups as partly underestimating the industry's complexity. As a result, family-owned construction companies felt that startups have not yet developed market-revolutionizing products that would be worthwhile to invest in or support via an FSC. In addition, FF A criticized that startups' promises sometimes differ from the product's actual development maturity, supported by other expert interviews. In some cases, this aspect has led to family firms discovering only during the collaboration that much more development work than initially anticipated was needed, leaving them feeling betrayed. Such adverse experiences rendered failed construction companies more skeptical of future FSC, radiating FSC-reducing effects on other companies. Finally, family-owned construction companies' most strongly pronounced concern about startups is that they primarily pursue shortsighted exit strategies, which family firms perceived as incompatible with their idea of (family) entrepreneurship. As a result, some incumbents found themselves reluctant to enter FSCs based on their preconceived perceptions of startups.

On the contrary, the startups' perception of family-owned construction companies did not negatively influence their FSC intentions but motivated them in their development. In Cases B and C, for instance, the startups perceived their family-owned counterparts as slightly inexperienced in applying digital tools but open to new opportunities, which motivated the startup team to take them along in that direction. They also appreciated construction companies' open and honest feedback, which empowered and facilitated their development work. Only SU D noted construction companies' price sensitivity as slightly hindering the process, as it requires much convincing concerning necessary investments. Overall, however, the startups' perceptions of family-owned construction companies did not reduce FSC readiness on their part.

Thus, despite startups' FSC-enabling perceptions of family-owned construction companies, the incumbent's perceptions of startups may constrain FSC potential.

In summary, there is a common interest in FSC on behalf of respective collaboration partners. However, internal barriers relating to individual challenges and perceptions may have an inhibiting effect on FSC emergence. These insights yield the following propositions:

> *Proposition 1a:* The family firm's resource limitations, focus on revenue-generating day-to-day business, and lack of startup access, as well as the startup's difficulty in finding suitable collaboration partners, pose inherent challenges to the respective parties, limiting FSC potential.
>
> *Proposition 1b:* Startups' perceptions of family-owned construction companies inspire FSC intentions, while the opposite is observed in family-owned construction companies' initial perceptions of startups.

4.2. Ambiguous Influence of Externalities on FSC Potential

Alongside the somewhat aggravating internal circumstances, the construction industry's external environment was reported to constitute a harsh environment for FSC emergence as well. The analysis revealed that external factors have an ambiguous influence on FSC potential in that family-owned construction companies find themselves discouraged from engaging in FSC by general industry conditions while, at the same time, emerging trends pressure them to adapt to new circumstances, arousing interest in FSC.

Nature of the industry limits FSC potential. Throughout the interviews, interviewees noted the construction industry's discouraging effects on FSC emergence. The most significant barriers identified by interviewees include client dependence, low margins, the multitude of regulations, and the decentralized nature of construction projects.

First, many family-owned construction companies interviewed did not consider themselves drivers of innovation. Instead, they deliver the client's requirements, with little room for involvement, as FF A described:

> *"[...] We build other people's ideas. That means if a client and an architect say they want to build a wooden house, we will build a wooden house for them. We are not asked to contribute too much innovation." (CEO (FF), Interviewee 1, Case A)*

Thus, without explicit customer demand for innovation, some interviewees reported that construction companies have less incentive to propose and adopt innovation, limiting FSC potential.

If anything, interviewees noted, customers seek passive innovation, i.e., organizational or process innovation for leaner project execution, which translates into more favorable prices. However, this same price focus results in family-owned construction companies operating under shallow profit margins, limiting their willingness and overall financial capacity to invest in innovation. As a result, interviewees noted, FSCs are often disregarded because they initially incur costs without providing immediate benefits.

Another factor that several interviewees perceived as limiting FSC is the multitude of regulations that must be complied with. For instance, FF C noted that the German construction market still lacks highly innovative products, which he partly blamed on the countless standards and regulations a product must meet to be approved on the market in the first

place. Expert interviews supported this assumption, finding that many approaches to building more innovatively fail because the necessary regulations cannot be met. In that regard, the industry also represents a harsh environment for startups and the emergence of FSC.

Lastly, the decentralized nature of operations and unique conditions of almost every construction project were reported as hurdles for FSC. According to Cases B, C, and D, decentralization in construction is a challenge in executing FSC, as many steps and stakeholders along the value chain have to be involved in highly complex, decentralized processes. As a result, some family-owned construction companies felt discouraged from attempting an FSC as they would need to engage and negotiate with many stakeholders along the way.

The following quote aptly summarizes the construction industry's discouraging impact on FSC potential:

> *"[. . .] Even if a startup wants to emerge somewhere and solve these problems, this startup first needs a gigantic reach and depth of impact until all process participants become involved. And that is why I do not think many startups want to enter this entire construction sector. Because I find myself in an industry that is extremely price-sensitive, [and] does not want to spend money on things it does not know anything about. [. . .] And then, in the end, an end customer who says, 'I do not care about all that anyway because the cheapest one gets the order. I do not need innovation [. . .].'" (CEO (FF), Interviewee 5, Expert)*

Nevertheless, interviewees reported increasing pressure on construction companies to cope with emerging trends and compensate for the last years' shortcomings, arousing interest in FSC.

Industry trends reinforce the need for FSC. According to the case studies and expert interviews, the major trends and challenges in the construction industry include sustainability, digitization, and skilled labor shortage. In light of these drivers, construction companies are taking a more active approach toward innovation, arousing interest in FSC.

The first big trend outlined by interviewees is sustainability. As one of the largest CO_2 emitters (EDGAR/JRC, 2022), interviewees reported increasing pressure on construction companies to develop sustainability concepts, promote a circular economy, and use alternative building materials, engines, and energy sources. However, many family-owned construction companies interviewed perceived sustainability measures as requiring investments, attention, and creativity, which they partly felt overwhelmed with. Therefore, they expressed high hopes for startups to help them cope with this challenge, inspiring FSC potential.

The second significant trend in the construction industry that sparks FSC is digitization. As FF A and SU D explained, family-owned construction companies increasingly recognize that digitization and the resulting connectivity can provide enormous efficiency benefits by streamlining processes, creating more transparency, and enabling better data utilization. These elements were perceived as a great advantage, especially in the competition for the most cost-effective bidder. Simultaneously, the digitization of products and processes remains one of the areas with the highest potential for improvement, with many startups entering the market to create change. As such, all case study startups were founded to advance digitization and connectivity in the construction industry. Thus, there is FSC potential in digitization.

As outlined by the case studies and expert interviews, the third prominent challenge in the construction industry is the growing shortage of skilled personnel. In this respect, family firms reported needing to develop appropriate personnel strategies to recruit, motivate and retain employees, and seek alternatives to cushion these shortfalls. Among others, AI and robotics were reported to entail promising prospects, with some family firms, including FF B, already embarking on development partnerships with universities and startups. Therefore, several family firms surveyed perceived FSC as a promising measure to address the personnel issue.

In summary, the findings revealed that family-owned construction companies initially face an innovation dilemma in that the construction industry's circumstances negatively influence their willingness to innovate while emerging trends and developments simultaneously stimulate it. Thus, the external influence's impact on FSC potential is ambiguous, yielding the following propositions:

> *Proposition 2a:* The construction industry's client dependence, low-profit margins, numerous regulations, and the decentralized nature of construction projects present a challenging environment for FSC emergence.

> *Proposition 2b:* Severe labor shortage, deficits in digitization, and sustainability regulations put increasing pressure on construction companies to strategically address these trends, creating opportunities for FSC.

4.3. Restrained Cooperation Readiness

Despite a general interest in FSC and the pressure to innovate from industry trends, external and internal factors combined may initially induce restrained cooperation readiness among the respective parties. Throughout the interviews, this reticence was reflected in family firms' risk aversion and startups' challenge of managing complexity due to individuality.

Risk aversion. Family firms' risk aversion toward FSC, caused by external and internal factors, manifested in their reluctance to share internal know-how, concerns about the startup's longevity, and hesitancy to engage in projects they cannot estimate. Risk aversion was particularly pronounced among family firms that have not yet participated in an FSC.

As such, some interviewees demonstrated risk aversion by avoiding sharing their internal knowledge. They feared that by sharing and commercializing their know-how via the FSC, competitors could participate in the family firm's knowledge,

which would cause the family firm to lose its unique selling point and, thus, a competitive edge in the highly competitive construction industry. Thus, their reluctance to share internal knowledge restrained family firms' cooperation readiness.

Furthermore, some family-owned construction companies interviewed were concerned about the startup's longevity, reflecting their initial perceptions of startups as focused on short-term success and mainly pursuing exit strategies. Family firms feared that the startup could be sold to a corporation, resulting in a loss of costly development work. Furthermore, they assumed that, upon an exit, the startup would no longer be able to support them in the way they are comfortable with and, in some cases, require. As a result, some family firms were hesitant to engage in an FSC at all.

Lastly, risk aversion manifested in family firms' hesitancy to engage in projects they can hardly assess. Interviewees noted that family firms struggle to assess startups' viability, some of whose ideas are comparably distant from their core business model, which causes them to refrain from risky investments and participating in an FSC that could fail. Thus, the startup's anticipated failure reduces family firms' willingness to engage in FSC.

In summary, family firms' fear of disclosing internal know-how, uncertainty about startups' longevity, and hesitancy to engage in projects they cannot estimate, reflect family-owned construction companies' risk aversion, initially constraining FSC readiness.

Complexity due to individuality. Apart from the family firms' risk aversion, startups reported obstacles to FSC adoption arising from the construction industry's individuality and resulting complexity.

Due to construction's project-based nature and high individuality, startups recalled facing significant challenges in depicting holistic processes, as almost every construction company approaches projects differently. In this context, the limited selection of partners was reported to have an aggravating effect, as startups only gain relatively one-sided insights into the processes of individual companies. Worst case, case study startups recalled, the limited selection of partners might lead to the startup developing a too-unilateral solution that does not apply to the broader market if they only get feedback from a few practitioners. Thus, apart from SU A, who offers a universally applicable hardware solution, all case startups were initially concerned with the challenge of mapping processes holistically. SU C emphasized:

> *" [. . .] The construction industry is very, very heterogeneous [. . .] both in terms of data per se, in terms of the software used, in terms of processes, how construction sites are planned in the first place, these are actually very, very different. [. . .] The path until the construction site starts is completely different for many companies. And that is of course difficult for us to map." (Co-Founder & CEO (SU), Interviewee 19, Case C)*

As a result, interviewees noted that a tendency has emerged for startups to cherry-pick small parts of the overall construction process, which are similar in almost every construction company, and try to optimize those. However, even though these solutions are high performing in their sub-process, this development generates a plethora of offers on the market, among which the incumbents have to weigh up. Especially FF C found the proper selection of suitable startups hindering the emergence of new FSCs, as it takes much time to pre-screen suitable candidates:

> *"[. . .] It is simply a challenge to make a good selection, because there are already so many offers, and everyone knows [. . .] that the construction industry is poorly digitized. And then there are just a lot of offers flooding in. And you have to find your way through this jungle." (Digitization & Optimization (FF), Interviewee 14, Case C)*

Consequently, the findings revealed that some family firms hesitate to spend tedious time and resources reviewing the many offerings on the market, resulting in FSC not materializing.

The third FSC-limiting constraint, partly resulting from this multitude of software tools, was identified in interface management. Case study and expert interviewees noted that most construction companies want to ensure interface compatibility with existing software products when introducing new tools to allow for a smooth data flow within the company. However, ensuring this compatibility can be challenging for startups. SU D noted that programming interfaces with existing tools is generally straightforward from a technical perspective. However, as the industry is missing uniform data standards, the solution has to be adapted to a different data basis with every new client, which is complicated and time-consuming, creating significant FSC impediments. Interface management was perceived as a significant challenge in Cases C and D, with expert testimonies substantiating these findings. Some family-owned construction companies even mentioned refraining from pursuing an FSC if they feel the new solution is incompatible with existing software tools.

In sum, the high degree of individuality in construction manifests differently and constraints FSC potential. Startups have difficulty mapping holistic processes, resulting in many small-scale solutions that are difficult to integrate due to lacking data standards.

Considering that risk aversion and technical challenges related to individuality in construction initially limit FSC readiness, the following propositions can be established:

> *Proposition 3a:* The combination of internal and external factors (cf. propositions 1 and 2) creates risk aversion among family-owned construction companies, limiting their willingness to cooperate.

Proposition 3b: Startups face complexity due to individuality in construction, presenting impediments to FSC implementation for them and family-owned construction companies.

4.4. Use of Effective Measures to Unleash FSC Potential

To mitigate pre-collaboration impediments and unlock FSC potential, case study participants and expert interviewees with prior FSC experience proposed effective mechanisms. While startups should prioritize trust building and create financial incentives, family firms should establish the right mindset to enable FSC.

Trust-building. Across the case study interviews, trust was emphasized as a critical factor in unlocking FSC potential. The most effective trust-building measures reported include interpersonal fit, professionalism on the part of the startup, and leveraging personal touchpoints.

Cases A, B, and C highlighted interpersonal fit as decisive in unlocking FSC potential. For instance, FF B and FF C reported initially investing as much in the founders' personalities as in the product. Their decisions were strongly based on gut feeling and sympathy. In Case A, too, sympathy was fundamental as FF A explained that initially assessing the team's technical capabilities is almost impossible. Thus, decisions were made according to whom the people were and how convincing they presented themselves. SU C even incorporated the trust element when initially seeking partners. In particular, they primarily approached potential partners in the vicinity to strengthen trust by enabling regular on-site in-person exchanges. SU C shared:

> *"We made sure that all of our partners were located within our vicinity, simply to be able to visit the construction sites and to have a personal interaction with them. Especially in such a phase, when trust is ultimately at stake, and construction companies are not yet investing in a product or software but rather in the people behind it. And investing, in this case, means time, above all, or sharing data. In other words, it is all about trust. That is why personal proximity was very, very important to us." (Co-Founder & CEO (SU), Interviewee 19, Case C)*

In addition to the interpersonal aspect, interviewees noted that the startup's professionalism could increase family firms' trust. In Cases A and B, in particular, professional competence was vital. According to FF A, professionalism could be achieved through SU A's (IT) skills, excellent meeting preparation, and high development speed. FF B focused on the founders' academic and professional backgrounds and the business model's viability. Apart from these enablers, startups were perceived as professional and trustworthy when they were willing to understand the family firm's problems and implement adequate solutions. Expert interviews supported these findings, slightly disagreeing over the need for industry knowledge. While some felt industry knowledge is essential in ensuring professionalism, others feared that an overly entrenched industry background would limit the startups' necessary impartiality to develop highly innovative products.

Lastly, case studies and expert interviews agreed that personal touchpoints could increase trust to enable FSC. As such, all cases have emerged through references or personal contacts. A prime example of how these personal network effects can increase a family firm's trust is Case D. As previously outlined, SU D was founded as a spin-off from another family-owned construction company. To validate their idea, the founding team sought further cooperation partners and thus acquired six other construction companies that were friends with the founding company, one of which was FF D, who recalled:

> *"Since we have known [Founding-FF] [...] for 20 years, maybe even longer, and we know that what they initiate usually succeeds and, above all, is approached professionally [...], we said, 'We are in!'" ((Junior) CEO (FF), Interviewee 36, Case D)*

Expert interviews confirmed that references, personal contacts, and success stories build trust and inspire FSC. Some interviewees acknowledged that they would be more likely to engage in an FSC if the startup already has use cases and other partners. Similarly, startups reported gaining credibility with new partners and customers through reference marketing, as trust is higher when other well-known or – even better – befriended construction companies have already worked or collaborated with them.

In summary, trust is a crucial aspect in unlocking FSC potential and can be achieved through interpersonal fit, professionalism on the part of the startup, and personal touchpoints.

Financial incentivization. Another mechanism that case study participants reported as beneficial in mitigating initial barriers and unlocking FSC potential is financial incentivization, which is two-sided.

First, a financial incentive can be created by the relatively low capital investment required to engage in an innovation collaboration with a startup. According to the case study and expert interviewees, financial entry into an FSC is a comparatively low threshold compared to what a consulting firm would charge to develop innovative strategies. Therefore, a low entry price may tempt family firms to try a "riskier" project, as the anticipated loss will likely remain low. In Case A, in particular, the low entry price greatly benefited FSC emergence, as FF A emphasized:

> *"For me, how we have developed SU A, this low-threshold project entry, would be the blueprint for how this can also work in the future. I think it is only because of this that we have gone so far as to make it a research and development project in its own right." (Head of Department (FF), Interviewee 18, Case A)*

Family firms in Cases C and D also felt motivated to enter the FSC because the initial financial outlay was relatively small.

The family firm's acquisition of startup shares is the second financial incentive empowering FSC adoption. Ownership of startup shares can strengthen the family firm's commitment to actively promote FSC development, as it is associated with economic prospects for success. In Cases A, B, and C, the incumbents hold shares in the startup, significantly increasing their incentive to pursue the FSC closely to reap the economic benefits. Thereby, the investment may also reduce the family firm's fear of disclosing internal knowledge, as FF A explained:

> *"The more people participate, the more the startup develops and the more I benefit from it. If I remain the startup's only customer, so to speak, then the startup will no longer exist in three years." (CEO (FF), Interviewee 1, Case A)*

Similarly, financial investment was found to co-regulate the too-unilateral product development explained before. Once the incumbents held a stake in the startup, they were more interested in the solution gaining general market acceptance.

In this way, low-threshold project entry and shareholding in the startup can contribute to unleashing FSC potential in the construction industry.

Developing an enabling mindset. As elaborated by the interviewees, developing an innovative and FSC-enabling mindset is critical to unlocking FSC potential. According to case studies and expert interviews, there are four activities conducive this.

The first contributor to developing an enabling mindset involves the promotion of innovation as a key element of the corporate culture. Case study interviewees promoted an innovative culture by exemplifying innovation as leaders, actively seeking innovation, and giving employees the space and feedback necessary to pursue innovative activities. Expert interviews confirmed that a culture of innovation could significantly empower FSC. Their effective measures for promoting an innovative corporate culture included organizational ideation, empowerment of group dynamics, mobilization of resource capacities, and the development of knowledge databases.

The second factor contributing to mindset development is the openness to adopt an unconventional perspective to break previous conventions. As emphasized in the case studies and expert interviews, startups ask questions that industry experts have long stopped asking. As such, FF C explained that the FSC reminded them not to accept the status quo but challenge it to improve their business operations. By embracing this change in perspective, interviewees noted, family firms can unlock previously untapped innovation and FSC potential. This openness to novelty becomes even stronger with the entry of new generations, as acknowledged in Cases B, C, and D.

The third mindset-related measure, interlinked with the second mechanism, includes the inherent willingness to realize new opportunities. Across all case studies, the decisive factor in actually realizing FSC was the family firm's willingness to seize the opportunity and implement the project. SUs B, C, and D recounted that this fundamental openness to implementing new projects facilitated FSC realization considerably. Therefore, early adopters willing to experiment with and implement new ideas contribute to materializing FSC in construction.

Lastly, family-owned construction companies can develop the mindset necessary to unlock FSC potential by embracing the benefits of cross-fertilization. As such, case study participants recalled their positive experiences related to cross-fertilization. In particular, FF C and SU C mentioned the advantages of combining the startup's speed and the family firm's experience. Similarly, in Case A, the involved parties benefitted from the combination of capital and ideas. FF B summarized:

> *"[. . .] I believe that this is the motivation to somehow get into business with such young companies or to collaborate with them. You have both worlds. Or the cool things from both worlds. You have this family business background and also, of course, certain financial possibilities [. . .] and then, this mindset and this way of working and acting of young entrepreneurs can combine it quite well." (CEO (FF), Interviewee 4, Case B)*

Several expert interviews confirmed the benefits of cross-fertilization and its effect on unlocking FSC potential.

In summary, developing an FSC-enabling mindset conducive to unlocking FSC potential involves promoting innovation as a key component of their corporate culture, adopting an unconventional perspective to break previous conventions, being willing to seize opportunities, and embracing the benefits of cross-fertilization.

Thus, it can be concluded that trust building, financial incentivization, and the development of a promoting mindset contribute significantly to unlocking FSC potential, resulting in the following propositions:

> *Proposition 4a:* Startups acting as approachable and professional partners, willing to understand and solve the family firm's problems, seeking personal touchpoints, and financially incentivizing family firms, builds trust and unlocks FSC potential.

> *Proposition 4b:* By committing to making innovation part of their corporate culture, recognizing opportunities, and allowing them to be pursued, family businesses can challenge existing assumptions and leverage cross-fertilization to unlock FSC potential.

4.5. Tried and Tested Management of Challenges as They Arise

Impediments continued to emerge during the FSC in the case studies and expert interviews reviewed. The following section identifies these challenges and explains how involved organizations mitigated them or, in hindsight, would have mitigated them based on their lessons learned.

Perceived challenges during FSC. The most prominent challenges during FSC, as reported by case study participants, related to employee engagement, miscommunication of expectations, and resource management.

Case study and expert interviewees emphasized that employee acceptance and engagement are conducive to the success or failure of an FSC, as they are the ones who will ultimately work with the developed solution daily. Simultaneously, engaging them entailed noticeable challenges in the individual cases, with employees questioning implementation feasibility, showing reluctance to change, and being skeptical about the solution's benefits. Different knowledge bases between family firm employees, startups, and among employees were further reported to complicate comprehensive employee engagement. Similarly, the different perceptions of construction reality may impede FSC progress, as was described in Cases A and D. If employees perceive the developed solution as irrelevant, their skepticism increases, and a dismissive attitude toward FSC develops, creating challenges or even generating failure.

Next, diverging expectations, some of which were not communicated precisely enough from the beginning, posed inherent challenges for the involved organizations during the FSC. Analyzing the individual case studies, the different expectations mainly related to the speed of software implementation (Cases C, D), adherence to initial timetables and milestones (Cases A, B, D), and the pursuit of development goals (Cases B, D). Consequently, involved organizations reported challenges in reconciling the different expectations.

Finally, as has been confirmed by all four case studies, managing resources was a significant challenge during FSC, both on the part of the family firm and the startup. Cases A, C, and D emphasized the startup's human resource limitations, caused by faster task than team growth and frequently changing actors within the startup team. This condition partially impeded the initial development speed and exchange. SU C summarized:

> *"I think one challenge is [...] that you are simply limited in resources. And even if a certain user wants something, and you would actually like to implement it, and you think, 'that makes sense,' you simply do not have the capacity for it." (Co-Founder & CFO (SU), Interviewee 32, Case C)*

Similarly, on the part of the family firm, as FF B explained, lacking resources led to significant slowdowns in the FSC if it did not get the incumbent's adequate attention.

Thus, in summary, challenges during FSC involved employee engagement, miscommunication of expectations, and resource management.

To deal with these emerging challenges, the single-case and cross-case analyses identified three effective mitigation mechanisms. These include embracing FSC as an attention-intensive task, engaging multiple family firm stakeholders, and ensuring target-oriented communication.

Understanding and embracing FSC as an attention-intensive task. The first mechanism to mitigate impediments during the FSC is understanding and embracing it as an attention-intensive task. Involved organizations realized this strategy by family firms supporting the startup's development, providing necessary human resources to support the FSC, and adopting a long-term perspective on FSC success.

First, family-owned construction companies enabled and actively supported the startup's development to adequately promote FSC and address the previously explained problem of differing construction reality perceptions. FFs A and B, for instance, allowed the startups' products to be tested under realistic conditions on the construction site. In this way, the solution could be developed to comprehend and accommodate realistic use cases. In Case C, this measure was even pursued further, with SU C completing an internship with FF C on the construction site for several months to accompany and experience the daily tasks on-site. By "playing foremen," SU C explained, they could better understand and map realistic processes.

Second, family firms emphasized the need of dedicating adequate human resources to accompany and provide the necessary attention to the FSC. According to interviewees, hiring employees specifically for FSC ensures that day-to-day business is supported and innovation can still be actively pursued. As such, FF A and FF C have dedicated employees supporting FSCs. An expert interviewee who has already had his own FSC experience confirmed:

> *"And that, I think, was also one of the successful levers for us to say, yes, this requires a personnel point, even in our size, and resources are made available for this because if the other employees do this on their own in addition to their daily business, then it gets difficult." (CEO (FF), Interviewee 38, Expert)*

A captivating perspective on human resources was provided by Interviewee 40, who emphasized the importance of the dedicated person combining a technical perspective with entrepreneurial thinking to adequately "translate" the involved stakeholders' intentions. As far as he is concerned, this technology/entrepreneur symbiosis greatly empowers FSC progress in the construction industry.

Third, case study and expert interviewees emphasized the importance of assuming a long-term perspective on the collaboration. This way, the involved parties developed the necessary stamina to ensure the FSC's success. As FF B explained, structures in family firms have grown slowly but steadily over decades. Therefore, the change brought about by FSC cannot happen overnight either but requires gradual steps to be implemented over the long term. Similarly, FF

A stressed the importance of seeing the collaboration in perspective, as an FSC cannot achieve immediate success but needs time to evolve. SU A accommodated FF A in assuming a long-term perspective on FSC by creating smaller work packages as part of the overall project to celebrate interim success, increasing the stamina of all stakeholders involved. SU C added that, especially in time-consuming software development, it is essential for the parties involved to develop a joint vision for the FSC to maintain the necessary endurance. After all, SU D claimed, FSC is a "transformation."

Thus, understanding and embracing FSC as an attention-intensive task to address ongoing challenges during the FSC requires active startup development support, adequate human resources provision, and a long-term perspective on FSC.

Engaging multiple family firm stakeholders. Since employee engagement was perceived conducive to FSC success but entails significant challenges, the case study and expert interviewees elaborated on effective levers to engage multiple family firm stakeholders and mitigate related impediments. These levers include respectful communication, inspiring employee self-efficacy, and soliciting user feedback.

First, Cases A, C, and D demonstrated how respectful eye-level communication can foster employee engagement. It enabled the parties involved to understand each other's challenges and to balance different perceptions and levels of expertise. Open communication also included transparency about missing industry knowledge on the part of the startup, which increased their credibility. This transparency increased employee engagement, as they felt valued and enjoyed explaining their tasks. Particularly in Cases A and C, family firm employees were impressed by the startups accompanying them to help and learn on-site. SU A recalled their involvement with FF A employees as follows:

> *"And what I think also resonated well was that we approached the people and said, 'I have no idea what you are doing. I have this [product], show me how you would use it. I just want to accompany you, I will help you. I've also got pants on that will get dirty, I've got steel-toed shoes on, now we will run off together and drive around for a day.' That had a very positive impact." (Co-Founder & CEO (SU), Interviewee 15, Case A)*

Next, Cases B, C, and D reported employee self-efficacy as supportive of the FSC's development. This self-efficacy was solicited by showcasing the product's benefits in facilitating daily tasks. Startups demonstrated the product's value proposition by creating tangible mock-ups for employees. While such a mock-up was naturally given in Case A due to the developed hardware, SU C relied on PowerPoint presentations, and SU D on click dummies. This mock-up creation allowed the construction company's employees to experience the actual application and its value-add physically. As a result, employees recognized the product's benefits in their daily work, increasing their commitment to actively participate in the FSC.

Finally, collecting user feedback was critical to employee engagement. SU D, for instance, reported that regular feedback loops with FF D employees positively impacted their credibility and the trust they were given, reversely benefitting challenge mitigation concerning employee engagement. Similarly, SU C shared a story about how their approach to generating user feedback increased employee engagement sustainably:

> *"I think people found it cool because they could explain a bit and tell stories, and in the end, they could see how the whole thing was developing – especially the companies involved early on, who initially saw what our software looked like. If you now talk about it and say, 'Hey, take a look at all the things that have changed and developed in the last year,' they also find it impressive and have ideas and visions of how it can continue. And then you notice relatively quickly that they also want to contribute and participate." (Co-Founder & CFO (SU), Interviewee 32, Case C)*

Ultimately, obtaining user feedback created win-win situations for involved organizations, as startups, too, benefitted from obtaining user feedback so as not to develop a solution irrelevant to the actual user.

In summary, engaging multiple family stakeholders through respectful communication, inspiring employee self-efficacy, and soliciting user feedback helped mitigate challenges concerning employee engagement.

Target-oriented communication. Finally, case studies and expert interviews suggested target-oriented communication as an effective challenge mitigation mechanism during the collaboration, involving expectation management, family involvement, and continuous exchange.

First, target-oriented communication comprises expectation management, which Case C and D declared particularly important in coping with ongoing challenges. In Case C, expectation management consisted of SU C regularly communicating progress, adjusting the schedule, and re-coordinating with FF C according to adapt milestones. On the contrary, FF D only realized retrospectively that they should have better managed expectations. FF D shared that, in hindsight, they would have defined and monitored expectations and goals, including timeframes and budget, more precisely, which might have prevented impediments. Thus, expectation management can contribute to mitigating challenges during FSC.

Second, interviewees highlighted that family involvement helped ensure target-oriented communication by prioritizing the project appropriately. Especially at the collaboration's start, when many (financial) decisions had to be made, direct and open communication between the family firms and the startups significantly accelerated the project's progress. During the FSC, as well, family involvement significantly empowered progress by communicating the project's seriousness and importance to their employees, thereby increasing their commitment, as was demonstrated in Cases B,

C, and D. Similarly, FF B reported that the family could exert a certain amount of pressure toward the startup when they seemed to no longer adequately prioritize the project. Thus, family involvement positively impacted project progress by ensuring target-oriented communication.

Finally, continuous exchange mitigated challenges during the FSC as part of target-oriented communication. Cases A, C, and D reported that continuous exchange to maintain cross-fertilization is a significant success concept intensively pursued. In particular, Case A hosts weekly or at least fortnightly exchanges with SU A reporting on the latest developmental status. SU C has created a working group with all its collaborative partners, within which joint concept development happens once a month, with SU C proposing ideas and incumbents providing feasibility assessments. In Case D, collaboration partners are updated on the latest developments every two weeks to ask questions or request improvement. This way, all organizations remain up-to-date and can combine their expertise for continuous product improvement.

Thus, target-oriented communication can be ensured through expectation management, family involvement, and continuous exchange.

In summary, with family firms and startups understanding and embracing FSC as an attention-intensive task, engaging multiple family firm stakeholders, and applying target-oriented communication, challenges that arise during the FSC can be successfully managed. The following propositions can, thus, be drawn:

> *Proposition 5a:* Due to different perceptions of construction reality, miscommunication of expectations, limited resource availability, and the challenge of engaging site personnel, impediments arise during the FSC.

> *Proposition 5b:* By understanding and embracing FSC as an attention-intensive task, engaging multiple family firm stakeholders, and ensuring target-oriented communication, involved organizations can effectively mitigate impediments during FSC.

4.6. Future Viability in the Evolving Construction Industry

Across the case studies and expert interviews, family-owned construction companies with FSC experience embraced it as a means to become future-oriented in an evolving construction industry. In particular, they reported feeling inspired by startups to explore new and unconventional avenues, enabling continuous change and business improvement and sustainably leading the company into the future.

Embarking on unknown, unconventional paths. First, case study and expert interviewees with previous FSC experience acknowledged the startups' support in adopting an unbiased mindset to break with preconceived notions and explore new, unconventional paths. For some interviewees, breaking away from previous presumptions enabled corporate transformation, a critical success factor in a changing environment. FF A, for instance, emphasized change and the willingness to change as crucial success factors in their company. Therefore, they stressed to actively pursue FSC as an enabler of corporate change:

> *"[...] This willingness to change is simply essential. And a project like this also proves that, even if it fails, it motivates people to be willing to change and shows them that if it works or could work, a change also represents an improvement for the company." (CEO (FF), Interviewee 1, Case A)*

According to experts with prior experience in FSC, collaboration with startups considerably supported them in shaping their future orientation in that startups encouraged and inspired them to adopt new perspectives. Family firms learned that they do not need to thoroughly plan a process before it can be started but that mistakes can and should be made along the way. Thus, FSC enabled continuous learning, change, and improvement through flexibility.

Sustainable direction. Aside from taking unconventional paths to inspire corporate transformation, family-owned construction companies achieved efficiencies, increased employee engagement, and expanded their overall business portfolio by participating in an FSC. Thus, they reported feeling empowered to sustainably direct their business into the future.

First, family firms reported significantly benefiting from FSC because their capacity to operate more efficiently, i.e., reduce costs or save time and required human resources, was increased. Interviewee 21, who had previous experience in FSC, reported:

> *"Everything happens incredibly fast, much, much faster. We can now build much faster, much more efficiently [...]." (CEO (FF), Interviewee 21, Expert)*

FF D also pointed out that FSC has allowed them to process tasks more efficiently. Similarly, Case B reported increased employee engagement resulting from FSC engagement, which boosted their dynamism and self-drive and, thus, further increased overall efficiency.

By engaging in FSC, case study and expert interviewees explained, family firms can further expand their portfolio to position themselves more broadly in an evolving construction industry. Interviewees acknowledged that focusing on what already exists is no longer sustainable in a changing market. Instead, it requires establishing flexible structures to explore new business divisions. FF C, for instance, has always embraced the idea that a company thrives the most when it is diversified, even in an overall healthy economic condition. Thus, they have been looking specifically for new investment opportunities, which is how FSC C emerged.

Ultimately, the family firms surveyed considered themselves well prepared for future challenges, thanks to participating in an FSC. Therefore, every company cooperating with a startup confirmed they would do so again.

Considering FSC's role in ensuring family firms' viability in an evolving construction industry, the following propositions can be drawn:

> *Proposition 6a:* By participating in FSC, family-owned construction companies can regain independence from industry biases and be inspired to enable continuous organizational change that ensures future viability in the evolving construction industry.

> *Proposition 6b:* In enabling family-owned construction companies to expand their portfolio to reduce dependency on individual business units and unlock efficiency potential to reduce costs, FSC represents an ideal opportunity for them to defend their market position.

5. Discussion and Conclusion

The present study aimed to provide insights into FSC in the construction industry by analyzing the impediments to collaboration, how involved organizations can mitigate these, and what role startup collaborations play for family-owned construction companies in preparing for (future) industry challenges. Drawing on the findings from case studies and expert interviews, FSC in construction was considered in three parts.

The first part concerned the impediments and corresponding mitigation strategies in the run-up to the actual cooperation. The findings proposed that pre-collaboration impediments resulted from external and internal factors and manifested in a restrained collaboration readiness, characterized by family firms being risk averse and startups struggling to navigate high individuality in construction. To address pre-collaboration challenges and unlock FSC potential, involved organizations engaged in trust-building, created financial incentives, and developed an enabling mindset.

The second part related to how involved organizations managed impediments during the FSC, leveraging tried and tested mitigation mechanisms. The insights revealed that challenges during FSC related to employee engagement, miscommunication of expectations, and resource management. The involved organizations mitigated these challenges by understanding and embracing FSC as an attention-intensive task, engaging multiple family firm stakeholders, and ensuring target-oriented communication.

The third part highlighted the FSC's impact on family firms' viability in an evolving construction industry. As such, the findings suggested that startup collaborations can support family-owned construction companies in preparing for future challenges and ensuring viability in an evolving construction industry by facilitating corporate transformation and realizing efficiencies, increasing employee commitment, and expanding the overall business portfolio.

Thus, following this three-part consideration of FSC in construction, the research questions on FSC impediments, mitigation mechanisms, and the FSC's role in preparing family-owned construction companies for (future) industry challenges could be illuminated comprehensively.

Next, the findings obtained are compared with the existing literature to draw theoretical and practical implications based on the insights gained. Finally, the study identifies limitations and suggests avenues for future research before drawing concluding remarks.

5.1. Comparison of Results With Literature

With the study uncovering impediments, mitigation mechanisms, and prospects of FSC in the construction industry, the findings confirm and extend prior literature on FSC, as well as innovation in family firms and construction.

In light of the first research question around FSC impediments, comparing the results with previous research detects similarities in general barriers to FSC before and during the collaboration. *Pre-collaboration barriers* observed in the present study included the family firm's risk aversion and the startup's challenge of navigating complexity due to high individuality caused by internal and external factors. Thereby, previously identified barriers related to trust-building (Bannerjee et al., 2016; Baumgärtner et al., 2022; Löher et al., 2017), conflicts of interest and expectations (Baumgärtner et al., 2022; Garbs, 2017), prejudices (Leitner et al., 2019), missing resources (Bannerjee et al., 2016; Meyer, 2017), family firm employees' limited opportunities to "look outside" their daily tasks (Baumgärtner et al., 2022, p. 22), and risk aversion (Bannerjee et al., 2016; Meyer, 2017; Prügl et al., 2019) could be confirmed by the interviews' findings. The family firms' reluctance to disclose internal know-how further matches previous insights on information withholding (Löher et al., 2017; Prügl et al., 2019). Moreover, interviewees initially reported difficulties in partner acquisition on the part of startups and a general lack of access to startups on the part of family firms. These findings further confirm previously identified challenges around finding collaboration partners (Armutat et al., 2015; Bannerjee et al., 2016; Baumgärtner et al., 2022).

A similar overlap of the obtained results and previous findings could be observed for *barriers encountered during the collaboration*. Previously studied FSCs revealed challenges arising from conflicts of interests/ expectations (Baumgärtner et al., 2022; Garbs, 2017; Löher et al., 2017; Meyer, 2017), missing resources (Bannerjee et al., 2016; Meyer, 2017), communication difficulties (Baumgärtner et al., 2022; Garbs, 2017; Leitner et al., 2019; Löher et al., 2017), stakeholder involvement (Baumgärtner et al., 2022), and the clash of two different corporate cultures (Bannerjee et al. 2016; Kawohl et al. 2015; Leitner et al. 2019; Prügl et al. 2019; Wallisch and Funke 2016), all of which were confirmed by the study's findings.

Thus, much of FSC's previously observed challenges were confirmed within the scope of this study. The present study's findings, however, extend existing FSC literature by identifying context-specific causes and effects of observed impediments to FSC in the construction industry.

As such, interviewees reported construction-specific characteristics as significantly impeding FSC emergence. These characteristics included the dependence on the client's specifications (e.g., Barlow 2000; Blayse and Manley 2004; Bygballe and Ingemansson 2011; Gambatese and Hallowell 2011; Gann and Salter 2000; Harty 2008; Lindblad and Guerrero 2020), price sensitivity (Ribeirinho et al., 2020), the multitude of regulations (e.g., Barbosa et al. 2017; Blayse and Manley 2004; Bygballe and Ingemansson 2014; Gambatese and Hallowell 2011; Kehl et al. 2022; Ribeirinho et al. 2020), and the decentralized, highly individual mode of construction operation (e.g., Barbosa et al. 2017; Dubois and Gadde 2002; Gann and Salter 2000; Harty 2008; Kehl et al. 2022; Ribeirinho et al. 2020). While these factors have previously been perceived as influencing construction innovation by the listed authors, this study revealed that they induce specific impediments in the FSC context. In particular, the construction context either reinforced observed barriers or generated new barriers to FSC.

For instance, the observed reluctance of family-owned construction companies to share internal know-how, limited (financial) resources to support FSC, and risk aversion prior to the FSC were primarily influenced by the fact that family firms face enormous competition in the construction industry due to the price-focused procurement system (Blayse & Manley, 2004; Dubois & Gadde, 2002; Hartmann, 2006), their low operating margins (Ribeirinho et al., 2020), and extreme price fluctuations in building materials (Berbner et al., 2023).

Similarly, the decentralized, highly individual construction mode presented startups with significant challenges in managing complexity due to individuality. More specifically, startups perceived the development of holistic solutions as a significant challenge in the run-up to FSC emergence. During the FSC, the complexity of construction continued to impose challenges, manifested by differing perceptions of construction reality and associated employee engagement restraints.

Thus, context-specific factors (for the role of context in construction innovation, cf. Röd 2016; Sexton and Barrett 2003; Tidd 2001) significantly reinforced and created barriers to FSC.

In sum, many parallels were identified between existing literature and the findings on impediments in FSC. These were extended by revealing that construction-specific characteristics reinforced barriers to FSC in construction or even created new ones. However, fundamental contradictions of the findings with existing observations were not uncovered.

With respect to the second research question concerning *how involved organizations can mitigate impediments*, previous best practices could be confirmed by this study's findings and extended by different mitigation strategies applicable to FSC in general and particularly suitable in the construction industry.

To *mitigate impediments prior to FSC*, previous research highlighted the importance of leveraging network effects and references (Löher et al., 2017), actively seeking touchpoints (Hofmann, 2016; Löher et al., 2017; Meyer, 2017), defining framework conditions including project budget and timeframe (Armutat et al., 2015; Löher et al., 2017; Wallisch & Funke, 2016), and managing expectations (Armutat et al., 2015). The interviews could confirm these findings. In particular, interpersonal fit, professionalism on the part of the startup, and personal touchpoints were perceived as beneficial to creating trust and unlocking FSC potential. Similarly, innovation-enabling mechanisms in family firm and construction innovation, including promoting an innovative corporate culture by advocating innovative ideas (e.g., Blayse and Manley 2004; De Massis et al. 2022; Gambatese and Hallowell 2011), actively seeking innovation (Hartmann 2006; Kellermanns and Eddleston 2006), and promoting organizational learning (e.g., Barlow 2000; Blayse and Manley 2004; Chinowsky and Carrillo 2007; Gambatese and Hallowell 2011) were identified conducive to enabling FSC among the case study and expert interviewees.

The present study's results extend prior findings surrounding pre-collaboration mitigation mechanisms by including financial incentivization as an effective way to unlock FSC. While a financial investment has been found to generally motivate family firms to engage in FSC (e.g., Leitner et al. 2019; Löher et al. 2017), it has not yet been framed as an effective measure to mitigate barriers. In particular, financial incentivization can mitigate impediments and benefit FSC in two ways. First, a low entry price can help overcome the family firms' initial inhibition to FSC adoption by keeping the anticipated loss in case of failure relatively low, thereby decreasing initial risk aversion. Second, by offering shares to the family firm, startups can build trust to convert the fear of knowledge transfer into the prospect of economic success. Since the family firm's fear of losing its competitive advantage by releasing valuable internal know-how impedes FSC emergence in the construction industry, this measure can be instrumental in unlocking FSC potential.

The study's findings could also confirm previously proposed m*itigation mechanisms during the collaboration*. The measures included trust-building through open exchange, mutual respect, and appreciation for one another (Löher et al., 2017). Furthermore, shared values and visions, continuous and mutual knowledge transfer, and common milestones were found to benefit challenge mitigation during FSC (Leitner et al., 2019). In line with these findings, respectful communication, expectation management, long-term perspectives on FSC, ongoing cross-fertilization, knowledge transfer, and transparency significantly contributed to mitigating impediments during the FSC in the analyzed case studies and expert interviews. Similarly, upper management support has been found to emphasize the importance of innovation in construction firms (Gambatese & Hallowell, 2011; Hausman, 2005; Sexton & Barrett, 2003), which can be aligned with the importance of family involvement in mitigating challenges during the FSC, as identified throughout the case study analyses.

The study extends previous observations on mitigation mechanisms during the FSC by including adequate human resources dedication to support FSC intentions as an effective

mitigation measure. This lever ensures that FSC receives adequate attention to not just run alongside the day-to-day business. In this way, innovation can be actively pursued without neglecting day-to-day business. In construction, the dedicated person should ideally possess a high technical affinity and an entrepreneurial mindset to understand and translate between the two parties to mediate between their perspectives.

Contrary to previous findings on the implementation of innovation in construction companies, which Bygballe and Ingemansson (2014) identified as "top-down" approaches, case study and expert interviewees promoted "bottom-up" attempts to FSC. More specifically, the findings proposed that interviewees sought their employees' active involvement and co-creation in the FSC. As such, interviewees emphasized the importance of engaging multiple family firm stakeholders, especially from the construction site, to help shape the FSC's framework. This measure had an incredibly empowering effect on employee satisfaction and FSC success, rendering it a powerful means in addressing impediments during FSC. In this way, this finding both refutes previous propositions and adds an effective tool for addressing FSC obstacles.

Altogether, the identified strategies for mitigating FSC-related barriers could be matched with the previous findings, extending them by uncovering additional mechanisms to address impediments based on the insights from the construction industry. Furthermore, a contradiction with previous findings regarding the approach to innovation in construction companies was identified.

Considering the third research question examined within the scope of this study, a high level of coverage with existing literature can be observed. Interviewees reported that engaging in FSC could increase their future viability in that FSC allows them to embark on unknown, unconventional paths, facilitate corporate transformation, realize efficiencies to ensure competitiveness, increase employee commitment, and expand their overall business portfolio. These findings match previously identified benefits of FSC for family firms, including diversification and expansion into new markets (Bannerjee et al., 2016; Löher et al., 2017; Meyer, 2017; Mocker et al., 2015; Prügl et al., 2019), competitive edge in a dynamic market (Bannerjee et al., 2016; Löher et al., 2017; Meyer, 2017), and increased innovation potential (Bannerjee et al., 2016; Leitner et al., 2019; Löher et al., 2017; Meyer, 2017). Moreover, prior research found that family firms significantly benefit from FSC by allowing them to rejuvenate their corporate culture (Bannerjee et al., 2016; Baumgärtner et al., 2022; Löher et al., 2017; Mocker et al., 2015), creating efficiencies (Bannerjee et al., 2016), secure survivability (Bannerjee et al., 2016; Meyer, 2017), and explore new business models (Leitner et al., 2019; Meyer, 2017). Thus, in line with previous insights, family-owned construction companies perceived FSC as an effective means to ensure future viability in an evolving construction industry.

This finding contradicts Bygballe and Ingemansson's (2011) finding that the construction industry generally considers external sources of innovation to be of minimal value. Instead, case study and expert interviewees emphasized innovation collaboration with (external) startups as particularly beneficial in accelerating corporate transformation. In particular, the startups' impartiality in adopting new perspectives on entrenched processes and developing their ideas further in collaboration with experienced construction companies was found to be highly successful. Thus, FSC was considered a valuable external source of innovation.

In sum, the findings related to the third research question were mostly consistent with previously obtained FSC-specific findings while refuting previous assertions about the value of external innovation in the construction industry.

Next to these findings directly related to the three research questions, the study further found similarities in family firm and construction characteristics and innovation behavior. As such, interviewees reflected the 4Cs (continuity, community, connection, command) in their behavior. For instance, their long-term perspective on FSC matches their pursuit of continuity. Active family firm stakeholder engagement complies with family firms' community notion, and the family involvement during FSC reflects the benefits family firms enjoy from command (Miller & Le Breton-Miller, 2005). The family firms' aim to elevate their performance through FSC to better serve customer needs reflect their pursuit of customer care as part of connection (Miller & Le Breton-Miller, 2005; Nieto et al., 2015). Furthermore, every FSC considered in the case studies involved internal process improvement, which is consistent with both family firms' propensity to improve internal processes (Classen et al., 2014; De Massis et al., 2022; Zellweger & Sieger, 2012) and construction companies' preference for organizational innovation (Blayse & Manley, 2004; Hartmann, 2006). These are just a few examples of the many parallels discovered between the findings and existing family business and construction literature. However, since these are beyond the scope of the research's objective, they will not be further specified in the following.

In summary, identified barriers, mitigation mechanisms, and FSC's role in ensuring family firms' future viability are largely consistent with the findings obtained in prior FSC research. Meanwhile, contrasts to previous construction innovation literature could be identified concerning the chosen innovation approach (top-down vs. bottom-up) and the value of external innovation. Furthermore, the present study uncovered that the observed events and actions of organizations involved in FSC in the construction industry are strongly influenced and informed by the industry's realities, extending previous insights and stressing the importance of future research to consider the role of context when studying FSC.

5.2. Theoretical and Practical Implications

Drawing on the similarities and differences observed between existing literature and the present study's findings, theoretical and practical implications can be derived.

By examining impediments, mitigation mechanisms, and prospects of FSC in the construction industry, the study's results confirm general FSC observations made in prior literature (e.g., Bannerjee et al. 2016; Garbs 2017; Kawohl

et al. 2015; Leitner et al. 2019; Löher et al. 2017; Prügl et al. 2019), while providing in-depth insights into how construction-specific factors impact the overall FSC process. As such, construction industry characteristics (e.g., Barbosa et al. 2017; Barlow 2000; Blayse and Manley 2004; Bygballe and Ingemansson 2011; Dulaimi et al. 2002; Fischer et al. 2014; Gambatese and Hallowell 2011; Gann and Salter 2000; Harty 2008; Kehl et al. 2022; Ribeirinho et al. 2020) were found to significantly influence barriers prior to and during FSC, emphasizing the role of context in assessing FSC impediments. Similarly, while some of the previously identified mitigation strategies to overcome barriers to FSC (e.g., Armutat et al. 2015; Hofmann 2016; Leitner et al. 2019; Löher et al. 2017; Meyer 2017; Prügl et al. 2019; Wallisch and Funke 2016) were confirmed by the findings of this study, more nuanced insights were derived on how the involved organizations in the construction industry can mitigate impediments. Consequently, by cross-referencing the results with existing literature, the study uncovered that observed impediments and mitigators depend not solely on family firm-specific factors but also on the broader context in which the FSC occurs.

As for family firms' future viability resulting from FSC engagement, the findings could largely confirm previous observations on why family firms would and should engage in an FSC, thereby extending the literature on construction innovation by suggesting startup collaboration, i.e., an external source of innovation, as a powerful means to survive and thrive in an evolving construction industry.

Thus, these observations, made in family-owned construction companies, add to the existing literature on FSC as well as family firm and construction innovation.

Along with these theoretical implications, the study's findings provide practical implications for family-owned construction companies and startups. Especially considering that all surveyed family-owned construction companies expressed interest in FSC, but only about half of them have already implemented this interest, these implications can contribute to guiding a pathway into future FSC in the construction industry.

First, family-owned construction companies can leverage FSC as a viable strategic measure to thrive in the evolving construction industry by honoring the following aspects:

- Intentionally seeking touch points with startups by attending industry-related trade fairs, participating in associations and working groups, and leveraging university collaborations can help overcome the lack of access to startups.
- Missing industry knowledge on the part of the startup should not discourage family-owned construction companies from entering FSC. On the contrary, the symbiosis of a startup's impartiality and the family firm's experience can develop highly beneficial solutions for the industry. Thus, instead of rejecting startups for their lack of industry know-how, family-owned construction companies should help them understand construction realities so that startups can better define actual use cases and develop the product in a more targeted manner, benefiting both parties.
- Acquiring startup shares can help reduce risk aversion, as the family firm's internal know-how is not lost but can be leveraged and marketed as a joint FSC product. In this way, knowledge transfer can be perceived as an opportunity to create a new revenue-generating business model.
- Providing sufficient human resources capacity to provide adequate FSC support increases the prospects for success. These prospects are even higher if the dedicated person acts as a mediator between the technical and business perspectives to translate perspectives and concerns.
- Actively involving multiple family firm stakeholders allows for cross-checking feasibility and receiving realistic feedback necessary to develop a solution relevant to the users while increasing employee satisfaction and commitment through appreciation.

Second, startups can increase the success rate of FSC in the construction industry by considering the following measures:

- Engaging multiple, heterogeneous partners to get as many perspectives as possible on the underlying problem greatly enriches the development of a generally applicable solution in the construction industry and, thus, increases prospects of success.
- Increasing attractiveness with family-owned construction companies to acquire suitable partners can be achieved through approachability, transparency, realism, and the ambition to learn about construction industry realities. Furthermore, financial incentivization can considerably increase risk tolerance on the part of the family firm.
- Informing family-owned construction companies about exit intentions from the beginning can avoid conflicts later on, as sharing these intentions gives the incumbents the authority to decide how to proceed with the FSC. Since the startups' short-lived nature can trigger risk aversion on the part of the family firm, clear communication helps them assess the situation.
- Being transparent about missing industry know-how can increase credibility and trust, as family-owned construction companies will not feel betrayed once they discover that promises differ from reality. In contrast, open communication about shortcomings can even accelerate FSC by helping incumbents understand how much explaining is still needed.

- Developing mock-ups to allow involved stakeholders to experience the solution enriches product development by allowing startups to obtain product-related feedback directly from the user. Likewise, it helps demonstrate intermediate success, increasing the involved parties' stamina.

By getting involved organizations to embrace these practical implications, FSC potential can be better harnessed in the construction industry.

5.3. Limitations and Avenues for Future Research

Although the present study was conducted according to the qualitative case study research specifications developed by Eisenhardt (1989), several limitations exist. Since the four case studies were conducted exclusively with interview partners from German family-owned construction companies, the results should not be generalized to all FSCs in the global construction industry or FSC in general. In addition, most participants represented the family firm's perspective, biasing the results in that the startup perspective was slightly underrepresented. Moreover, results were drawn exclusively from primary interview data and secondary data from company websites, LinkedIn pages, or press releases, excluding observations that would increase objectivity. Moreover, the propositions were derived purely analytically and not measured quantitatively. Considering these aspects, the study's findings do not allow for statistical generalization.

However, limitations simultaneously create avenues for future research. Thus, the study could be replicated with more case studies, including international construction companies, to achieve greater generalizability. Similarly, fellow researchers could extend this study's findings by surveying family-owned and non-family-owned construction companies. This approach would help understand whether the identified barriers and mitigation mechanisms depend on the interviewed organizations' family-aspect or industry-related drivers. In line with this, examining FSC within and across other industries would be insightful to identify how much of the observed FSC behavior depends on the overall context.

Furthermore, future studies should focus more on the startup's perspective on FSC in the construction industry. Since this study only interviewed startups with successful FSC experience, an interesting area of research would be to examine a cross-sample of startups with negative FSC experience in the construction industry. In this way, researchers could shed light on whether construction industry-specific circumstances discourage startups from engaging in FSC in the construction industry. Thus, the focus would not be so much on barriers and reasons for failure from the family firm's point of view but would also be more concerned with the startup's side. Finally, fellow researchers should quantitively test the propositions developed in this present study to achieve statistical generalizability.

5.4. Conclusion

The present study explored the impediments, mitigation mechanisms, and implications for family-owned construction companies' future viability through participation in an FSC in the construction industry. Drawing on the findings from 40 interviews, constituting four exploratory cases with four participants each and 24 expert interviews, the study developed a theoretical model depicting the FSC process in the construction industry. With this theoretical model, the study aimed to contribute to the emerging research field around FSC and provide practical implications for future FSC in the construction industry.

The study considered FSC in construction in three parts. The first part concerned the impediments and mitigation strategies in the run-up to the actual cooperation. In this phase, external and internal factors induced a restrained cooperation readiness. In particular, external factors, i.e., industry circumstances and emerging trends, had ambiguous implications for FSC potential. Internally, the organizations involved faced the challenge of overcoming their individual constraints and addressing partner perception to successfully pursue their shared motivation of developing a viable solution for both parties. To unlock FSC potential, the parties involved applied mitigation mechanisms, i.e., trust-building activities, mindset development, and financial incentivization, to progress from the pre-collaboration phase to the actual collaboration. During the FSC, organizations involved, again, faced challenges, some of which remained under the influence of initial impediments. To cope with emerging impediments during the FSC, case study interviewees elaborated on how it was essential to understand and embrace FSC as an attention-intensive task, involve multiple family firm stakeholders, and communicate in a target-oriented manner.

Finally, family-owned construction companies emphasized FSC's considerable importance in preserving their viability in the evolving construction industry. In particular, collaboration with startups allows family firms to explore new, unconventional paths to enable continuous change and sustainably navigate their business into the future. Thus, the family-owned construction companies surveyed considered themselves well prepared for new challenges, thanks to participating in an FSC.

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