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Article

Innovation collaboration between family firms and startups: Insights from the German construction industry

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Online-Appendix

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

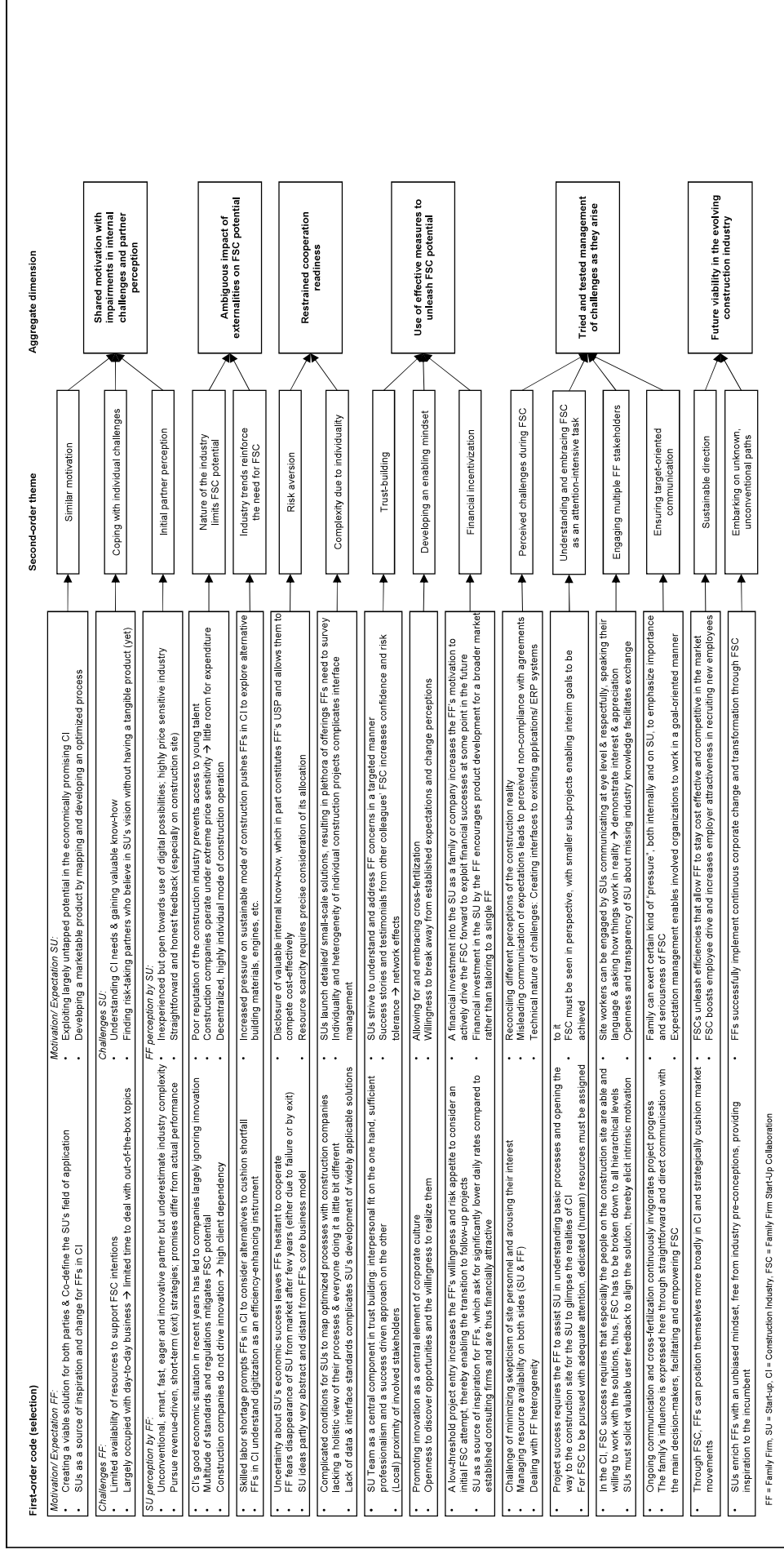
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Appendix

Appendix 1: Theoretical Model – Underlying Data Structure



Source: Own illustration based on interviews

Appendix 2: Codebook

Aggregate dimension	Definition of aggregate dimension	Second-order theme	Coding rule	Example
Industry conditions and emerging trends have dichotomous implications for FSC potential	The dimension, "Industry conditions and emerging trends have dichotomous implications for FSC potential" encompasses external influencing factors, in terms of the industry's nature and emerging trends.	Nature of the industry limits FSC potential	Quotes describing how industry conditions (negatively) affect innovation behavior/ FSC potential in the construction industry.	"This means that even if a startup wants to arise somewhere and wants to solve these problems, this startup needs a vast reach and depth of impact before all participants in the process are involved. And that's the hamster wheel we're stuck in, which is why I don't think many startups are entering this entire construction sector. Because I end up in an industry that is extremely price-sensitive, doesn't want to spend money on things it doesn't know anything about, and doesn't want to invest any money because "I can do something else with that money, if I can save it, I'll be cheaper on the market, I'll have a better chance of getting contracts." And then, in the end, there's the final purchaser who says, "I don't care about all that anyway, because the cheapest one gets the order. I don't need innovation." (CEO (FF), Interviewee 5, Expert)
		Industry trends reinforce the need for FSC	Quotes describing how emerging trends within the construction industry are enabling FSC.	"The only thing that can help is customer pressure or social pressure or an emergency situation, i.e., a real urgency. In other words, in addressing certain topics, such as sustainability, [the SU] helps you. It helps you to address the topic of BIM, the topic of digitalization, sustainability, topics like that, all of which are well known and sufficiently well known, and it helps." (CEO (FF), Interviewee 25, Expert)
Shared motivation with impairments in internal challenges and partner perception	The dimension "Shared motivation with impairments in internal challenges and partner perception" illuminates internal factors impacting FSC potential.	Similar motivation	Quotes describing the SU's and FF's respective expectations and motivations to an FSC.	FF: "Yes, it would have to solve some problem, it would have to solve the problem, reliably solve problems for us and then it would have to be economical." ((Junior) CEO (FF), Interviewee 36, Case D) SU: "The big goal at the beginning was, of course, hey, we want to build a partnership so that in the end we have a software that can be used by FF C. At best will be used, of course from our perspective. That we are able to develop this software at all. That is ultimately the goal." (Co-Founder & CEO (SU), Interviewee 19, Case C)
		Coping with individual challenges	Quotes describing the SU's and FF's respective challenges to an FSC.	FF: "Because every day there are dozens of new advertising brochures from some startup that has developed something new, and they all have good ideas. But especially in medium-sized companies, the capacities are not always available to implement all the ideas, and you can't always realize everything, because it simply has to be handled." (CEO (FF), Interviewee 17, Expert) SU: "The first thing, of course, is to find partners, which is the critical resource. It's not as if you start a company, somehow have an idea, and now all the construction companies come up to you and say, "Hey, we're waiting for you, please let us start and change the industry." Of course, it doesn't work that way; you have to acquire the construction companies yourself as partners. That means that's the critical resource. And I would be lying if I now said that we could have taken 50 partners and then decided on just those three. Of course, it wasn't like that." (Co-Founder & CEO (SU), Interviewee 19, Case C)
		Initial partner perception	Quotes highlighting how SU and FF	FF: "What has to be said, which is absolute, for me, fascination, is the people's cleverness, the gift of being able to familiarize oneself insanely quickly with foreign

	perceive each other.	factual topics, but at the same time, in my eyes, the complete underestimation of the complexity, the complexity of the process." (CEO (FF), Interviewee 23, Expert)		
		SU: "At that time, I was still a bachelor's student, [...] my first impression was that they work in a very structured way, but perhaps don't yet use the digital tools to the extent that they can be used to exploit all the added value." (Co-Founder & CEO (SU), Interviewee 34, Case D)		
Restrained cooperation readiness	The dimension "Restrained cooperation readiness" examines barriers to FSC.	Risk aversion	Quotes that demonstrate how risk aversion arises and influences FSC.	"And the question is, would you also do it if it was your money? If this question were to be asked more often, I would expect one or the other company to survive longer in the market. And of course, you don't create such a fast innovation as when you play high risk. But the risk of failure is also lower." (CEO (FF), Interviewee 10, Expert)
		Complexity due to individuality	Quotes that represent how the project-based nature and high individuality in construction impair FSC.	"And in principle, every construction site is unique. And what definitely makes life more difficult when it comes to digitization is that we have so many different participants along the value chain." (Digitization & Optimization (FF), Interviewee 14, Case C)
Leveraging a selection of effective measures to unleash FSC potential	The dimension "Leveraging a selection of effective measures to unleash FSC potential" includes measures to overcome barriers that arise prior to an FSC.	Trust-building	Quotes identifying trust-building measures to overcome FSC barriers.	"[...] beyond that, of course there's also a lot about sympathy and trust at such a moment, because otherwise you don't start working with three men at all, I'd say, after all, it's still money, it's still money. So the chemistry has to be good." (Head of Department (FF), Interviewee 18, Case A)
		Developing an enabling mindset	Quotes outlining the benefits of an empowering mindset towards FSC.	"We simply said, 'Let's see if we can invest a small amount of money in something that happens to fall over our feet or that we think is particularly good and interesting prospectively.' That was just such a fundamental decision." (CEO (FF), Interviewee 9, Case C)
		Financial incentivization	Quotes describing the impact of financial/economic factors.	"I think what's also a relevant factor is that we also said early on, 'hey, there's also a possibility besides the partnership, maybe you want to invest at some point.' Well, that's also another factor, because that's when you get people even closer on board. Because as soon as you have some kind of skin in the game, you might have a different motivation." (Co-Founder & CFO (SU), Interviewee 32, Case C)
Tried and tested management of challenges as they arise	The dimension "Tried and tested management of challenges as they arise" contains mechanisms to help address challenges that continue to arise during the FSC.	Perceived challenges during FSC	Quotes that highlight challenges that continue to arise during FSC.	"And I think, in addition to that, especially if you're in an industry where you don't have the 2, 3, 10 years of experience yourself, you're going to be sent in a certain direction by every new partner. And the fewer partners you have, the more clearly defined this direction is. But the more dangerous it is, because you can't get away from this direction." (Co-Founder & CEO (SU), Interviewee 19, Case C)
		Understanding and embracing FSC as an attention-intensive task	Quotes implying that FSC is a time-consuming matter that needs appropriate attention.	"Digitization in construction was an 'aha' moment for us when we realized that we also have to tell customers that they have to assign dedicated people to it." (Co-Founder & CTO (SU), Interviewee 37, Case D)
		Involving multiple FF	Quotes showing the	"Yes, so basically, that brings us back to the topic of authenticity and the topic of visiting

Future viability in the evolving and changing construction industry	stakeholders	importance of multi-stakeholder involvement within the FF.	the construction site yourself. I believe that regardless of whether a cooperation is formalized or not, regardless of whether the managing director says we will implement the software or not. In the end, you have to convince the users on the construction site." (Co-Founder & CEO (SU), Interviewee 19, Case C)
Future viability in the evolving and changing construction industry	Ensuring target-oriented communication	Quotes emphasizing the need for goal-oriented communication.	"And ultimately, I would say, as much transparency as possible, that is, especially with regard to the topic of data, of course FF C also shares sensitive data with us, cost data, time data from various processes, which you would not simply share with any company. And at the same time, of course, we also share, or had to share at the beginning, "what is the current software status? What can we do, what can't we do?" That means simply doing a lot of expectation management." (Co-Founder & CEO (SU), Interviewee 19, Case C).
	Sustainable direction	Quotes proving that FSC helps sustainably directing the company.	"But in general, I think, as I said, with startups you have the great opportunity to simply develop further, to position yourself more broadly and thus to be much better equipped on the market than if you only have one leg to stand on." (CEO (FF), Interviewee 7, Expert)
Future viability in the evolving and changing construction industry	Embarking on unknown, unconventional paths	Quotes describing how SUs can help FFS broaden their horizons.	"And that's why I see the necessity or the opportunity in startups, in terms of technologies, in terms of rethinking in a different direction, in order to do unconventional things and, yes, to get away from what we've been inoculated with according to the accepted rules of technology and whatever else, and big door openers, [...]." (CEO (FF), Interviewee 6, Expert)

Source: Own illustration based on interviews

Appendix 3: Exemplary Quotes From Case and Expert Interviews

Aggregate dimension	Theme	Exemplary interview quotes
Industry conditions and emerging trends have dichotomous implications for FSC potential	Nature of the industry limits FSC potential	Case A
		“This means that if a client and an architect say they want to build a wooden house, then a wooden house will be built for them. We are not asked to contribute too much innovation.” (CEO (FF), Interviewee 1, Case A) “I mean, construction is not innovative. There is no innovation in the construction kit. If there is innovation, it stems from manufacturers, from suppliers. But even there, it's modest.” (CEO (FF), Interviewee 1, Case A)
		Case B
		“The industry itself is very complex, simply because the work processes are all decentralized. I have my headquarters, I may have my construction yard, or I may have several of them. Then I have my various construction sites, and the bottom line is that everything has to be coordinated decentrally, i.e., machine flow, personnel flow, material flow, and so on. And that's quite a lot.” (Co-Founder & MD (SU), Interviewee 30, Case B)
		Case C
		“So it's actually almost not possible and otherwise, there are not many. At least not that I know of at this point. Products that displace others from the market or get larger market shares. That's what I meant just now, (...), what has arrived in reality, there is actually still not that much in construction. [Interviewer]: And what could be the reason for that? [Interviewee]: I think the whole myriad of certificates, TUV standards, all kinds of things that you need to be certified on the market in the first place.” (CEO (FF), Interviewee 9, Case C) “I mean, the special thing about the construction industry in general is, of course, the decentralized way of working - we're not stationary, but always have a construction site that's somewhere else. And in principle, every construction site is unique. And what definitely makes life more difficult when it comes to digitization is that we have so many different participants along the value chain.” (Digitization & Optimization (FF), Interviewee 14, Case C)
		Case D
		“Of course, as in every other industry and as everywhere in life, digitization also plays a role in this. (...) Construction is certainly still lagging miles behind the other industries. It certainly also has something to do with the fact that construction is organized in a decentralized manner.” ((Junior) CEO (FF), Interviewee 36, Case D) “But of course, there is also the fact that construction as an employer or as an industry does not have a particularly good employer image.” ((Junior) CEO (FF), Interviewee 36, Case D)
		Experts
		“And I have actually found that innovation is almost only to be found somewhere in demand-saturated markets or in highly competitive markets, where there is simply a need to develop new areas of business to be able to continue to survive in the market. And that's not such a problem in the construction industry, because the shortage of skilled workers simply ensures that companies can still achieve acceptable profits or returns with traditional business models, which everyone is actually happy with. That's why people are still a bit skeptical about innovation, yes, I don't want to say skeptical, but there's also little fire or external compulsion to say, “We have to bring about change now.”” (CEO (FF), Interviewee 5, Expert, Pos. 9) “And of course, we've had so much to do in recent years that we said, “Why should we bother with such nonsense here that we don't understand anyway? We have enough to do. We don't need all this.” And then we didn't embark on it either.” (CEO (FF), Interviewee 2, Expert) “We still have old regulations, a huge bureaucracy jungle, but (...) there is no demand for innovative products.” (CEO (FF), Interviewee 5, Expert)

		• "It is a rather conservative industry. It's an industry that develops very slowly, very inertially. An industry, I think, that has always been geared towards efficiency, and therefore perhaps also represents a rather harsh environment for startups." (CEO (FF), Interviewee 8, Expert) • "But there is hardly an industry that operates so close to marginal costs. In other words, the economic scope is not particularly large in many cases." (CEO (FF), Interviewee 10, Expert)
	Industry trends reinforce the need for Innovation/ FSC	Case A • "In other words, we are trying to digitize our value creation. I do see that as a trend. I am also in contact with many other medium-sized companies, where we are simply trying to exploit the digitalization capabilities that exist, from the planning stage to the construction site. There's a lot of potential there." (CEO (FF), Interviewee 1, Case A) Case B • "(...) up to last year, a more visual strategic cooperation, also in the form of an investment, which involves robotics, where we are simply convinced that this will definitely play a role in the construction industry in the future. Keyword skilled labor shortage and fewer (...) people who want to get their hands dirty on the construction site. And this can be remedied using robotics and artificial intelligence." (CEO (FF), Interviewee 4, Case B, Item) Case D • "If you look at the improvements or the optimizations, the increases in efficiency in the processes through digitization, that is enormous. And the construction industry, on the other hand, is lagging behind entirely." (Co-Founder & CTO (SU), Interviewee 37, Case D) Experts • "And the topic, "How do I deal with permanent change?" Because nothing is as constant as change. We only need to look at the last three or four years, with Corona, with the Ukraine war, enormously increased costs, framework conditions, and even more so the increase in the shortage of skilled workers." (CEO (FF), Interviewee 25, Expert) • "The only thing that can help is customer pressure or social pressure or an emergency situation, i.e., a real urgency. In other words, addressing certain topics, such as sustainability, helps you. It helps you to address the topic of BIM, the topic of digitalization, sustainability, topics like that, all of which are well known and sufficiently well known, and it helps." (CEO (FF), Interviewee 25, Expert) • "Then we have the whole topic of digitization. It's a trend that's coming up everywhere, and everyone has to deal with it. We have been dealing with it for some time now, or for many years. We are also trying to be at the forefront of this topic. Of course, it also consumes time and resources. But you have to participate in this, too. If you don't, you'll quickly be overtaken." (CEO (FF), Interviewee 2, Expert) • "I would say that startups are the drivers of digitization. Because it's all about good ideas that simplify work. And if someone has a good idea, then sooner or later it will be applied." (CEO (FF), Interviewee 16, Expert)
Shared motivation with impairments in internal challenges and partner perception	Similar motivation	Case A • "I believe that the requirements and the goals were to develop a solution that meets the requirements, i.e., on the one hand, of course, in terms of technology, but on the other hand, in the larger context, in terms of business." (Co-Founder & CEO (SU), Interviewee 15, Case A) • "(...) the people's motivation, if you just always say "I want to earn money as quickly as possible." Making money is fine, but that shouldn't be the main focus. There has to be an interest in the business model, that has to be there." (CEO (FF), Interviewee 1, Case A) Case B • "And then, of course, in the end, the added value that is expected for the company's own business model." (CEO (FF), Interviewee 4, Case B) • "Actually, I found it quite exciting or still do, because as I said, as I said to the fellows out there or in the construction yard, it's still something that is being developed and you can easily contribute and also maybe just do it in such a way that it's made easy for our needs." (Operations Scheduling (FF), Interviewee 13, Case B)

		Case C “But in the end, the expectation was that it would not just be a one-way flow of information in the direction of SU C, but that there would be some kind of exchange.” (Digitization & Optimization (FF), Interviewee 14, Case C) Case D “Very briefly perhaps, also that we then have such a (...) once and for all solution and do not have to start thinking again in five years, “do we perhaps need to do it differently?”” (Junior) CEO (FF), Interviewee 36, Case D) “The expectations were to get a practical solution that is tailored to us as a civil engineering company. Without us having to rework anything, without us having to make any compromises, but one that solves exactly our problems.” ((Junior) CEO (FF), Interviewee 36, Case D, Pos. 59) Experts “Except for a few ideas, I am free of ideas and would rather need someone who tells me, “This and that.” Where I then say, “Well, it’s clear, it’s logical, it’s derivable, wonderful, let’s do something about it.”” (CEO (FF), Interviewee 25, Expert) „In principle, a startup is, in my view, a think tank or perhaps even a research laboratory in the broadest sense for medium-sized companies. And you have to think about how you can simply earn money or how you can finance it.” (CEO (FF), Interviewee 23, Expert) „But the point is to get a completely new approach, new perspectives. And I believe that it is more fertile if this idea lies with an external partner and you yourself, in this case for example the construction company, the established construction company, contributes its ideas, its feedback, its everything that is possible. I think it’s more fertile that way than if you develop it yourself from within yourself.” (CEO (FF), Interviewee 8, Expert)
	Coping with individual challenges	Case A “And of course, it’s not always easy to find the right partner who says, “Hey, I’ll take the risk, I’ll invest money and in the end it’s yours.”” (Co-Founder & CEO (SU), Interviewee 15, Case A) “So (...) startups lack A, the practice-relevant expertise. There is a difference (...) between watching a cow graze and being present at a slaughterhouse. And the average start-up entrepreneur has relatively little idea about the things he wants to digitize. In theory, yes, but in practice it’s quite different.” (CEO (FF), Interviewee 1, Case A) Case B “So, I think as a startup, on the one hand, you have to prove yourself first. And prove, probably on the levels of, “hey, I can kind of speak from the domain knowledge, I can have a discussion there.” I think that’s a big point. Then sort of proving yourself on, “hey, if we discuss something, it’s going to be implemented.”” (Co-Founder & MD (SU), Interviewee 30, Case B) Case C “But the bottom line is that what we’re doing now is really super deep down in the industry. Very, very deep in the real processes, on the site itself, where you have to have a very, very deep understanding.” (Co-Founder & CFO (SU), Interviewee 32, Case C) “The first thing, of course, is to find partners, which is the critical resource. It’s not as if you found a company, somehow have an idea, and now all the construction companies come up to you and say, “Hey, we’re waiting for you, please let us start and change the industry.” Of course, it doesn’t work that way; you have to acquire the construction companies yourself as partners. (...) And I would be lying if I now said that we could have taken 50 partners and then decided on just those three. Of course, it wasn’t like that.” (Co-Founder & CEO (SU), Interviewee 19, Case C) “In the cooperation with SU C, it was obvious from the very beginning that they were not yet ready. We’re there to trial things a bit and let them take a look at our day-to-day work, so that they can test their software and develop it with our input. But you can’t do ten of these collaborations, or even five, at least not on the scale in which we operate.” (Digitization & Optimization (FF), Interviewee 14, Case C)

		Case D “That is to say, the typical problems that you then have, where you approach things in a very Dunning Kruger effect-like manner, saying, “I have no idea about the construction industry, but about software development.” Just start, do it, and you’ll quickly see that a lot of things are much more complicated than you originally thought.” (Co-Founder & CTO (SU), Interviewee 37, Case D) Experts “They often have great ideas but are not yet technically ready. So that’s how I’ve experienced it now, they have the right ideas, they have the right visions, but they need a partner from the real world somehow.” (CEO (FF), Interviewee 21, Expert) “Well, not everyone is suitable. Only a few people who dare to think outside the box can do that. Most of them, of course, deal with the actual construction problem because that’s what they’ve learned.” (CEO (FF), Interviewee 39, Expert) “The situation is that all resources are concentrated on managing day-to-day business somewhat successfully. And in such phases, many efforts to innovate are thrown overboard. Because smaller, medium-sized companies simply can’t afford to work side by side. They can’t afford it in terms of personnel, and they don’t want to afford it financially.” (CEO (FF), Interviewee 12, Expert)
	Initial partner perception	Case A “(…) Normally, such large companies are usually a bit, as I already said, carrier in the plot (…), which is completely normal from a certain size. I had the feeling that it does not take extremely long with FF A however, thus decision cycles did not take extremely long.” (Head of Marketing (SU), Interviewee 22, Case A) “Well, that they are at the cutting edge, that they are innovative, that they can fill the innovation gap that exists in the SME sector, especially in construction.” (CEO (FF), Interviewee 1, Case A) Case B “(…) for me, there are a bit like two, two types of (…) family-run companies out there. One is where the initial founder (…) is still running the company. I would say that the topic of digitization is very, very difficult for them to break through externally (…). And then, on the other hand, and this is also the case with FF B, the next generation is now coming into the company and, from my point of view, they are saying, “Are you all dysfunctional out there, the way we are running our processes right now, (…). And I think this Young Generation, which is sort of coming along, has the opportunity to drive that.” (VP Product (SU), Interviewee 27, Case B) Case C “In general, when you first come into the construction industry as an outsider, you first think to yourself, “okay, that can’t actually be the case, that everything works so well here, in quotation marks, even though the processes are still so chaotic in parts,” that especially in the companies themselves, for example, data is not shared properly at all, that the work is done super insularly, that this collaboration is also somehow missing in large parts.” (Co-Founder & CFO (SU), Interviewee 32, Case C) “I always find it interesting when such complex things are tackled with a seemingly simple approach or business model, which I always find cool and impressive.” (Digitization & Optimization (FF), Interviewee 14, Case C) Case D “I would say that with the construction industry I have found an industry that is very hands on, that can even forget about etiquette, (…) that can really give you hard-hitting feedback.” (Co-Founder & CTO (SU), Interviewee 37, Case D) “At that time (…) my first impression was that they work in a very structured way, but perhaps do not yet use the digital tools to the extent that they can be used to exploit everything in terms of added value.” (Co-Founder & CEO (SU), Interviewee 34, Case D) “Well, I think I sometimes find it impressive how they do it, how they are set up digitally, how they communicate with each other, how they organize themselves, (…). We don’t have that here.” (Junior) CEO (FF), Interviewee 36, Case D)

Restrained cooperation readiness		Experts • "Yes, they also have a culture that I can't transfer to our employees at all. They would say you are crazy." (CEO (FF), Interviewee 31, Expert) • "What we have noticed is that the big problem with start-ups is that they always think in terms of exit strategies." (CEO (FF), Interviewee 29, Expert) • "What has to be said, which is fascinating, for me, is the people's cleverness, their ability to get to grips with unfamiliar topics very quickly, but at the same time, in my eyes, the complete underestimation of the complexity, the process's complexity." (CEO (FF), Interviewee 23, Expert) • "And the startups we work with here are really cool products. I think they are also quite a bit ahead of the traditional market in terms of the scope of services or speed." (CEO (FF), Interviewee 5, Expert) • "That is, when we have contact with startups, it is mostly related to companies that are aiming somewhere at internal process optimization, (...). I notice that there are some startups that are already transferring existing ideas from other industries to the construction industry. Yes, there are startups, but I haven't really felt the big disruptive bomb yet." (CEO (FF), Interviewee 5, Expert) Case A • "I think a lot of family businesses struggle because the startups' business model is of course far, far away from the previous form of the previous business models." (CEO (FF), Interviewee 1, Case A) • "Yes, I think that is also important. Of course, many small companies are also afraid of this, saying "my know-how will then be passed on to others."" (CEO (FF), Interviewee 1, Case A) Case B • "And what is always a bit of a danger is that you might take up ideas that are too abstract and too freaky, that are still so far away that they are simply not gripping enough." (CEO (FF), Interviewee 4, Case B) Case C • "Because such a software conversion is of course always complex. I mean, (...) the more complex the implementation of a software is, the more reluctant you are to do it with a startup, because then you say, "Who knows if they'll still be there in five years, and then we'll be left with nothing."" (CEO (FF), Interviewee 9, Case C) • "Simply because it is also a bit like that, the companies are perhaps also in competition at the end. And then the question is, "Okay, to what extent do they want to develop this together with its competitor?"" (Co-Founder & CFO (SU), Interviewee 32, Case C) Experts • "Yes, of course we have a hard time with that because we don't like to introduce things in the company that have not yet been tried and tested, especially with software. Because when you change an entire company over to software that doesn't work properly, there's so much dissatisfaction, it's madness. And that's why we've kept our hands off it so far." (CEO (FF), Interviewee 16, Expert) • "And the question is, would you also do it if it was your money? If this question were to be asked more often, I would expect one or the other company to survive longer in the market. And of course, you don't create such a fast innovation as when you play high risk. But the risk of failure is also lower." (CEO (FF), Interviewee 10, Expert) • "So, when they set themselves up independently as a product, you have to be aware that everything you put into the start-up as know-how will be marketed at some point. So you basically give away your know-how." (CEO (FF), Interviewee 39, Expert)
Complexity due to individuality		Case B • "But what a lot of people don't understand, and that also makes it difficult, in this initial phase or generally in the accompaniment is, a lot of people want to digitize their "crap" process, then they basically have a crap digital process. That's sort of what's happening today. (...) Very few people, and this is what I get from a partnership corner, is that they don't think bigger. They don't say, "now let's look at this holistically," instead they are always very, very, very ad hoc driven." (VP Product (SU), Interviewee 27, Case B)

Leveraging a selection of effective measures to unleash FSC potential		• “Yes, I think that is a major problem in our industry, that it is difficult to set standards or offer standard products. Standard processes, yes, and that is also a bit of our focus and our maxim, that we standardize processes, but not the products, because we just don’t have the possibility.” (CEO (FF), Interviewee 4, Case B) Case C • “And that, of course, is also an issue. So if you think about BIM, which actually only makes sense objectively, but then fails because there is no uniform standard and everyone somehow does something themselves, but not really.” (Digitization & Optimization (FF), Interviewee 14, Case C) • “And in principle, every construction site is unique. And what definitely makes life more difficult when it comes to digitization is that we have so many different participants along the value chain.” (Digitization & Optimization (FF), Interviewee 14, Case C) Case D • “In other words, interfaces were an issue from the very beginning, and the challenge was that there was no standard. Well, there is a standard for some things, but often there is nothing at all. (...) We are happy to participate in new standards, because we simply see that this is the only way to be efficient. Whether it has to be an ISO standard is another question. But if you can at least somehow agree in the industry to say, “This is how we exchange data,” that’s a great deal.” (Co-Founder & CTO (SU), Interviewee 37, Case D) Experts • “(...) Startups are currently dealing with a lot of detailed problems in construction. But I think we are simply missing the big picture.” (CEO (FF), Interviewee 5, Expert) • “And now, through this whole startup culture that has developed, there are more and more very, very, very specific and very small-scale solutions, which therefore solve a specific problem. But that also means that if you got involved in every solution, the number of applications used in the construction sector would of course increase exponentially.” (CEO (FF), Interviewee 17, Expert)
	Trust-building	Case A • “Moreover, of course there’s a lot about sympathy and trust at that point, because otherwise you don’t start working with three men at all, I’d say, because it’s still money, it’s still money. So the chemistry has to be good.” (Head of Department (FF), Interviewee 18, Case A) • “What always helps, of course, is if you mention in a side sentence who you have actually already worked with in some way, regardless of how intensive the collaboration was or what was actually done.” (Co-Founder & CEO (SU), Interviewee 15, Case A) Case B • “Yes, I also look a bit at what other partners they have already convinced and taken on board.” (CEO (FF), Interviewee 4, Case B) • “And then (...) of course you also form your own opinion. How promising is the business model? What kind of founding team is it? Have they perhaps already founded somewhere else? What kind of resume do they have? Where did they study, where have they worked before? Yes, such questions all play a role there.” (CEO (FF), Interviewee 4, Case B) Case C • “With us, it’s very important to always try to understand their problems first. What kind of interest is there in finding a solution? What is the starting position of the company? What are the needs of the person you are talking to? And then to show what we have, how we can solve these problems with our solution.” (Co-Founder & CFO (SU), Interviewee 32, Case C) • “(...) we made sure that the partners were all located in this region, simply to be able to go to the construction sites and to have a personal exchange. Because especially in such a phase, where it is also a lot about trust and where the construction companies do not really invest in a product or a software, but rather in the people behind it.” (Co-Founder & CEO (SU), Interviewee 19, Case C)

	Case D • "Because we simply noticed that software companies have a bad reputation in the construction industry. And when they can see the whole thing live and in color and listen to people who actually use it and not those who create it, then it's all very different again." (Co-Founder & CEO (SU), Interviewee 34, Case D) • "And since we have known the CEO-Founder-FF and the company Founder-FF for 20 years, maybe even longer, and know that what they do usually works and is approached professionally, and we were also looking for a solution for this, we said, "We're in." (Junior) CEO (FF), Interviewee 36, Case D) Experts • "They always want to see, there are already X users, there is a support network, there are success stories showing that this has worked before." (CEO (FF), Interviewee 10, Expert) • "And there was a very big, a very, very big selling point that it was simply a good fit on a human level. The people involved harmonized well and were on the same page. And on a professional level, I think speed plays a very big role." (CEO (FF), Interviewee 17, Expert) • "In other words, simply appearing modern and progressive, but on the other hand not criticizing everything the customer has done so far." (CEO (FF), Interviewee 17, Expert)
Developing an enabling mindset	Case A • "I believe that the start-up business is definitely worthwhile for us and that it is also being promoted here. But simply because it is also, shall I say, practiced at the top. If you have someone in a family-run company who says, "I only want old and proven and I won't spend anything on new and dynamic," with the risk that it won't work out, then you don't stand a chance, it won't work out." (Head of Department (FF), Interviewee 18, Case A) • "And this willingness to change is simply very important. And a project like this also shows that even if it fails, I think it motivates people to be willing to change and also shows people that if it succeeds or could succeed, that a change also represents an improvement for the company. If you have seen and experienced these two or three times, then you are more open to the fourth than you were the first time. In that sense, it also has a cultural impact. Definitely." (CEO (FF), Interviewee 1, Case A) Case B • "But yes, you have to stay ahead of the game and be a role model. And set an example and keep showing the direction you want to take." (CEO (FF), Interviewee 4, Case B) • "And then, of course, it has great potential, this cross-fertilization of the young savages, who are highly motivated to come up with new digital, innovative ideas and then also promote or support family businesses, enabling them with external input, so to speak. And that is basically a very cool constellation, because the startups always need this feedback from the market and also want to be challenged to a certain extent as to whether their product is really what the market needs." (CEO (FF), Interviewee 4, Case B) Case C • "I would say that (...) the interest on the part of FF C was also there relatively early, simply because what we do is also very, very relevant for them. I think that's always very important, and there was definitely interest in somehow getting something going together." (Co-Founder & CFO (SU), Interviewee 32, Case C) • "That's why the speed and the, let's say, freshness of startups is definitely extremely good. And then you have to somehow combine the best of both worlds. All the experience that is available in the construction company with the approaches and ideas of such a startup". (Digitization & Optimization (FF), Interviewee 14, Case C) Case D • "They notice that it is part of the corporate strategy that we want to be innovative, that we want to be at the forefront of machine technology and, yes, as I said, I think the most important thing is that they notice that something is happening." (Junior) CEO (FF), Interviewee 36, Case D)

		• “And I do believe that this is a certain point of innovation, or perhaps a measuring point for innovation, in construction companies as well. How open they are towards it.” (Co-Founder & CTO (SU), Interviewee 37, Case D) Experts • “Recognizing transformation and perceiving it in its violence, anticipating where it is going. Even if much is in the fog and is a crystal ball. But positioning oneself to perceive changes as early as possible and to align the company as a whole with them. Innovation, development of R&D.” (CEO (FF), Interviewee 12, Expert) • “It also requires openness to simply approach people, perhaps to first sense an opportunity, at least. And then to approach the people and get together. To simply overcome the risk of being rejected or that the counterpart, in this case perhaps the startup, does not see this cooperation approach at all or perhaps has completely different ideas about cooperation.” (CEO (FF), Interviewee 8, Expert)
Financial incentivization		Case A • “I have a different approach and say it's not a competitive advantage whether I have good accounting or don't have good accounting or whether I know where my equipment is or not. But the more people join, the more the startup develops and the more I get out of it as well. If I remain the startup's only customer, so to speak, then the startup won't exist in three years. That's why I have a great interest.” (CEO (FF), Interviewee 1, Case A) • “And otherwise, for me, the way 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 of its own.” (Head of Department (FF), Interviewee 18, Case A) Case C • “I think what's also a relevant factor is that we said early on, “hey, there's also a possibility besides the partnership, maybe you want to invest at some point.” (...) because you get the people even closer on board. Because as soon as you also somehow have skin in the game yourself, then maybe you have another motivation as well or you also get more information that we otherwise only share with shareholders.” (Co-Founder & CFO (SU), Interviewee 32, Case C) • “Well, these are minimal, minimal amounts or minimal percentages that you have to pay somewhere. I don't know exactly how much that is on balance.” (CEO (FF), Interviewee 9, Case C) Case D • “I would say that the biggest barrier is actually trust. Because, of course, as a young company, you first have to take a leap of faith. I would also say that we earned it by being very attractive in terms of price at the beginning. That gave them an incentive.” (Co-Founder & CEO (SU), Interviewee 34, Case D) Experts • “So, when you work with a start-up, you actually have to reinvest or have a stake in it. Because otherwise everything that is reinvested will eventually be gone.” (CEO (FF), Interviewee 39, Expert) • “That's why there are lots of starting points for startups. And I think some startups are preaching to the choir if they do a little bit of acquisition and show companies, “Look what we can do here.” And then there are big eyes in amazement. And because they don't arrive like I don't know, the big consulting groups, who say, “Yeah, I'll be happy to advise you for €1,000 a day,” but they do it first and for very little money, and to that extent the threshold is also very low.” (CEO (FF), Interviewee 12, Expert, Item 44)
Tried and tested management of challenges as they arise	Perceived challenges during FSC	Case A • “And (...) we have grown as a company, of course. But as it is always the case, the tasks do not grow proportionally to the people, but instead people grow in line with the tasks and the work performance that is required. And that was of course a big challenge (...).” (Co-Founder & CEO (SU), Interviewee 15, Case A) • “So, with SU A, the biggest barrier has always been these points where we said, “now one part of the project is finished and if we want to continue, we have to invest more money and commission the next part.” And those were always the points, when it comes to money, it's

	basically a point where you question again, "are we still on the right track?". Does that make sense now? Is it justified for the next step and can I convince the CEO again?" (Head of Department (FF), Interviewee 18, Case A) Case B "It's not easy. Of course, everyone has a full workload and tries to get their work done. And then there are development topics that you have to deal with. It's always a balancing act. Especially in family-owned companies, which don't have big research and development departments that only deal with such topics, but instead have to work on the side, so to speak, which makes the whole thing slower." (CEO (FF), Interviewee 4, Case B) "The construction companies actually do a lot of the same things, but they all do them differently in some way. And that is one of our biggest challenges, to find a consensus (...)." (Co-Founder & MD (SU), Interviewee 30, Case B) Case C "Yes, these radical changes in the company. That's always the problem, whether internally in our company or in other companies, that you have to keep your employees on board somehow and not lose them. I would say that this is always an obstacle - also in terms of time." (Digitization & Optimization (FF), Interviewee 14, Case C) "I think one of the challenges is that when you're partnering with several companies, and everyone has their own wishes and ideas, you're also simply limited in terms of resources. And even if a certain user now wants something, and you would actually like to implement it, and think, "that makes sense," but you simply don't have the capacity for it." (Co-Founder & CFO (SU), Interviewee 32, Case C) Case D "Changing, changing players on the opposite side was a problem. Lack of personnel on the opposite side." ((Junior) CEO (FF), Interviewee 36, Case D) "That was a problem. And then, quite simply, the program development process. In some cases, they even gave us promises that they didn't keep." ((Junior) CEO (FF), Interviewee 36, Case D)
Understanding and embracing FSC as an attention-intensive task	Case A "So I hired an employee, a young employee, of course, who was supposed to handle this whole topic of internal billing, equipment, on a full-time basis, which had actually always run as a side business for us. And he then started researching the market and came across two startups that also dealt with this topic." (CEO (FF), Interviewee 1, Case A) "(...) So we split it up, always into sub-projects, simply the smallest possible work packages, the quickest possible successes, so that you can then also show the success of this project, partial success, internally at FF A as a basis for the next steps. That was always very, very important and also one of the positive factors for the overall project." (Co-Founder & CEO (SU), Interviewee 15, Case A) Case B "So that was really learning to test our hypotheses, but also in the end, so to speak (...)prototype testing, getting out there, "hey, now use this thing," standing next to it and looking at how it is used, how do you get people first of all somehow onto an end device (...)." (VP Product (SU), Interviewee 27, Case B) Case C "One of the founders then accompanied this project on the SU side and was really on the construction site two days a week and accompanied foremen from morning to night and looked at what he was doing and sought to see how he could do that in SU C or map it in SU C?" (Digitization & Optimization (FF), Interviewee 14, Case C) "But I think it's very, very important that these companies open up, that they also give startups the chance to visit them and learn. Because if there is no approach from the construction companies, the startup cannot develop a solution that adds value." (Co-Founder & CEO (SU), Interviewee 19, Case C)

		Case D • "Digitization in construction was an 'aha' moment for us when we realized that we also have to tell customers that they have to assign dedicated people to it." (Co-Founder & CTO (SU), Interviewee 37, Case D) Experts • "And that, I think, was also one of the successful levers for us to say, yes, this requires a personnel element today, 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 day-to-day business, then it becomes difficult." (CEO (FF), Interviewee 38, Expert) • "And I think that's also a bit of a message that you have to give to everyone. Even the startup people. It's all great. But remember, it takes time." (CEO (FF), Interviewee 2, Expert)
	Involving multiple FF stakeholders	Case A • "We said right from the start that the system is only good if it doesn't affect the employee at all, because it has to run fully automatically. Therefore, the test is positive, because people don't even realize it, put foolishly." (Head of Department (FF), Interviewee 18, Case A) • "And what I think also went down well was that we went up to the people and said, 'I have no idea what you're doing. I have this here, show me how you deal with it. I just want to accompany you, I'll help you. I've also got pants on that get dirty, I've got steel-toed shoes on, now we'll go off together and drive around for a day.'" (Co-Founder & CEO (SU), Interviewee 15, Case A) Case B • "You have to engage the employees, you have to convince them, you have to motivate them to embrace this desire for change. You may not be able to prove the added value to them right away. In reality, this is simply slower and more difficult. We then talk about the change process. And here my experience is simply that less is more and smaller steps lead, or it is actually the only way to the goal." (CEO (FF), Interviewee 4, Case B) • "And yes, we also try to tickle these ideas and improvements out of the employees, so to speak, because if they come up with it themselves, of course, then you don't need to motivate them much. Motivation is at its highest when they can implement their own ideas." (CEO (FF), Interviewee 4, Case B) Case C • "Yes, so basically, that brings us back to the topic of authenticity and the topic of going to the construction site yourself. I believe that regardless of whether a cooperation is formalized or not, regardless of whether the managing director says we will implement the software or not. In the end, you have to convince the users on the construction site yourself." (Co-Founder & CEO (SU), Interviewee 19, Case C) • "And then always proactively asked, 'Why do you do that? How does it work? Can I come along all the time?' Whatever. And I think people thought that was cool, because they could explain a bit and tell stories, and in the end they could see how the whole thing was developing." (Co-Founder & CFO (SU), Interviewee 32, Case C) Case D • "In fact, the users are much, much more important to us. We also say that before we sign a contract in any way, we first want to come on site and take a look at it on site, so that we can get to know the people on site. Because it doesn't help if the decision is made in an elite circle somewhere in a meeting room and you haven't even talked to the people who are going to use it later or even shown them what you can and can't do. Like in a relationship. Both have to say yes." (Co-Founder & CEO (SU), Interviewee 34, Case D) • "But you have to manage to build trust with the employees who will use it in the end. And you can do that, above all, if you're there, if there's a face there, so that they know, 'Ah, if I write to the support team now, it'll end up on their desk and it'll work.'" (Co-Founder & CTO (SU), Interviewee 37, Case D)

	Experts “And then I think that they also need certain success stories in the company at the beginning, that they can then also do storytelling. And it is always best implemented when employees tell their colleagues about their successes and why it is beneficial for them.” (CEO (FF), Interviewee 38, Expert) “We have developed our product in such a way that it is now available to the people in construction, it protects the people, it simplifies work for the builders and not for the customers. And that was also very, very important for me to do something for my own industry.” (CEO (FF), Interviewee 7, Expert) “And from my point of view, it would be most beneficial if the communication regarding feasibility and testing did not take place with the management or the boss of the medium-sized company, but on the construction site with experienced foremen from the lower management level. Those who are outside, who receive the plans, who then say, how should we do this, because they are the most creative.” (CEO (FF), Interviewee 6, Expert)
Ensuring target-oriented communication	Case A “So this issue of staying in touch weekly or fortnightly and having it reported is essential, I think, because otherwise this schedule simply takes on a life of its own.” (Head of Department (FF), Interviewee 18) “And I am always convinced that open and honest communication lasts longer and is more appreciated in the end than any promises that no one can keep. Especially in family businesses. And there's nothing wrong with not delivering on something you said you would. It's just important to communicate it and explain why you can't do it.” (Co-Founder & CEO (SU), Interviewee 15, Case A) Case B “The advantage of a family business is that the decision-makers are also the entrepreneurs. So you don't have five decision-making bodies that you have to pass through first, as is the case with some large corporations, where there are various departments for innovations and research and development. And then the decision is made quickly.” (CEO (FF), Interviewee 4, Case B) “I believe that this is a matter for the boss. (...) And that is also my argumentation saying, “Guys, the boss wants to try this, we are doing it now and this is how it is,” I think it also has an influence. And also towards the SU, because as I said before, (...) the CEO FF B must have made an agreement with them or must have made an agreement with them at that time.” (Operations Scheduling (FF), Interviewee 13, Case B) Case C “We also do working groups, let's put it that way, where you have a project with specific construction companies or partners or even consultancies and say, “Hey, we have this focus topic in product development, we want your expertise, our software development expertise, we'll bring it all together,” and then proceed, most of the work and input comes from our side, somehow concept development, but then in very close coordination with the companies.” (Co-Founder & CFO (SU), Interviewee 32, Case C) “And the third point is then also the very clear topic of expectation management, i.e., that we always communicate a timeframe in advance that is very conservative and then, in case of doubt, we prefer to be faster and people are excited about how fast we are and not just, “We'll do it in two weeks” and then we'll only be done after three months.” (Co-Founder & CEO (SU), Interviewee 19, Case C) Case D “And I would definitely, or I will say, in the future, when we do things like this, I will push for us to be more specific and more emphatic about our requirements. Say very clearly, “this and this is what we want to have and we want to have this in four weeks. And if we don't have it in four weeks, we want feedback, why not.”” (Junior) CEO (FF), Interviewee 36, Case D) “(…) you have the people sitting there who are involved. They have their own interest in moving this forward and they also move it forward. And a decision is made quickly and efficiently. That gets to the heart of it.” (Co-Founder & CTO (SU), Interviewee 37, Case D) Experts “Close exchange is essential, so that things are quickly reflected back to the developers when things don't work.” (CEO (FF), Interviewee 17, Expert)

Future viability in the evolving and changing construction industry	Sustainable direction	Case B “In terms of the soft aspects, you can already feel that the employees, people who were perhaps rather skeptical at the beginning, are becoming a bit more open and are bringing a bit more drive and dynamism to push things forward.” (CEO (FF), Interviewee 4, Case B) Case C “(…) because we originally said, or I personally said, the last few years have been quite good, but at some point the construction industry will decline again, and then that's quite good. Our entire company is actually structured in such a way that we are versatile and broadly positioned (…).” (CEO (FF), Interviewee 9, Case C) Case D “But what is much more important, I believe, is (…) the understanding of how it is done and that it is done uniformly and that there is also a willingness to do it differently. We don't even say that SU D-products make people work better, because if you look at family businesses, which have often been around for several hundred years, they can't work better, but they can work differently. And through the “different”, other potentials are released.” (Co-Founder & CEO (SU), Interviewee 34, Case D) Experts “But in principle, I think, as I said, with startups you have the great opportunity to simply develop further, to position yourself more broadly and thus to be much better prepared for the market than if you only have one leg to stand on. That's why I think it's a good option for both sides, I'd say, to develop.” (CEO (FF), Interviewee 7, Expert) “(…) in my opinion, today's construction companies need to position themselves more broadly. A startup is also a step toward broadening the company's portfolio. In other words, startups that expand a company's portfolio benefit the entire company. It's not just the startup that benefits.” (CEO (FF), Interviewee 7, Expert) “And that's the advantage, I think, of a startup, I allow it to operate in parallel and it doesn't hurt the existing ones. They feel confirmed that the others are just playing around. And for me, what they are playing around with is the connectivity for tomorrow.” (CEO (FF), Interviewee 25, Expert) Case A “It has helped in the sense that you deal with the topics more intensively, which you may not have done before. So I believe that the internal organization has become better as a result, regardless of whether the cooperation is working or not, if you simply deal with it.” (CEO (FF), Interviewee 1, Case A) Case B “I believe that those who are quick and radical now will be in a much stronger position in five to ten years than those who, I would say, are hesitant because they are afraid that they will lose, I don't know, some people, because they are somehow running into problems internally”. (VP Product (SU), Interviewee 27, Case B) Experts “We don't want to manifest what we have, (…) that's why I say, if someone comes along, a startup with a great idea, anytime.” (CEO (FF), Interviewee 7, Expert) “I think what start-ups can show us is that we shouldn't always think a process or an idea through to the end but should simply start doing it.” (CEO (FF), Interviewee 29, Expert) “(…) we are also constantly learning. So if there's one thing that has constantly driven us, which I mentioned earlier, it's learning from others. And we simply try to use simple ideas that are good to improve processes.” (CEO (FF), Interviewee 38, Expert)
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Source: Own illustration based on interviews