Alternative platform-based market-entry models and strategies: a smart construction case study[1]

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Abstract

Frame of the research. *Despite the expanded research and innovation activities related to smart construction, there remains a lack of empirical studies on the emergence of platform businesses and related market-entry models and strategies. Thus far, studies have focused more on the technologies themselves and on the single-firm level but less on platform-based value compositions at the ecosystem level.*

Purpose of the paper*. This study aimed to increase empirical understanding of the emergence of platform-based businesses from an ecosystem perspective and examine alternative market-entry models and strategies in smart construction.*

Methodology*. The empirical study is based on a longitudinal qualitative and multimethod case study conducted in Finland between September 2020 and December 2021.*

Results*. First, the results demonstrated the emergence of platform-based businesses from an ecosystem perspective and the co-design of related alternative market-entry models and strategies in smart construction. Second, five alternative platform-based entry models were classified with preferences among ecosystem actors. Furthermore, platform-based entry models seemed to embed several optional platform entry strategies. Third, the findings indicated the critical role of a clear visionary leader in orchestrating and facilitating a co-evolution process.*

Research limitations*. This empirical study is based on a single case study in an ongoing co-evolution state. Although the findings are tentative, they may open avenues for further studies.*

Practical implications. *This work provides a deeper understanding on the emergence and establishment of platform ecosystems in the field of smart construction. In particular, the adjusted conceptual frameworks may support ecosystem orchestrators and concerned actors when evaluating alternative market-entry models and strategies for further development.*

Originality of the paper. *This paper brings new empirical insights into the identified research gaps by demonstrating the emergence of platform businesses and ecosystem actors who are co-designing alternative platform-based market entry models and strategies in smart construction.*

Key words: platform business; entry models; entry strategies; smart construction; case study; digitalization

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1. Introduction

Digitalization has opened up new value creation opportunities throughout different industries. Indeed, the rapidly growing data and platform economy creates new innovation and value creation opportunities not only across industries but also beyond established linear value creation logics. Thus, the data and platform economy challenges, or even disrupts, established value chains, particularly in traditional industries, such as construction (e.g., Lappalainen and Aromaa, 2021; Maxwell, 2018). Despite digitalization trends and the use of advanced technologies that enable both improved efficiency and completely new value creation opportunities, the construction industry is struggling with significant productivity challenges worldwide. However, there are numerous ongoing research and experiments regarding digital solutions for complex, knowledge-intensive decision-making and orchestration in dynamic construction projects (e.g., Woodhead *et al.*, 2018; Zhao *et al.*, 2019; Jia *et al.*, 2019; Hall *et al.*, 2020). Furthermore, by enabling digitalization, the platform ecosystem approach can advance systemic changes that are crucial in tackling major challenges, such as sustainability in construction and the built environment (Lappalainen and Aromaa, 2021).

Despite the expanded research and innovation activities related to smart construction, there remains a lack of empirical studies on the emergence of platform businesses and related market-entry models and strategies. Thus far, studies have focused more on the technologies themselves and on the business potential at the single-firm level but less on platform-based value compositions at the ecosystem level (Leminen *et al.*, 2018; Mikkola *et al.*, 2020; Maxwell, 2018). Furthermore, a broader view of strategy considerations in the context of platforms is lacking (Pussinen *et al.*, 2023; McIntyre & Srinivasan, 2016). Therefore, the present study aims to increase empirical understanding on the emergence of platform-based businesses from an ecosystem perspective and examine related alternative market entry models and strategies in smart construction. This work builds on theoretical debates and recent studies regarding platform ecosystem characteristics as well as platform-based market-entry models and strategies (e.g., Gawer, 2014; Parker *et al.*, 2016; Stummer *et al.*, 2018; Woodhead *et al.*, 2018; Hein *et al.*, 2020; Sorri *et al.*, 2019; Isckia *et al.*, 2020; Wallin *et al.*, 2021; Karhu and Ritala, 2020; Valkokari *et al.*, 2022; Pussinen *et al.*, 2023), with a particular focus on the construction industry.

This empirical study, which is based on a longitudinal qualitative case study conducted in Finland between September 2020 and December 2021, aimed to examine the emergence of platform-based businesses in smart construction and the establishment of multi-actor ecosystems and co-innovating platform-based (value) offerings toward co-designing alternative options for market entry. This paper focuses on alternative platform-based market-entry models and strategies in smart construction. In the next section, the theoretical background is presented, followed by the methodology and case description. The paper continues with a summary of the main results and ends with a discussion of the results and a presentation of the study's conclusions.

2. Theoretical Background

This work combines theoretical approaches to the study of critical platform ecosystem characteristics with market-entry models and strategies. To narrow the identified research gaps, we aimed to increase empirical understanding on the emergence of platform-based businesses from an ecosystem perspective and examine related alternative market-entry models and strategies in the field of smart construction.

2.1 Platform ecosystem definition

The concept of a "platform ecosystem" has been widely adopted by both researchers and practitioners in the rapidly growing field of data economy. Platform ecosystems are created around technological platforms that are typically owned or governed by platform leader(s) that connect multiple sides of markets, including users, advertisers, developers, and content providers, to facilitate value co-creation and capture (e.g., Aarikka-Stenroos and Ritala, 2017; Hein *et al.*, 2020; Wareham *et al.*, 2014). As platform ecosystems enable nonlinear and dynamic value creation and capture, they also challenge traditional, linear value creation logic, corporate governance models, rules, and relationships between products and service owner(s), vendors, and users and how they are generated in emerging ecosystems (e.g., Parker *et al.*, 2016; Hein *et al.*, 2020). Within this field, the roles of actors have changed, becoming more diverse in recent years. Furthermore, the entry of new players has also become critical. In this context, (organizational) actors must make a strategic decision to negotiate their roles in the emergent platform ecosystem either as owners or, alternatively, as financers, coordinators, producers, facilitators, or developers (Hein *et al.*, 2020; Lappalainen and Federley, 2021; Valkokari *et al.*, 2017). According to Jacobides *et al.* (2018), ecosystem emergence is enabled by modularity and complementarities. Moreover, the core of ecosystems constitutes combinations of modular complementarities and shared rules of operation (Ibid; cf. Thomas and Autio, 2020).

2.2 Critical characteristics for establishing a platform business

A platform functions as a coordination and control mechanism of a business ecosystem, suggesting a paradigm shift from viewing the digital platform as a pure technological platform to approaching it as a platform-enabled business ecosystem with its own resources, assets, and actors (Valkokari, 2015; Thomas and Autio, 2020; Xu *et al.*, 2018). *Nevertheless, what are the critical characteristics required for establishing and orchestrating a platform business?* In their systematic literature review of key platform elements, Sorri *et al.* (2019, p. 9) concluded that there is a "great deal of variation within the sources regarding which characteristics are considered important when developing successful digital platforms." However, *value creation potential and logic* (which also includes the main actors), *network effects,* and *governance* seemed to be highlighted in almost all core references in their literature review. Therefore, these were chosen as the focus areas of our empirical study.

Value creation potential and logic involve the identification of actor roles so that value can be created, along with the ways by which the beneficiaries' attraction and commitment can be obtained in a one-, two-or multisided platform within a target market. Furthermore, as a critical differentiation from linear business logic, the *core interaction and mechanisms of network effects* must be designed. Core interaction is defined as the exchange of value that attracts most users to interact on the platform, thus enabling expansion beyond the original core interaction over time to ensure competitiveness and growth (Parker *et al.*, 2016). In addition, "network effects refer to the impact that a number of users of a platform has on value created for each user" (Parker *et al.*, 2016, p. 17). Thus, while enhancing scalability and defensibility, positive network effects are a fundamental source of value creation and competitiveness in a platform business. (Ibid; Gawer and Cusumano, 2014; Hein *et al.*, 2020.) To capture value, a revenue model for the platform must be carefully developed to achieve optimal and dynamic pricing (including other incentives) that can serve various actors (Lappalainen and Federley, 2021; Parker *et al.*, 2016).

Regarding *governance*, Hein *et al.* (2020) referred to three alternative archetypes of ownership: a central platform owner, a consortium of partners, and a decentralized peer-to-peer network to balance control rights against the autonomy of ecosystem actors (De Reuver *et al.*, 2018). A licensing platform and open source can be applied as alternatives to typical owner-based management models (e.g., Parker and van Alatyne, 2009; Parker *et al.*, 2016). Ownership status affects the evolutionary dynamics of an ecosystem in terms of how governance mechanisms, such as input and output control and decision rights, are exploited (Tiwana, 2014; Hein *et al.*, 2020). Therefore, the *openness of platform architecture* comprises both technical and collaborative/contractual mechanisms that enable the access and participation modes of key actor groups in value creation and innovation (Hein *et al.*, 2020; Tura *et al.*, 2018; Parker *et al.*, 2016; Lappalainen and Federley, 2021). It has been reported that the level of openness changes along with platform co-evolution, even though previous architectural and strategic design choices play an important role in the platform ecosystem life cycle (e.g., Isckia *et al.*, 2020). Thus, modular architecture makes growing complexity manageable during the platform ecosystem lifecycle.

In addition to these critical elements, Tura *et al.*, (2018) in their comprehensive platform design framework, highlight the concept of *platform competition*, which includes design considerations of a platform's launch, competitiveness, *innovation*, and scalability. Competitiveness in a platform launch and diffusion is achieved by attracting, reaching out to, and maintaining critical mass against incumbent or other new players. As the complexity of a platform ecosystem heightens, increased openness becomes a necessity, calling for different governance mechanisms to balance co-creation and value capture, as well as competition and collaboration within a co-evolving platform ecosystem against competitors (e.g., Hein *et al.*, 2020; Isckia *et al.*, 2020; Cennamo and Santaló, 2019; Letaifa, 2014; Lappalainen and Federley, 2021). Interestingly, Isckia *et al.* (2020) demonstrated how platform owners build capabilities and orchestrate

the coupling process between the innovation part and the business development part of platform ecosystems. Consequently, the growth of a platform ecosystem may be very slow in the early phases of its lifecycle despite the fact that businesses based on digital platforms are associated with rapid growth potential (Pussinen *et al.*, 2023).

2.3 Platform entry strategies

Although platform strategies have been studied widely, there is a need to better understand and clarify optimal entry strategies. In their systematic literature review, Wallin *et al.* (2021) identified 22 platform entry strategies under four main categories: (1) Onboarding, (2) Offering, (3) Opportunistic strategies, and (4) Pricing (the least important but not a focus in this paper). *Onboarding strategies* relate to the sequence of entry and preferred user groups. These include entry strategies, such as one-sided launch or simultaneous on-boarding by building multi-sided participation incrementally, marquee users' or producers' strategies, targeting users with dual roles, micro-market launch, and the so-called producer evangelist (e.g., Wallin *et al.*, 2021; Parker *et al.*, 2016; Stummer *et al.*, 2018; Evans and Schmalensee, 2010). This means that a platform must be designed to encourage producers to bring their own customers as users to the platform (Parker *et al.*, 2016, 96). Entry strategies, such as standalone products or services, coring, seeding, or exclusivity agreement strategies, may also be built on the *platform offering* (e.g., Wallin *et al.*, 2021; Parker *et al.*, 2016; Stummer *et al.*, 2018).

Meanwhile, *opportunistic strategies* consist of entry strategies in which the entrant platform avoids huge upfront investments in value creation and captures value the incumbent ecosystem's resources (Karhu and Ritala, 2020). Karhu and Ritala (2020, p. 2) identified three alternative strategies: (1) copying parts of those resources (exploitation), (2) following the development cycle of key boundary resources (pacing), and (3) placing itself inside the platform (injection) (cf. the piggyback strategy mentioned by Parker *et al.*, 2016). Essentially, these strategies challenge and may change the winner-takes-all logic and dynamic that is typical in the platform business (Ibid). Overall, according to Wallin *et al.*, (2021) studies indicate that, in business practice, these entry strategies are typically applied by combining several specific strategies. The competitive environment is changing so rapidly that agile strategies are necessary.

2.4 Co-evolution approaches of platform-based ecosystems: from generic to contextual frameworks

The emergence and co-evolution of platform ecosystems have mainly been studied theoretically or as ex-post studies of well-known global platform success stories (e.g., Isckia *et al.*, 2020; Sorri *et al.*, 2019). The most classical model of ecosystem co-evolution comprises the lifecycle phases of birth, expansion, leadership, and self-renewal or, alternatively, death (Moore, 1996). Based on empirical studies, respective sequential models have been proposed (e.g., Ketonen-Oksi and Valkokari, 2020; Letaifa,

2014), with an emphasis on ecosystem dynamics regarding value-creation vs. capture and collaboration vs. competition. Alternatively, Gawer (2014, p. 1246) presented an organizational continuum of technological platforms that features a corresponding organizational form, a set of accessible capabilities, and a corresponding type of governance for each degree of interface openness. By calling the framework a "continuum," Gawer (2014, p. 1246) demonstrated a kind of fluidity and the existence of possible evolutionary pathways between configurations (cf. Leminen *et al.* 2018). However, this generic integrative framework does not include a value proposition dimension.

The co-evolutionary approach to digital transformation *in the construction industry* illustrates the transition from a radio-frequency identification (RFID)-centric focus to an Internet-of-things (IoT) focus. The latter enables a combination of data from different sources to facilitate knowledge-intensive decision-making, even in real time, among various actors in construction projects (e.g., Woodhead *et al.*, 2018; Lu *et al.*, 2011; Zao *et al.*, 2019). However, as Woodhead *et al.* (2018) concluded, instead of combining point solutions, a key step for construction companies is to establish *strategy-driven IoT* ecosystems with long-term advantages. They defined the IoT ecosystem as "an integrated "layer" of hardware, software, connectivity, and information flows linked to key decision-making activities. This "layer" is much broader than the construction industry itself and includes all other industries that play different roles in a continually adapting built environment, such as a smart city. Accordingly, the ingredients of an IoT ecosystem are known in the construction industry. However, there is often a lack of a bold *vision* that "creates a synthesized possibility that stands on top of well-curated data that makes mining and using it in new applications easy to achieve" (Woodhead *et al.*, 2018, p. 42). Yet, they did not explicitly refer to a need for construction-related *ecosystem-wide digital platforms,* while Maxwell (2018) proposed re-thinking value generation enabled by a construction-industry-wide platform ecosystem in breaking boundaries between traditional sub-domains (Lappalainen and Aromaa, 2021.)

In summary, this study aimed to increase empirical understanding on the emergence of platform-based businesses from an ecosystem perspective and examine related alternative market-entry models and strategies in smart construction. The main research question is as follows: *What kinds of alternative platform-based market-entry models and strategies can be identified in smart construction?*

3. Methodology

A longitudinal case study approach (Yin 2003) was applied in the current work to empirically examine the emergence of the platform-based business ecosystem in the Finnish construction industry. The entire research process followed an abductive research approach, in which empirical and theoretical explorations were iteratively alternated and intertwined (Dubois and Gadde, 2002). The empirical research target was

related to the ambitious vision of six company partners, a research institute, and a public funding agency to establish a global smart building platform ecosystem. The two-year joint project adopted a strong multi-disciplinary research and co-innovation approach. This study aimed to examine the emergence of a platform ecosystem in *smart construction*, from establishing a multi-actor ecosystem to co-innovating a platform-based (value) offering and co-designing alternative entry models and strategies for market entry. The case study is described in more detail in the later sub-section. The aim of the studied platform ecosystem was to offer a complete platform-based solution for the construction phase serving needs of different stakeholders, facilitating the smooth flow of the construction process. The platform aims to enable several activities that can help customers build efficiently, mainly by connecting infrastructure with the material and people flows. It is a private network solution that is easy to deliver and install, providing much-needed service for a variety of stakeholders the construction sites. The seven proof of concepts (POCs), presented in Figure 1, illustrate different applications provided by the proposed platform, such as data-based productivity analytics and real-time monitoring of site resources.

3.1 The empirical research process

We selected participative observation, two-phased thematic interviews, and a collaborative business design workshop as the research methods to study the emergence of a dynamic platform ecosystem in real time. The longitudinal case study was implemented between September 2020 and December 2021 (Table 1).

Tab. 1: The methods of the empirical case study

Method	Time Schedule	Outcome
Participative observation in weekly Teams meetings, the field and company visit	Sep 2020-May 2021	Memos, presentation slides
Literature review	Sep 2020-Nov 2021	Research gaps & needs, concepts, methodology
First-round interview, N=13 Second-round interview N=12	Nov 2020-Jan 2021 May-June 2021	Recordings, memos Transcriptions, memos
Collaborative business design workshop among key partners N=14	October 2021	Photos of group works from the flip charts and memos

Source: our elaboration

Participative observations (Hennink *et al.*, 2011) in weekly Teams meetings as a shared practice of the platform ecosystem actors provided a better understanding of co-innovation and co-evolution as dynamic and long-term processes and facilitated the testing of tentative assumptions along with ongoing processes. Unfortunately, due to the COVID-19 pandemic, company and construction site visits were limited to only single opportunities.

Altogether, 25 thematic interviews, divided into two rounds, were conducted. The participants included representatives from various involved actors, such as builders, suppliers, and equipment rental companies, in addition to system integrators, technology integrators,

connectivity providers, platform architecture developers, and data analytics and application specialists. In the first round, the themes of the interviews covered the following: (1) current and future challenges in the construction and building lifecycle, (2) value co-creation opportunities specified in use cases, and (3) expectations regarding collaborations. In the second round, the themes included the following: (1) co-innovation as a process and its outcomes, (2) contributions to user experience goals, and (3) business opportunities and interests for a common platform ecosystem. The questions were specified according to the roles and responsibilities of the interviewees. Most of the interviewees were involved in both interview rounds, but some changes occurred due to dynamic participation in the co-innovation processes. Prior to their participation, all interviewees signed an informed consent form, which included information about the purpose of the study and data confidentiality.

As this was a longitudinal iterative case study followed by an abductive research approach, in which empirical and theoretical explorations were iteratively alternated and intertwined (Dubois and Gadde, 2002), the analysis was conducted in several phases throughout the empirical research. The main unit of analysis was the platform ecosystem. Moreover, the raw empirical data were rich enough to cover several research focus areas and were already used in several publications (e.g., Lappalainen and Aromaa, 2021; Aromaa *et al.*, 2021). The qualitative data analysis, which was guided by the research questions, was also based on the main interview themes listed above and the selected theoretical approaches. In a more detailed case description, we presented previous phases and outcomes of the platform ecosystem emergence and related case studies (see Section 3.2).

Furthermore, during the empirical study, the researchers realized that the raw empirical interview data allowed for the examination and construction of *alternative platform-based market-entry models and strategies.* Therefore, the analysis of raw interview data was refocused from certain themes, such as "expectations toward collaboration," "co-innovation as a process and its outcomes," and "business opportunities and interests for a common platform ecosystem." For this analysis, the research question was specified. In addition, a supplementary literature review was conducted regarding critical platform ecosystem characteristics to construct alternative platform-based market-entry models and platform entry strategies. These concepts facilitated preliminary thematic classification in an iterative analysis of selecting, coding, and categorizing the data, as well as further elaborating conceptualization (cf. Sekaran and Bougie, 2016). As a result, the researchers drafted five scenarios as platform-based entry models for the selected target construction market. These adjusted conceptual frameworks with case study results are presented in Table 3 (Results) and Figure 3 (Conclusions and Discussions). The researchers also presented these scenarios to the key ecosystem actors, who considered them relevant for further elaboration. For that purpose, the researchers prepared and facilitated a collaborative workshop for the key ecosystem actors (N=14). The program included an introduction, presentation of the customer case, step-by-step collaborative elaboration of the proposed five scenarios

(individually and within three groups), and a wrap-up among groups with a closing discussion. The researchers collected the scenario materials co-produced by the groups in the flip charts, along with memos from the groups and final discussions. These materials were utilized to finalize the comparison of five platform-based market-entry models and to compare them with entry strategies classified in the literature and presented in the theoretical background section.

3.2 Case description

The aim of the platform was to enable safe and smooth construction processes and to achieve a great productivity leap in construction projects by developing shared platform-based digital solutions. The co-innovation process followed the construction of the residential building and involved several project members, including solution developers, a builder, and a research partner. In addition, various actors joined the ecosystem activities throughout the co-innovation process.

The *co-innovation process and emergence of the platform ecosystem* were initiated by the system integrator (also serving as the key logistics solution provider), who took the orchestrator role and gathered critical actors. These participants represented different roles and specialized knowledge regarding building construction, the related materials' supply chains, and technology development. First, they focused on tracking and monitoring materials to improve material logistics in construction projects. However, due to the collaborative explorations, multiple use cases were co-created, thus expanding the scope from materials tracking and monitoring to rental equipment, people safety, and workflows, in addition to indoor conditions. Altogether, seven specified *Proof of Concept (POC)* projects were conducted as parallel co-development processes, which were combined with the digital innovation platform for data storage and sharing among the developers involved. The developed technology infrastructure was then installed at a real building construction site as a physical experimental platform, thus enabling the technical and user experience (UX) validation of POCs. In addition, POC owners, researchers, and the orchestrator conducted evaluations covering technological, data, business, ecological, and UX perspectives.

The *main ecosystem outcomes* resulting from the co-innovation processes are summarized in Table 2.

The new business opportunities related to the seven POCs are summarized in Figure 1: (1) construction site smart infrastructure, (2) equipment tracking and monitoring, (3) dust monitoring, (4) situational picture and analytics, (5) elevator UX, (6) private cellular network, and (7) building digitalization and data visualization.

As illustrated in Figure 1, the construction site smart infrastructure serves as the multi-layered basement for other POCs, thus benefiting different actors in complex and dynamic knowledge-intensive on-site and off-site activitiesthroughout construction projects and related supply chains. The business potential of each POC was evaluated as rather significant in terms of facilitating knowledge-intensive, real-time decision-

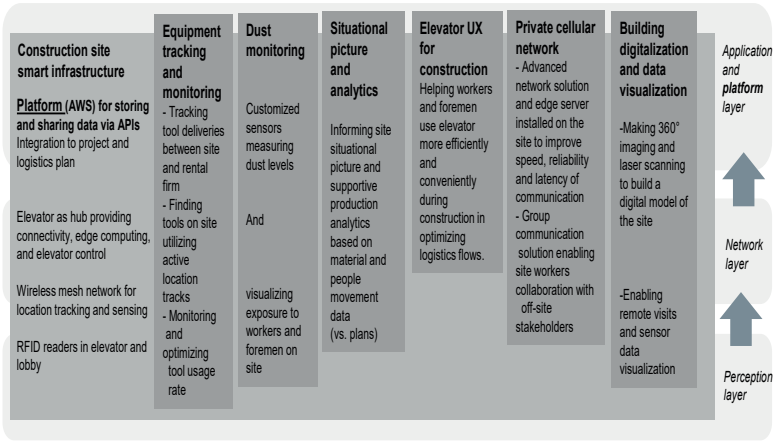
making, transparency, and communication among involved actors on-site and off-site (Aromaa *et al.*, 2021). According to several interviewees, even minor efficiency and productivity improvements can have considerable economic impacts on all involved actors (Ibid.). Moreover, the POCs based on complementariness form a *systemic platform-based value composition* with numerous scalable value co-creation and capture opportunities in the construction industry (cf. Jacobides *et al.*, 2018). Compared with single and separate point solutions (cf. Woodhead *et al.*, 2018), this was considered a *basis for differentiation and competitiveness*, even in the global construction market. However, as seen in Figure 1, there are also competitive solutions within the systemic platform-based value composition.

Tab. 2: Summary of the ecosystem outcomes

Vision	Co-innovation capabilities	New value creation and capture opportunities serving various actors	Platform business capabilities
Enabling safe and smooth processes and a great productivity leap in construction projects by developing shared platform-based digital solutions.	Critical complementary resources of ecosystem actors Joint innovation platform (data storage, transfer via APIs) Enabling selective Developer engagement (APIs, guidance, toolkits)	Seven POCs (Figure 1) providing systemic platform-based solution instead of separate single point solutions	Alternative scenarios for go-to-market models Contributions to alternative models for Governance, Business models and Technical architecture with Design principles

Source: Adjusted from Lappalainen & Aromaa, 2021, p. 11.

Fig. 1: Seven POCs posited in the IoT platform framework for the smart buildings

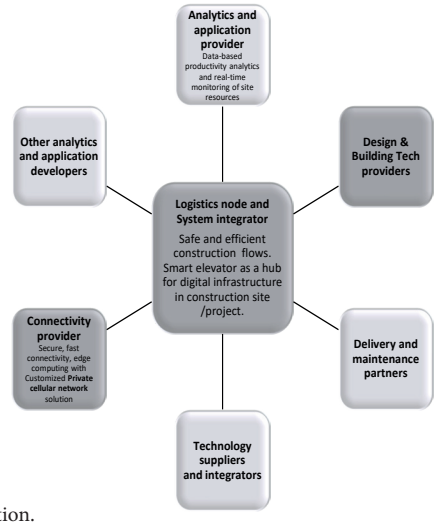


Source: Adjusted from Lappalainen & Aromaa, 2021, p. 11.

As part of the introduction to co-designing entry models in the collaborative workshop, the study participants were asked to specify critical ecosystem actors and related value offerings to ensure differentiation and

competitiveness in the selected target market. A simplified illustration of *the main actors and their roles in the platform-based value offerings* is presented in Figure 2, in which the participants were defined as having critical roles in terms of competitiveness and differentiation.

Fig. 2: The simplified illustration of the main actors with their roles in value offering



Source: Our elaboration.

The dark gray boxes illustrate key actors, whereas the light gray boxes represent numerous partners, mainly SME companies. As can be seen, the logistics node/system integrator serves as an orchestrator of a co-innovation process and an establisher of a platform-based innovation ecosystem. This actor was also considered a natural orchestrator of the platform business ecosystem. Both the orchestrator and connectivity provider are established pioneering and global players with local networks and partners in the areas of marketing, sales, operations, delivery, and maintenance. Among the design and building tech partners, there may be some key partners related to the smart building lifecycle. Furthermore, some design tech partners were identified as critical for competitive value offerings; however, the current co-evolved ecosystem lacked the presence of such partners. Overall, high-level security as well as standardized ontology, modularity, and interoperability were defined as the critical design principles that would enable the technological architecture to produce competitive value offerings.

4. Results

In this section, the main results are presented to address the study's research question: *What kinds of alternative platform-based market-entry models and strategies can be identified in smart construction?* The empirical findings are also integrated into the key concepts and literature presented in the theoretical background section.

4.1 Alternative platform-based market-entry models

As described in the Methodology section, the researchers generated five scenarios of alternative market-entry models based on the interview data gathered throughout the co-innovation process. We call these "scenarios" because they are still rather general and emergent. These five scenarios were introduced during the co-design workshop, and the participants were asked for further elaboration regarding two aspects: (1) *which of these were the most relevant scenarios and (2) why and whether there were still other alternatives to explore.* Based on the analysis, the researchers specified five alternative scenarios for market-entry models, including sales and marketing options and distribution, installation, and maintenance options. As seen in Table 3, the scenarios were compared based on critical platform ecosystem characteristics, namely, *Core interaction and network effects, Innovation potential, Openness (tech.+collab. architecture)* and *Governance*, which were presented previously in the section discussing the study's theoretical background.

Tab. 3: Summary of five scenarios for alternative platform-based market-entry models

Scenario /Elements	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**
Sales and marketing	1. Cross marketing and selling between Connectivity provider and System integrator 2. Direct marketing and selling by individual partners				
Value composition/offering base	Key partners' offering and related operations	Key partners' offering and related operations with *limited add-ons* by application developers	*Expanded* networked offering and related operations	Key partners' offering and related operations with *co-innovation potential*	*Joint* platform-based offering and operations
Platform decisions	Key partners operate in their company-specific platforms with necessary mutual (dyadic) interfaces	Key partners operate in their company-specific platforms with necessary mutual (dyadic) interfaces Connectivity provider serves *apps store -type platform* for SMEs	Analytics and application developer serves also platform for key partners /ecosystem	Key partners operate in their company-specific platforms with necessary mutual (dyadic) interfaces *Joint innovation platform* with developer portal	Joint platform among ecosystem actors
Core interaction and network effects	None	Limited	Expanded	Limited	Maximum
Innovation potential	Limited	Limited	Expanded	Great	Maximum
Openness (tech.+collab. architecture)	Closed	Selectively open	Selectively open	Selectively open	Several levels of openness
Governance	Value chain, Company-specific platform models	Value chain /Mixed	Platform licensing model	Shared ownership model, Platform licensing model, Central platform ownership model	Central platform ownership model
Distribution, installation and maintenance	1. System integrator responsible for installing and maintenance all digital infra in the construction site 2. Dedicated local partners of the System integrator installing and maintenance all digital infra in the construction site 3. Dedicated local partners of Connectivity provider installing and maintenance base stations				

Source: Our elaboration.

As seen in Table 3, the five alternative market-entry models vary in several critical ways. For example, Scenario 1 consists of key actors developing their current offerings by operating in their company-specific platforms with the necessary mutual (dyadic) interfaces. However, these platform decisions do not enable original core interactions (*data sharing and combining from multiple sources*) and mechanisms for network effects. Innovation potential is also highly limited due to the mainly dyadic

interfaces; thus, openness-in terms of technical architecture-can be defined as "closed." Therefore, the governance model is actually characterized as a traditional value chain model or as company-specific platform models, which does *not support to build on those agreed differentiation factors*.

Scenario 2 has the same basis as Scenario 1, but in addition, the connectivity provider serves an apps-store-type platform for SMEs. Therefore, to enable these kinds of value co-creation opportunities, selectively, openness is needed for Big Data sharing and combining, such as API interfaces between key actors and selected SMEs. Compared with a traditional value chain governance model, not only technical and collaborative boundary resources, but also new value creation logics (business models) are called for among actors. In fact, even selective/limited SME engagement allows serving multiple users in construction projects and sites (with an apps store). However, Scenario 2 still lacks a comprehensive, platform-based value offering as the *main co-defined differentiation factor.*

In Scenario 3, steps toward achieving this type of value offering and platform-based value creation logic are taken when the selected SME partner and analytics and application developer also serve a *joint platform for key partners.* A shared platform enables building on core interactions (data sharing and combining from multiple sources) and positive network effects (e.g., to attract SMEs as complementors and customers as end users). However, these, along with innovation potential, are defined only as "expanded" due to *reservations related to ownership of the platform and related governance and business models.* In such a scenario, the owner of the platform comes from outside the original partners of the platform ecosystem initiative; however, the company has the valuable strategic and complementary capabilities needed for a competitive and differentiated value offering and market-entry model. A platform licensing model might be considered the relevant governance model among platform owners and other key actors (e.g., the system integrator and the connectivity provider).

Similarly, Scenario 4 consists of the same basis as Scenario 1 while also including a J*oint innovation platform*. This platform decision has great innovation potential and calls for selective openness in technical and collaborative boundary resources to facilitate developer (SME) engagement. However, the fundamental elements of a platform business, such as *core interaction and network effects*, may sometimes be limited in the innovation platform (and activities), especially when key actors launch outcomes in their company-specific offerings and platforms. As shown in Table 3, several alternative governance models for joint innovation platforms can be identified. Further investigations are needed, which is the most relevant model for key actors to exploit innovation potential.

Finally, Scenario 5 is built on the original vision of a joint platform-based value offering, which is exploited via a joint platform among key partners for the benefit of expanding a multi-sided platform ecosystem. From the platform economy perspective, this platform decision enables maximum opportunities for core interactions and mechanisms of network effects to generate value in both business and innovation activities among diverse actors of multi-sided platform ecosystems. A central platform

ownership model seems to be the most relevant governance model with agile business models. In addition, several levels of openness are required in terms of technical and collaborative boundary resources.

Among the workshop participants, there were *different views of the relevant market-entry scenarios.* In particular, most of them shared the view of the key partners' offerings, in which key partners operate in their company-specific platforms with necessary mutual (dyadic) interfaces and supplement company-specific offerings. Furthermore, many of the participants supported the idea of exploring two alternative options to enable developer involvement. Scenario 2, including the digital marketplace for SMEs, was considered an important aspect of business-model entry and competitive customer/end-user experience. Scenario 4, which included a joint innovation platform, was also proposed to enable mutual data sharing, experiments, and transparency, in addition to feeding business co-innovation. However, the participants shared the view that a *joint platform ecosystem was not a relevant market-entry alternative (Scenario 5), although it may still form a long-term vision.* Furthermore, the participants agreed that a lead ecosystem partner is needed in all other options except Scenario 1, and plays a crucial role in the next steps to further elaborate these relevant scenarios among key actors.

Market-entry scenarios were supplemented with alternative channels for sales and marketing, distribution, installation, and maintenance, as summarized in Table 3. Cross-marketing and selling by key partners were mostly supported. This is because, as major global companies, they have established sales and marketing channels and direct customer relations (with construction companies). In addition, one group proposed joint ventures for agile sales and marketing. Many alternatives for distribution, installation, and maintenance models and partners were also supported. The participants also experienced difficulties in deciding on the optimal model when the offering was still under development. Although key global actors already possessed established channels and local partner networks for distribution and installation, the need for new specialized local partners was also identified.

4.2 Alternative platform-based market-entry strategies

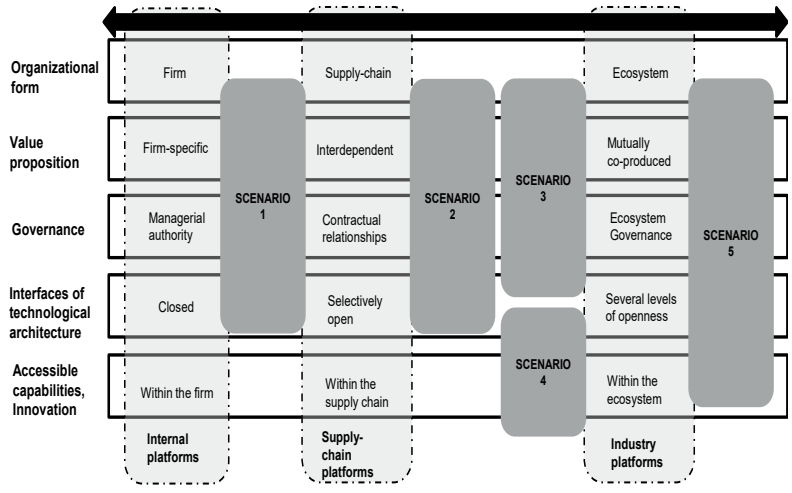
When reflecting on the results from market-entry models to platform entry strategies presented in the theoretical background section, the following interpretations can be made. First, the original vision of the platform ecosystem initiative investigated in the current study was based on *differentiation logic*, a typical concept applied in platform businesses (e.g., Karhu and Ritala, 2020). A complete and systematic platform-based value offering, including the entire digital infrastructure and AI-enabled analytics and applications for various construction ecosystem actors, was co-defined as the main differentiation factor against point-like solutions widely available in the selected target market. This characterized *offering-related entry strategy* is known as the exclusivity agreement, where offering exclusive high-quality content can help [in] signaling positive prospects for the platform and accelerate a platform's growth (Wallin *et al.*, 2021;

Stummer *et al.*, 2018). However, these platform entry strategies seemed to be valid mainly in Scenarios 3 and 5, which were not supported by the workshop participants. Instead, the platform entry strategy focused on onboarding (also known as *producer evangelism*) fit with all five scenarios. This strategy stresses the role of producers in bringing their own customers to the platform (Wallin *et al.*, 2021; Parker *et al.*, 2016). Finally, the study participants strongly supported building on key partners' company-specific platforms with the necessary mutual (dyadic) interfaces and supplementing company-specific offerings (i.e., *Opportunistic strategies*). However, it is important to note that investments cannot be avoided and "quick wins" in platform business may not be possible in the complex, institutionalized, and rather conservative construction market (cf. Karhu and Ritala, 2020; Hall *et al.*, 2020; Woodhead *et al.*, 2018; Maxwell, 2018).

5. Discussion

In Figure 3, alternative platform-based market-entry models are posited in the adjusted organizational continuum of technological platforms defined by Gawer (2014). This figure highlights the differences among the different scenarios, and the framework is supplemented with a value proposition dimension. Moreover, these scenarios were not only seen as alternative market-entry models but also as *co-evolutionary steps*, that is, from firm-specific and supply-chain-type platform businesses toward eco-systemic models and strategies. These findings are aligned with previous studies, which also illustrate diverse and novel opportunities instead of mere path dependency (e.g., Gawer, 2014; Leminen *et al.*, 2018).

Fig. 3: Alternative scenarios for platform-based entry models in the integrative framework



Source: Adapted from Gawer, 2014, p. 1246.

The previous literature also supports our research findings, indicating that while platform ecosystem approaches in the construction industry are particularly challenging, while necessary in pursuing systemic transitions, such as digitalization and sustainability (e.g., Woodhead *et al.*, 2018; Maxwell, 2018). Actually, Ikeda and Marshall (2019, p. 34) proposed this kind of "Platform over Platform" strategy as the most advanced entry strategy, in which "by offering their customers even more compelling and unique cross-platform experiences, entrant(s) can create new mega-platform environments, overarching existing, otherwise successful platform systems".

In summary, first, the longitudinal empirical case study *demonstrated the emergence of platform-based businesses from an ecosystem perspective,* as well as the co-designing of related alternative market-entry models and strategies in the smart construction industry. The original platform ecosystem initiative in smart construction proved to have a very ambitious long-term vision and was challenged throughout the emergence of platform-based ecosystems. To enable novel data and platform business opportunities, there were complex issues to be solved beyond traditional industry borders as well as business and institutional logics. However, the basement was co-developed for the "construction flow ecosystem."

Second, five alternative scenarios for *platform-based market entry models were classified based on critical platform ecosystem characteristics* (e.g., Sorri *et al.*, 2019; Parker *et al.*, 2016; Tura *et al.*, 2018; Hein *et al.*, 2020; Isckia *et al.*, 2020). These scenarios highlighted some variations in preferences among the key ecosystem actors. Furthermore, platform-based entry models seemed to embed several optional *platform entry strategies.* This finding is aligned with previous studies, which indicated that in actual business practice, these entry strategies are applied by combining several specific strategies (e.g., Wallin *et al.*, 2021; Parker *et al.*, 2016). Competitive environments change so rapidly that agile strategies are necessary.

Third, the *holistic conceptual frames* (Table 3 and Figure 3) to compare the identified and subsequently developed alternative market-entry scenarios were structured and adjusted based on earlier literature (e.g., Gawer, 2014; Parker *et al.*, 2016; Tura *et al.*, 2018; Sorri *et al.*, 2019; Isckia *et al.*, 2020). Moreover, they could be seen not only as entry models but also as alternative development steps.

Fourth, the results indicated the critical role of the *clear visionary leader* in orchestrating and facilitating a co-evolutionary process from platform-based innovation toward a platform-based business ecosystem. As earlier platform ecosystem literature shows, platforms are typically established around a focal actor (e.g., Valkokari *et al.*, 2017; Hein *et al.*, 2020; Isckia *et al.*, 2020; Valkokari *et al.*, 2022). In the case study, the main focus was on the co-innovation process and the development of platform-based value offerings among ecosystem actors across traditional industry borders. Furthermore, the first initiatives for co-designing alternative market-entry models were taken to direct further development among key ecosystem actors-a process that revealed the crucial need for common strategic alignment and the guidance of a visionary leader or orchestrator.

6. Conclusions

This study aimed to increase *empirical understanding* on the emergence of platform-based businesses from an ecosystem perspective and examine related alternative market entry models and strategies in smart construction. In this study, such explorations were based on recent discussions on platform ecosystem characteristics as well as platform-based market-entry models and strategies. Regarding its *main theoretical implications,* the study brings forth new empirical insights into the identified research gaps by demonstrating the emergence of platform-based innovations of alternative platform-based, market-entry models and strategies in the smart construction industry from an ecosystem perspective. This study contributes to the literature by structuring and adjusting conceptual frames to analyze the identified alternative platform-based entry models and strategies.

As for the study's *practical implications,* a deeper understanding is provided regarding the emergence of a platform ecosystem in an establishment within the field of smart construction. In particular, the adjusted conceptual frameworks may support ecosystem orchestrators and actors involved in evaluating alternative market-entry models and strategies for further development. This supports the practice-oriented generalizability of our findings, and the, allowing the study to contribute to the very limited literature on strategy considerations in the context of platforms. In other words, the identified entry models and strategies can be generalized in other industries, especially in different business-to-business contexts. Thus, the findings also illustrate how platform-based businesses do not "fit" into the core business logic and culture of a traditional, pipeline-based business, as they require strategic considerations among multiple actors.

Regarding its *research limitations*, this empirical study is based on a single case study undergoing a co-evolution state. Thus, the empirical findings are only tentative and not generalizable; instead, they open avenues for further studies. Therefore, further research may need to continue this study by conducting a follow-up investigation into the subsequent co-evolution phases of a platform-based business ecosystem. Another option would be to expand a single case study into new cases to increase the amount of empirical evidence and verified conceptual frames, as well as to gain a better understanding of platform ecosystem emergence and relevant market-entry models and strategies. Doing so can help support the implementation of the eco-systemic changes that are needed in the construction industry.

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