Leveraging the Benefits of Modularity in the Provision of Integrated Solutions: A Strategic Learning Perspective

Anna Salonen, University of Turku, Turku School of Economics, Department of Marketing and International Business, Rehtorinpellonkatu 3, 20500 Turku, Finland

Risto Rajala, Aalto University, School of Science, Department of Industrial Engineering and Management, Otaniementie 17, FI-02150 Espoo, Finland

Ari Virtanen, Access Control and Integration Solutions, Kone Corporation, Keilasatama 3, P.O. Box 7, Espoo 02150, Finland

Abstract

The purpose of this study is to improve the current understanding of the ways a manufacturer can learn to leverage the benefits associated with modular solution designs in its transition to a solution provider. We find that a modular solution design acts as a key integration mechanism, allowing the provider to orchestrate actors in the supply network for simultaneous exploitation of resources related to the existing solution modules and exploration of new ones. Yet, to implement a modular solution design effectively, the provider needs to engage in strategic learning that improves its ability to explore customers' readiness to adopt new types of solutions, while it develops an ability to deploy the derivative solutions by utilizing the resources related to its core product business. Mastering the co-evolutionary processes of strategic learning that combine elements of explorative and exploitative learning facilitates a pursuit of the industrializer path to service-based growth. For managers, our findings demonstrate the ways a manufacturer may unlock the economies of scale in solution business by leveraging the benefits of a modular solution design.

Keywords: solution business, integrated solution, modularity, industrialization, strategic learning, case study

1 Introduction

Management scholars have long argued that sustained competitive advantage requires from the focal firm the ability to capitalize on both opportunity-seeking exploration and advantage-seeking exploitation (March, 1991; Levinthal & March, 1993). However, in the solution business context, it appears difficult for manufacturers to manage the service transition process in a way that enables taking advantage of both explorative and exploitative learning. In particular, manufacturers often struggle to find effective ways to explore solution business-related market opportunities, while exploiting established manufacturing-based competences (Windahl & Lakemond, 2010). One of the reasons is noted by Benedettini et al. (2015), who suggest that service transitions change the manufacturer's relationship with its external environment, while causing internal frictions in integrating service processes, values, and competences into organizational practices.

The efforts of the scholarly community to address the challenges related to the service and solution-based business have resulted in several significant contributions, such as a special issue of *IMM* (Evanschitzky, von Wangenheim & Woisetschläger, 2011). Yet, the managerial impact of these contributions is arguably constrained by the tendency of marketing scholars to emphasize content over process (Martens, Matthyssens, & Vandenbempt, 2012). Thus, while it is well understood based on prior research *what* solution business is, less is known about *how* manufacturers learn to incorporate its key design principles into effective organizational practice.

To contribute to this gap in existing understanding, the purpose of this study is to develop a better understanding of how manufacturers learn to leverage the strategic benefits associated with modular solution designs. In doing so, we build on the idea that firms engage in strategic learning processes to facilitate the interpretation, implementation and dissemination of knowledge related to opportunity-seeking exploration and advantage-seeking exploitation (Kuwada, 1998; Siren, Kohtamäki, & Kuckertz, 2012). Accordingly, we draw on nearly a decade of research, to explicate how in implementing a modular solution design, a provider of smart building solutions has engaged

in a strategic learning process that has facilitated its ability to transition beyond project-based integration of solutions. In other words, through leveraging of the strategic benefits of modularity, the firm has developed an ability to deploy integrated solutions on an industrial scale as part of its core product operations. At the same time, it can flexibly integrate internal and external resources into tailored customer solutions. This facilitates its ability to both explore and exploit solution business-related market opportunities.

Through an analysis of the strategic learning process tied to the implementation of a modular solution design in a longitudinal case study setting, we contribute to an organizational learning perspective on solution business, which is missing from prior research in the field that has relied on conceptual and static cross-sectional approaches. Our research demonstrates that the benefits of modular solution designs extend far beyond the avoidance of costs related to project-specific integration of solutions (Davies et al., 2006; Davies et al., 2007; Storbacka, 2011). In implementing a modular platform-based solution, the provider improves its ability to explore customers' readiness to adopt new types of solutions, while ensuring that the derivative solutions can be deployed utilizing organizational competences developed for the core product business. This ability is crucial for the "industrializer" path to service growth (Kowalkowski et al., 2015), but requires a prolonged period of strategic learning during which the provider redefines its design process used to integrate solutions (Kuwada, 1998).

The paper is structured as follows. Section two presents the conceptual background for our research. Section three discusses the methodology. In section four, we present the case analysis and findings. The last section discusses the implications and conclusions of the study.

2   Conceptual background

A substantial body of literature concerning manufacturers' transition towards service-based growth has focused on explication of solution business. Prior research has conceptualized solution business

as a type of service-based business model (Storbacka, 2011) that requires an ability to engage customers in relational processes during the various phases of the solution life cycle that precede and follow the integration of product- and/or service-based components into customized responses to complex customer needs (Tuli et al., 2007; Evanschitzky et al., 2011). A typical transition to solution business involves extending the manufacturer's scope of supply through seamless integration of previously disintegrated product-based components into functional systems (Matthyssens & Vandenbempt, 2008) and efforts to offer increasingly sophisticated forms of post-deployment support services to customers (Ulaga & Reinartz, 2011).

In many cases, solutions are developed ad hoc, in close collaboration with customers, requiring project-based efforts to manage technical application integration of the solution components (Davies & Brady, 2000; Matthyssens & Vandenbempt, 2008; Kowalkowski et al., 2015). However, to succeed in solution business, providers arguably must not only look for ways to develop more complex offerings through the integration of previously disintegrated subsystems, but also balance these efforts with standardization activities that lead to offerings that are more easily repeatable (Salonen, 2011; Storbacka, 2011). Pre-defined solutions require less project-specific efforts to integrate solution components into a functional whole, which lowers the costs and operational complexities related to provision of integrated solutions. Thus, efforts to limit variety through specification of pre-defined solution configurations enhances the provider's value appropriation capabilities and helps to unlock volume in solution business (Storbacka, 2011; Kowalkowski et al., 2015).

Development of industrialization capabilities is particularly important for solution providers following the "industrializer" path to service growth (Kowalkowski et al., 2015). Such firms seek to capitalize on the knowledge and experience gained from more complex projects by finding ways to downsize and standardize solution offerings (Ibid). While difficult to realize in practice, it is believed that key to pursuing the industrializer path to service growth lies in the adoption of a

modular solution design consisting of a "basic modular system and its standardized components" (Davies et al., 2007, p. 186).

The modularity of a solution can be considered as a continuum describing the degree to which the components of a solution can be separated and recombined through predefined interfaces (Schilling, 2000), thus facilitating cost-effective customization of solutions (Davies et al., 2006; Davies et al., 2007; Storbacka, 2011; Roehrich & Caldwell, 2012). More recently, it has been suggested that solution providers leverage modularity to accommodate the growing complexity of solution networks (Eloranta & Turunen, 2016). In other words, given that solutions can be considered as bundles of knowledge-based components that are integrated by the focal firm into functional solutions (Valtakoski, 2017), the ability to orchestrate networks of actors in support of solution provision is thought to be an increasingly crucial task (Windahl & Lakemond, 2006; Davies et al., 2007; Gebauer, Paiola, & Saccani, 2013; Jaakkola & Hakanen, 2013). The more complex and extensive the offering, the higher the coordination costs and the greater the operational risks (Nordin et al., 2011).

Research on applications of modularity principles in the service context is scarce. While some work has been done in the field of service modularity, this research focuses purely on service-based components (see e.g., Pekkarinen & Ulkuniemi, 2008). Here the task of developing standardized interfaces between the integrated components is likely to be easier than in cases requiring integration of physical component interfaces. The research stream that addresses complex product systems as integrated combinations of both physical and service-based components (e.g., Davies et al., 2007) assumes that conditions supporting modularity are present at the industry level (Schilling, 2000). However, given that manufacturing industries are not characterized by a similar degree of open standards as are, for instance, ICT-based industries, it can be expected that solution providers will struggle to design and integrate externally sourced product and service components into functional solutions for customers. Doing so is likely to require purposeful steps towards

modularizing the solution offerings and the processes that link actors in these service systems (Vervest et al., 2004; van Liere et al., 2004). However, very little is known about how these processes translate into functioning organizational practice.

To better understand how manufacturers learn to leverage the strategic benefits associated with modular solution designs, we next discuss the generic principles of modularity and then introduce the central principles of Kuwada's (1998) strategic learning framework. This lays the basis for the analytical framework that we draw upon to understand the learning processes relevant for our study.

2.1 Characteristics of modular solution designs

The generic principles of modularity are well understood through work done in the field of operations management. Baldwin and Clark (1997, p. 84) define "modularity" as "building a complex product or process from smaller subsystems that can be designed independently yet function together as a whole." Modularity can be analyzed at the level of products, organizations, and production systems (Sanchez & Mahoney, 1996; Schilling & Steensma, 2001).

The extent to which systems migrate towards increasing or decreasing modularity depends on the presence of multiple conditions that may reinforce each other (Schilling, 2000). For instance, the heterogeneity of both component inputs (diversity in technological options and differentiation in firm capabilities) and customer demands favors modularity at the system level. This effect can be amplified by environmental changes such as increased competitive intensity. A focal firm that is active in an industry not characterized by modular conditions will have to develop specialized interfaces that coordinate the functions among a set of components supplied by specialized vendors (Schilling, 2000).

At the product level, the principles of modularity give rise to "platform thinking," an approach to new product development that focuses on the commonality of subsystems to diffuse

them across projects (Gawer, 2014). Platforms use an architecture that designates core and peripheral modules with core modules embodying the company's valuable core capabilities on market understanding, product and production technology, and distribution capability (Meyer & DeTore, 2001). The interfaces between the core and peripheral modules determine how the modules of the system work together (Baldwin & Woodard, 2008). For the purposes of this study, we define a modular solution design as consisting of a platform that is based on a predefined architecture. This architecture specifies the core and peripheral solution modules that connect to each other via standardized interfaces. To understand how a manufacturer may learn to implement the conditions characteristic of modular solution designs, we now discuss the central principles of strategic learning as outlined by Kuwada (1998).

2.2 Learning to implement a modular solution design

The strategic learning framework addresses the creation and distillation of strategic knowledge, and the integration of that knowledge into an ability desired by the focal organization. Strategic learning is distinct from business learning, which applies to specific problem areas, but does not lead directly to a redefinition of the organization's strategic behavior. Based on this view, a requirement of strategic learning is acquisition of corporate-level knowledge that prompts changes in the firm's basic assumptions and then in its strategic behavior. (Kuwada, 1998)

Subsequent research has conceptualized strategic learning as a mediating construct between exploratory and exploitative learning (Siren et al., 2012). Thus, strategic learning can be understood as a higher-order learning mechanism that facilitates the firm's ability to internalize and apply strategic knowledge generated through opportunity and advantage-seeking activities (Ibid). Given that solution providers typically explore solution business-related market opportunities in close collaboration with customers through ad hoc projects well before they begin to exploit these opportunities through building of industrialization capabilities (Kowalkowski et al., 2015), the distinction between explorative and exploitative business-level learning is useful for the purposes of

this study. Figure 1 depicts how we adapt key aspects of the strategic learning framework to formulate the analytical framework for this study.

When applying strategic learning to the solution business context, we assume that in the initial stages, the solution provider acts as a systems integrator (Davies et al., 2007) and its strategic design processes (Kuwada, 1998) center upon integrating an expanded set of solution components into customer-specific solutions through project-specific integration organized separately from its core product business (Valtakoski, 2017). Such activities are likely to contribute to business-level learning that allows the provider to explore emergent, service-based market opportunities. However, without an organizational integration mechanism that allows knowledge from exploratory actions to be exploited by the entire organization, the provider will likely struggle to manage a profitable transition to solution-based business on a larger scale (Windahl and Lakemond, 2010).

To overcome these inherent challenges, we assume that at some stage in the solution transformation process, the focal firm undergoes a strategic learning process during which it manages a shift from project-specific integration to the provision of modular, platform-based solutions. During this learning process, the solution provider redefines its design process used to integrate solutions, which requires a change in its basic assumptions about the optimal organizational arrangements that should be applied to integrated solution provision. By implementing a modular solution design based on a platform architecture (Meyer & DeTore, 2001), the provider then specifies core and peripheral solution modules that connect to each other via predefined interfaces. These modules can be integrated and configured into customer-specific solutions without the need for project-based integration.

We explore the strategic learning process and associated benefits of implementing a modular solution design through our in-depth case analysis. In doing so, emphasis is placed on understanding how the focal firm has developed an ability to leverage the benefits of a modular solution design in a way that capitalizes on both exploration- and exploitation-based strategies. We expect such an ability to support a transition to the industrializer path to service growth, which based on prior research, is difficult for solution providers to manage (Kowalkowski et al., 2015).

3 Research method

Our research explains how a manufacturer learns to leverage the strategic benefits associated with modular solution designs. As the understanding of this complex phenomenon requires the collection of rich, longitudinal data in a real-life context, we relied on a single case study (Siggelkow, 2007). Our research follows the guidelines for abductive research, combining inductive and deductive phases (Dubois & Gadde, 2002; Locke, 2010). Abductive research allows iteration between the empirical context and the model world thereby facilitating the process of theorizing from case study research (Locke, 2010).

3.1 Case selection and research approach

The case selection was purposeful, with the aim of learning something based on the case at hand rather than seeking representativeness (Patton, 2002). We hoped to arrive at a detailed understanding of a complex phenomenon in a single case setting (Gummesson, 2000; Patton, 2002). The case firm, Kone Corporation, is a globally operating provider of integrated, smart building solutions. Smart building solutions are intelligent subsystems that make the buildings in which they are installed "smarter." Some examples are automated access control and signage solutions attuned by the identification of individual users. Other well-known examples include automated heating, lightning and air conditioning based on user profiling and data analytics. Kone Corporation has

moved from solutions integrated as projects to the provision of integrated solutions based on a modular solution design.

Our research was conducted in stages from 2006 to 2015, and has drawn upon several data collection methods: archival search (internal documents, memos, marketing material, correspondence and bulletins), participant observation (Jorgensen, 1989; Spradley, 1980), formal semi-structured interviews, and informal conversations (see table 1). Similar approaches have been used in numerous studies in management research (Langley et al., 2013). As is typical of the abductive approach, the research questions outlined in this study were not included in the research agenda when the data collection in the case firm began in 2006. Instead, the initial empirical observations identified new issues that were then explored as data collection progressed (cf. Dubois and Gadde, 2002).

Similar to Martens et al. (2012), the data in this study was collected in distinct research projects spanning the years 2006-2015. The initial wave of interviews (2006-2010) was conducted as part of a larger research consortium that examined the growing propensity of manufacturers to transition to solution business. Kone was one of the many companies studied within this project. The researchers maintained an ongoing collaboration with Kone beyond this initial project, tracking the development of its solution business over time. The second wave of interviews was conducted between 2013 and 2015. Its purpose was to understand the transformation in Kone's approach to solution business, which focused on implementation of a modular solution design. In the second stage, this study benefitted from participant observation through inclusion of an inside researcher (Langley et al. 2013): a key executive responsible for implementing a modular solution at Kone.

3.2 *Data collection methods and data analysis*

This research develops a comprehensive understanding of the phenomenon under study in its real-life context involving extensive, in-depth involvement with the case firm. As noted by Langley et

al. (2013), the inclusion of both inside and outside researchers facilitates a combined understanding of the local setting with the possibility for distancing, which is helpful in closely examining contemporary processes as they enfold. To maintain distancing, the inside researcher did not attend the formal interviews conducted as part of this study and did not participate in the data analysis. Instead, consistent with participant observation, the inside researcher has compiled chronological event timelines and memos. This material has facilitated understanding of internal decision-making processes and of the events that contributed to the implementation of a modular solution design at the case firm.

Informants for the formal interviews were chosen from among managers and experts in the case organization. Altogether, this study draws from 21 formal interviews with informants of the case organization (see appendix 1) that were tape recorded and transcribed. Of these 21 interviews, 12 were conducted from 2006 to 2010 when the firm was making its transition into a solution provider, but had not yet implemented a modular solution design. This stage was important not only to understand the initial transition and its organizational context, but also to arrive at a high level of "interactional expertise" (Collins, 2004) that became the foundation for the close relationship with the case company that was necessary in the subsequent stages.

The second stage of the research began in 2013. By then, the case firm had embarked upon a concerted effort to build a modular solution design under the leadership of a newly recruited executive. The outside researchers collected company documents and other secondary material with this executive to understand this critical phase of the case firm's solution transformation. In this stage, the outside and inside researchers held 15 informal meetings to discuss the case firm's implementation of a modular solution design. In these meetings, the external researchers documented the development of the modular solution, for example, by constructing a timeline of the process based on calendar entries. In addition, the researchers took extensive notes. The purpose of

these meetings was to arrive at a practical and theoretical understanding of the transition to a modular solution design (Dubois & Gadde, 2002).

The external researchers conducted nine formal interviews between 2013 and 2015. Having the external researchers conduct the interviews prevented the inside author's influential position in the organization from coloring the informants' opinions. All interviews were recorded and transcribed. Finally, this study used archival material such as internal company documents and marketing material to triangulate the findings. Table 1 summarizes the data collection.

Insert table 1 about here

In analyzing the data, we followed the thematic analysis method whereby data is reorganized by themes resulting in a few factors that explain the phenomenon better than data in the unstructured form (Lee, 1999). By combining theoretical and empirical knowledge in the course of data collection, our theoretical framework evolved (Suddaby, 2006). The framework based on strategic learning (Kuwada, 1998) was used to structure and analyze the findings.

3.3   Assessment of the research method

Validity in qualitative research hinges on gaining full access to the knowledge and meanings of respondents (Remenyi et al., 1998). Great care was taken in this research to ensure that access was at a high level, including participant observation by the inside researcher. A similar approach to participant observation was taken earlier, for example, by Stigliani and Ravasi (2012). Data triangulation improved the validity of our findings. We relied on key informants from different levels and functions within the case firm. As stated earlier, we also limited the inside researcher's influence on other informants by excluding him from the interviews conducted by the outside

researchers. To strengthen our interpretations, we maintained a clear chain of evidence from the empirical data, enriching our case description with a rich set of quotations (Yin, 2009). None of these quotations were statements by the inside researcher.

To ensure the reliability of the study, we described the research process and data collection in detail (table 1). Furthermore, unlike most prior studies that investigate in-depth processes in organizations, we have not anonymized the case firm. This contributes to the transparency of our research and enables an accurate contextual portrayal of the studied case (Jick, 1979). In terms of generalizability, we have striven for analytical rather than statistical generalizability. Thus, we expect that the processes uncovered through this research form the basis on which such processes can be understood in similar companies (Gummesson, 2000).

4 Findings

We begin with a brief background on the case firm and then report the findings as consistent with the analytical framework presented in figure 1. We place emphasis on understanding how the focal firm has developed an ability to leverage the benefits of a modular solution design. This includes an assessment of the initial set of basic assumptions that led Kone to explore solution business-related market opportunities through project-based integration. This is followed by an explanation of what caused Kone to redefine its design process used to integrated solutions, thus leading to implementation of a modular solution design. We also discuss the outcomes of this learning process in terms of how strategic learning related to implementation of a modular solution design has enhanced Kone's ability to capitalize on both exploration and exploitation strategies, thus enhancing its ability to make the transition to the industrializer path to service growth.

4.1 Case description

Kone Corporation is the world's second-largest elevator manufacturer, with elevator sales forming the core of new equipment sales. Service and new equipment sales each account for roughly half of the company's turnover. The service business offers several types of life-cycle services ranging from basic product maintenance to availability guarantees. While elevators remain at the core of the firm's identity and operations, changes in the external competitive and technological environment have prompted Kone to explore opportunities connected with solution business. More specifically, while the elevator industry has matured, digitalization as an industry megatrend has created new opportunities for the development of integrated, smart building solutions that facilitate a smoother flow of people in buildings.

4.2   Project-based exploration of solution business-related market opportunities

Kone's experimentation with solution business dates to early 2000 when members of the company's R&D department experimented with new configurations of integrated components that expanded beyond the company's core offering in elevators. For instance, the company developed integrated solutions that would allow building residents to arrive home without having to open doors or switch on lights. However, the solution transformation process did not formally begin until 2007 when Kone launched its renewed market vision dedicated to providing the best people flow experience:

> *We updated the core of the vision, which [now] stems from Kone delivering the People Flow Experience… Previously our brand promise was the Heart of Your Building, which means that the core of the business was the dark elevator shaft where we can build the elevator...Conceptually we made a really brave decision because we addressed this kind of [user] experience level, which is really far from commodity business.*
>
> Senior Executive, Marketing and Communications

While the newly communicated vision marked a clear departure for the firm from its established basis in the elevator business, it was initially far from clear how the vision should be translated into practice. For instance, it was unclear which configurations of core solution components provided by Kone in the areas of elevators, escalators, and doors should be integrated with new peripheral ones accessed from external partners to create integrated solutions that enhance the people flow experience in buildings. Thus, a period of project-based exploration ensued.

In exploring solution business-related market opportunities, Kone's management placed strategic emphasis on insulating the core product business from the potentially disruptive effects of a solution business transition. This meant that solutions requiring project-specific integration of components falling outside of Kone's core product offering were delivered through a separate project-based unit. This ensured that such activities did not disrupt the firm's well-developed processes to sell and deliver the core product offering. However, such organizational separation also meant that the firm could not fully leverage the transformative potential of solution business-related initiatives:

> *Our sales are pretty much still product sales. In the salespeople's food chain, project sales are on the best level...they can sell integrated solutions. But how to get them to align, to migrate this solution sales down [to product sales]. Maybe we need to also take the product offering in another direction so it's not just case by case...otherwise it jumps out of their [product salespeople's] range if you have to start doing handiwork. Then it directly goes to project sales.*

> *Assistant Vice President, Product Business*

> *Perhaps it's the [Project] organization which has an ability to take risks and this kind of entrepreneurial spirit... but it's still such a small part of our kind of whole scope of*

activities... the problem there is that they've done so much of the work case by case….The

volume side has been taught to think that everything is automated. It doesn't help much

that we do it only once…our whole system rejects these non-standard practices.

Director, Solution Business

4.3   Redefining the solution design process to support exploitation of production-based resources

While Kone experimented with different solution configurations through project-based integration, some early market signals began to point at the insufficiency of such an approach. In 2010, one of its main competitors launched a new type of turnstile solution. It made the traffic flow of people inside of buildings smoother and more efficient by seamlessly integrating two previously disintegrated components (elevators and certain elements of access control). Kone's management considered the competitor's solution as a mere product extension, as it did not seem to reflect a systematic conceptual frame tied to an overarching solution business vision centered on supporting a better flow of people in buildings:

We looked at it [the competitor's offering] …It is in practice just a product that contains an

integrated elevator call…we decided from the beginning that we are not going to bring one

component at a time…We want to build a framework that expands people's thinking…Then

for many years to come we can drop new products onto that framework.

Senior Executive, Marketing and Communications

Thus, while Kone considered itself an industry pioneer in its approach to solution business, the actions of its competitors revealed that Kone's implementation of the solution business vision into effective business practice had been insufficient. Consequently, Kone's sales organization began to report lost sales. This forced Kone's management to comprehend the strategic importance of developing an industrially efficient approach to its solution business.

To bridge the competitive gap, Kone's management appointed an internal task force to suggest concrete steps that the company should take. The task force recommended development of a platform-based solution architecture, which would reduce the cost and simplify the component integration process behind the delivered solutions. Such a platform would integrate a limited selection of core and peripheral solution modules to enhance the flow of people in buildings without the need for customer-specific project integration work. This would decrease the costs of integration and ensure that Kone's product business unit could be charged with the task of selling and delivering the solution, thus helping to unlock volumes in solution business:

> *To make it part of the volume business….a really crucial factor is how easy our solutions are to deliver, install and sell… We need to develop a platform on top of which to build new solutions.*

> *Platform Manager, Solution Business*

4.4   Leveraging partner networks to support development of a platform-based solution

The construction of a solution platform was considered so important that in 2011 Kone established a dedicated business unit for this purpose and hired an executive from outside of the firm to oversee its development. The first task of the unit was to determine the peripheral solution modules that Kone should connect to its core offering of elevators, escalators and doors. After some internal discussion, attention was turned to the integration of subsystems that belong to the public domain of buildings. Thus, for instance, in office buildings, Kone's managers believed that enhanced value-in-use could be created by integrating subsystems that facilitate the people flow from the point of entry to the building and ending with arrival at proprietary office spaces. Kone's existing offering in elevators, escalators, and doors formed the core of this platform to which complementary subsystems in access control, destination, information, and monitoring provided by external partners could be linked. The resulting solution offering was launched in 2013 to selected markets

18

as "People Flow Intelligence" (PFI), a family of product-based solution components that can be configured in a variety of ways:

> *Our solution platform includes four entities. There we have Access Control, Destination Control, Monitoring and Information Management. So, these are the four footings of our People Flow Intelligence solution. These are the themes, under which we develop our new products.*

> *Project Manager, Solution Business*

Integration of the new peripheral solution components onto the platform has required Kone to form strategic partnerships with external providers. In doing so, a challenge encountered by Kone has been that external providers of key solution components come from highly fragmented industries with few commonly agreed-upon standards. Thus, developing the Kone solution platform has required initiation of joint R&D projects to develop standardized interfaces connecting peripheral solution components provided by Kone's partners onto the core platform.

As emphasized by the respondents, development of the platform in collaboration with strategic partners has been far from easy, as it has required that the top management of Kone's partners understand, share, and act upon Kone's solution business vision tied to a better people flow. Here introduction of the "Turnstile Solution" by Kone's competitor was also an impetus for action for its partners, demonstrating the market potential of a "productized" solution that is based on a predefined platform. Since Kone is a much larger market actor and typically engages with customers earlier in the building construction project cycle, it could convince its partners to commit strategically to shared development of a platform that is nevertheless controlled by Kone. The partnerships also involve mutual learning about technology and markets:

> *Building the partnerships [to develop and integrate the modules] needs to be planned up front. In general, finding a suitable partner, who is interested in exactly this kind of a*

partnership takes time. On the other hand, even though we could develop the required competences in-house, it just does not fly without the industry expertise.

Platform Manager, Solution Business

Once the shared vision was established, detailed legal and business negotiations have been needed to establish mutually agreed-upon practices on an operational level. This is critical as the externally sourced peripheral solution modules are sold and maintained under Kone's brand as part of its PFI offering. As emphasized by the respondents at Kone, the long-term success of its solution business vision necessitates an understanding that the needs of customers can change through the installation's life cycle. Thus, the integrated solutions must be built from the start in a way that allows them to be modified and upgraded at a later point in time. This objective can be met more easily if the solution is modular and the solution platform accommodates further extensions. Furthermore, efficient customization can be achieved through software-based features that are built onto the basic platform. Thus, Kone can update new features and turn on additional applications, as required by changing customer needs. However, ensuring the ability to do so has required careful management of the network of relations with selected key suppliers of peripheral solution modules:

Service is about 50% of our business…if the customer says…that now we would like to have new features that are not in the software… we cannot deliver if [the Access Control partner] does not cooperate.

Senior Legal Expert

As illustrated in figure 2, through development of the solution platform, Kone has strengthened ties with selected key partners that provide access control, monitoring, information, and destination modules. To integrate these modules onto the platform, Kone has developed the needed technical and interorganizational interfaces. However, despite a shift in focus to a platform-based approach, Kone continues to deliver solutions through project-specific integration. This is

necessary to incorporate solution components from suppliers falling outside of the strategic partnerships. For instance, a customer with global operations may wish to utilize a certain access control provider in all its global locations that is not included in Kone's solution platform. In such a case, Kone needs the ability to integrate the solution component desired by the customer. In addition, large projects that require customization act as reference cases and testing grounds for new and innovative solutions that can later be migrated to the firm's volume business through development of the solution platform:

> *When we get skyscrapers, large airports and subways trains. When you have references, you can typically succeed in volume business as well --- some development projects are done first for our products…After that, it's easier to start dropping them into our volume [mainstream] products.*
>
> *Senior Executive, Major Projects*

Insert figure 2 about here

4.5   Outcomes of the strategic learning process

With a newly developed, platform-based solution design, Kone can offer smart solutions that recognize users and their access rights, and guide them to their intended destination: the users' profile is stored in the access control system; destination control assigns passengers to the correct elevators; information panels provide guidance; and the way in which people move through the buildings can be monitored in real time. Such functionalities offer important benefits not just to the building user, but also for the owner and operator. The resultant PFI offering is a product-level manifestation of the firm's solution business vision. Given that the PFI offering is based on a

specified architecture with predefined modules and options without the need for project-based integration, the derivative solutions can be sold and delivered by the firm's product division. This means that the sold solutions can be deployed in large volumes with a high degree of industrial efficiency by using the established personnel, competences, and processes of its product business unit:

We have defined these interfaces for it, for how to do it...it's been designed so that when all those, lines there in the process chart, when they're green, that's when the order processing is completely standardized.

Project Manager, Solution Business

The PFI offering was first launched to selected markets around the globe in 2013 and since then the firm has continued to develop the readiness of its sales subsidiaries around the globe to sell, install, and service the delivered solutions. Beyond developing its ability to deploy solutions as part of its core product-based operations, Kone also understands the value of ongoing exploration of emerging market opportunities in the solution business sphere. For instance, it brings designers, salespeople, R&D, and management together at annual customer experience events. The purpose of these events is to improve the organizational understanding of how to improve Kone's ability to deliver the best people flow experience in buildings. Such an understanding can then be incorporated into the future development of the Kone solution platform.

Figure 3 summarizes Kone's solution transformation process. As illustrated in the figure, in the initial stages, the focus of organizational learning was on exploring opportunities for market value creation through project-based integration organized separately from the core product business. Systematic efforts to capture value from these identified opportunities began in 2011 through development of the Kone solution platform. During this learning process, the development of the solution platform has only been a first step, and the more difficult and time-consuming phase

is ramping up the capabilities of Kone's subsidiaries around the globe to sell, deliver, and service the solutions that can be derived from the Kone PFI solution platform. In developing these capabilities, Kone has engaged in strategic learning that enhances its ability to deliver integrated solutions with the same operational effectiveness as the core product offering, thus improving its ability not only to create, but also to capture value from solution business.

Insert figure 3 about here

---

5   Discussion

The purpose of this study has been to develop a better understanding of how manufacturers learn to leverage the strategic benefits associated with modular solution designs. To do so, we have relied on the strategic learning framework as the key analytical frame. Adoption of this analytical framework has facilitated development of an understanding of how modular solution designs facilitate leveraging of exploration and exploitation-based strategies in solution business, so as to facilitate a transition to the industrializer path to service growth (Siren et al., 2012; Kowalkowski et al., 2015). To ground our theoretical contributions, the discussion is organized around the development of three propositions.

5.1   A modular solution design facilitates exploitation of the provider's production resources in the provision of integrated solutions

As depicted in figure 3, the business learning that Kone engaged in when it initially integrated solutions on a project basis was highly explorative (March, 1991). It aimed at experimentation and discovery of opportunities for new market value creation through project-based integration of solutions. This formed the basis for an understanding of which configurations of core and peripheral

23

solution components could be feasibly integrated to form solutions that enhance the flow of people in buildings. The firm continued with this mode of solution provision for years until a change in its external competitive environment prompted a change in the solution design process (Kuwada, 1998).

The activities of Kone's competitors drew management's attention to the fact that integrative added value in solution business is not merely driven by the ability to bridge different subsystems in buildings through project-specific integration. Instead, of key importance is the ability to understand what configurations of solution components form a desirable platform from which the firm can deploy derivative solutions with a high degree of industrial efficiency by utilizing its established production-based resources. Following this realization, Kone began concerted efforts to develop a modular solution design.

As depicted in figure 3, the strategic learning that Kone went through in implementation of a modular solution platform has facilitated development of an ability to deliver integrated solutions with a similar degree of operational effectiveness as the core product offering. At the same time, Kone sustains a focus on explorative business learning tied to development of a better architectural and component level understanding of the solution components (Sanchez & Mahoney, 1996) through continued project-specific integration of solutions. If there is sufficient market demand to justify investments into further platform development, a modular solution design provides the integration mechanism that allows the entire organization to act upon such exploratory knowledge through integration and deployment of product-like solution components (Garrett *et al.,* 2009; Slater and Narver, 1995). Based on these observations, we propose:

Proposition 1: A modular solution design allows exploration at the architectural and component levels of the solution development without sacrificing the efficiency of exploiting the production resources in the delivery of solutions.

The observations from the studied case facilitate a better understanding of the learning processes that underlie development of industrialization capabilities in solution business (Storbacka, 2011). Such capabilities are key to solution providers pursuing the industrializer path to service-based value creation and growth, but seem difficult for solution providers to develop (Kowalkowski et al., 2015).

Based on the experiences of our case firm, we would argue that at least some manufacturers start the transition process to solution business from a position where they have extremely well developed processes to sell and deliver the core product offering cost effectively. However, in the initial stages of the solution business transition, the focal firm may lack an understanding of how to incorporate solution business-related activities as an integral part of its core product operations. In other words, a provider with a basis in manufacturing is inclined to retain strategic design processes reflective of that heritage (Kuwada, 1998). Such an organization cannot easily absorb non-standard operating principles that accompany a solution business organized around project-specific integration.

Thus, until the solution is "productized" through development of a solution platform (Meyer & DeTore, 2001), structural differentiation (Gilbert, 2005) is adopted to isolate explorative activities that require customer-specific and project-based integration efforts of externally sourced peripheral solution components. During this exploratory period, the manufacturer lays the necessary foundation for architectural and component level understanding of the various configurations of solution components that form a desirable solution platform to be subsequently exploited (Sanchez & Mahoney, 1996). However, before this exploratory understanding is integrated into knowledge that the entire organization can act upon, these projects seem to act as useful references cases. As such, they allow showcasing of the focal firm's ability to support its customers through more comprehensive integrated solutions, but without an organizational integration mechanism provided

by a modular solution design, such customer interfacing competences cannot be fully exploited by the focal firm.

Thus, based on the experiences of the studied case, we would argue that a modular solution design acts as a key organizational integration mechanism (Windahl & Lakemond, 2010), which allows the manufacturer to transition from project-specific integration to product-based exploitation in solution business. In essence, a platform-based solution architecture allows the manufacturer to access and integrate core and peripheral solution components into customized responses to complex customer needs while utilizing design processes originally developed for the core product business.

5.2 *Leveraging the benefits of modular solution designs requires orchestration of the production network*

In implementing the shift to a modular solution design, Kone demonstrates the importance of managing inter-organizational relations with suppliers during the development of industrialization capabilities (Storbacka, 2011). As depicted in figure 2, given the lack of prevailing industry standards (Schilling, 2000), Kone has had to strengthen network ties with selected key partners that provide access control, monitoring, information, and destination components. This has allowed development of the needed technical and interorganizational interfaces that underpin the Kone solution platform. The dimensions of network management that have driven the formation of these strategic partnerships reflect those identified by operations management researchers regarding the patterns and rules for network orchestration (e.g., Min et al., 2005; Morris, 1983) as occurring on three levels of integration: strategic, operational and technical (table 2).

Insert table 2 about here

Furthermore, as demonstrated in figure 2, while strengthening of network ties with selected providers, Kone also maintains the ability for project-specific integration of solution components falling outside of the pre-specified platform. This helps to maintain its capabilities for market-based exploration, which forms the basis for further development of the solution platform and deployment of the derivative solutions. These observations lead us to propose the following:

Proposition 2: Leveraging the benefits of modularity requires active management of the supply network to facilitate simultaneous integration of new (peripheral) modules onto the solution platform and enhancement in the efficiency of collaboration with the providers of existing (core) modules.

The lessons learned from the studied case contribute to a better understanding of how manufacturers learn to leverage the complexities inherent in solution networks in a way that enhances their effectiveness in solution provision (e.g., Davies et al., 2007; Storbacka et al, 2013; Eloranta & Turunen, 2016). Given that solution providers increasingly act as systems integrators responsible for integrating internally and externally sourced solution components (e.g., Davies et al., 2006; Davies et al., 2007), the ability to orchestrate networks of actors in support of solution provision has become a key management task (Windahl & Lakemond, 2006; Davies et al., 2007; Gebauer et al., 2013; Jaakkola & Hakanen, 2013). At the same time, the mechanisms that drive management of network relationships in the solution business context have not been well understood.

Based on the findings from the studied case, we suggest that leveraging the benefits of modularity through the integration logic requires more than development of the technical interfaces between the integrated components (Eloranta & Turunen, 2016). As highlighted in table 2, key to managing the network of internal and external actors is to understand the required integration efforts at the strategic, operational, and technical levels (Morris, 1983; Min et al., 2005). Managing these integration levels requires significant resource commitments from the participating actors; such commitments can be induced through development of a negotiated understanding of the

practices and related benefits that govern the collaboration. When implemented properly, these integration mechanisms ensure that internal and external actors at all organizational levels can act effectively in support of a unified solution business vision organized around the focal integrator. Active management of the supply network is particularly important when an industry lacks agreed-upon standards. In such instances, the solution provider needs to develop specialized interfaces to coordinate the functions among a set of components supplied by specialized vendors (Schilling, 2000).

5.3 *A transition to the industrializer path to service growth requires organizational learning at multiple levels*

In the previous sections we sought to understand the strategic learning process that facilitates integration of strategic knowledge gained from explorative and exploitative learning. We next explain how this strategic learning has facilitated Kone's ability to both create and capture value from solution business (Storbacka, 2011).

As noted in previous research, building of the value appropriation mechanism seems difficult for solution providers, which hinders their efforts to transition onto the industrializer path to service-based growth (Kowalkowski et al., 2015). Thus, manufacturers often remain stuck in an exploratory phase of project-based integration of solutions, which is organized separately from the manufacturer's core product business (Galbraith, 2002; Valtakoski, 2017). Under such circumstances, the exploratory strategic knowledge gained through project-specific integration cannot be fully exploited as the manufacturer lacks an integrative higher-order learning mechanism (Siren et al., 2012). It is here that the role of a modular solution design becomes important, as it allows the manufacturer to apply strategic knowledge gained through project-specific integration through its core product operations. Based on the studied case, doing so is key to facilitating repeatability and scalability that drive effective value appropriation in solution business.

Furthermore, as evident in the case of Kone, when the solution provider shifts to the industrializer path to improve its value appropriation, it does not merely shift from exploratory to exploitative business level learning, but rather strives for ambidextrous performance through an integration of both types of learning (Gibson & Birkinshaw, 2004; Lubatkin, Simsek, Ling, & Veiga, 2006). This entails finding ways to retain the firm's ability for opportunity-seeking exploration, while it learns how to better apply existing resources for efficient exploitation of these opportunities.

As explained previously, such ambidexterity can be facilitated by leveraging modularity in ways that allows the manufacturer to explore architectural and component level learning (Simsek, 2009; Sanchez & Mahoney, 1996), while it builds industrialization capabilities to promote repeatability and scalability. An example of such combinative capabilities would be use of annual customer experience events to improve the organizational understanding of how to improve Kone's ability to deliver the best people flow in buildings. These ideas can first be tested through project-specific integration of solutions and then subsequently be exploited through migration onto the solution platform if there is sufficient market demand to capture value from the investments in platform development (Schilling, 2000). By managing the strategic, operational, and technical levels of integration (table 2) with selected suppliers of peripheral components, these complementary learning processes drive the incremental evolution of the solution platform, module by module. These observations lead us to propose the following:

> *Proposition 3: Modularity of the solution design facilitates a product manufacturer's transition to industrial solution provision through leveraging business level learning in the technical development of the solution modules, their operational integration into order delivery processes, and through improved effectiveness in the orchestration of the supply network.*

The findings from the studied case thus suggest that a platform-based approach improves the solution provider's ability to act in the market as an integrator of knowledge charged with the task

of orchestrating a modular production system consisting of a network of autonomous but interrelated actors (Sanchez & Mahoney, 1996; Valtakoski, 2017). This is because a modular solution design ensures that exploratory business-level learning aiming at identification of new market opportunities and planning for platform upgrades can remain in the hands of a focal actor (Sanchez & Mahoney, 1996). At the same time, loosely coupled groups of organizational actors can focus on improvements to the solution components that underlie that platform (Sanchez & Mahoney, 1996). The solutions derived from a pre-specified platform, consisting of both internally and externally sourced solution modules, can be deployed with a high degree of industrial efficiency utilizing design principles developed for the manufacturer's core product business. The ability to manage these exploration- and exploitation-based strategies by leveraging the benefits of modular solution designs is critical for supporting the focal firm's ability to pursue the industrializer path to service growth (Kowalkowski et al., 2015) in a network context (Windahl & Lakemond, 2006; Davies et al., 2007; Gebauer, Paiola, & Saccani, 2013; Jaakkola & Hakanen, 2013; Storbacka et al., 2013).

6 Conclusions

From the previous research we know that to succeed in solution business, providers need not only to find ways of developing more complex offerings through integrating previously disintegrated solution components, but also to balance these efforts with standardization activities that lead to offerings that are more easily repeatable (Salonen, 2011; Storbacka, 2011). While difficult to realize in practice, it is thought that key to developing such a capability lies in the adoption of a "basic modular system and its standardized components" (Davies et al., 2007, p. 186). At the same time, it has not been well understood how solution providers learn to leverage the strategic benefits associated with modular solution designs.

To fill this gap, this study has relied on a longitudinal, qualitative case study to demonstrate how a solution provider engages in strategic learning to leverage the benefits associated with modular solution designs. Such a learning-based perspective is missing from prior solution business research which relies on conceptual and static cross-sectional approaches. The approach adopted in this study has enabled us to demonstrate how the benefits of modular solution designs extend beyond avoidance of costs related to customer-specific integration of solutions (Davies et al., 2006; Davies et al., 2007; Salonen, 2011; Storbacka, 2011) or of better leveraging the complexity of solution networks (Eloranta & Turunen, 2016). More specifically, we find that by implementing a modular platform-based solution, the provider improves its ability to explore customers' readiness to adopt new types of solutions, while ensuring that the derivative solutions integrated from internally and externally sourced solution modules can be deployed using organizational competences developed for the manufacturer's core product business. Mastering these co-evolutionary learning processes of exploration and exploitation is far from easy, but when successfully implemented, they facilitate the manufacturer's pursuit of the industrializer path to service-based growth (Kowalkowski et al., 2015).

6.1 *Implications for practice*

Based on the studied case, we suggest that manufacturers attempting a transition to solution business need to strategically consider the intended role of the solution offerings in the firm's operations. Project-based integration of solutions, which is organized separately from the provider's core product business appears to act as a useful customer-interfacing tool that allows the focal firm to explore new opportunities to create market value. However, without an organizational integration mechanism provided by a modular solution design, strategic knowledge gained through project-specific integration cannot be fully exploited through leveraging of the provider's production-based resources. This hinders the provider's ability to build repeatability and scalability that drive effective value appropriation in solution business.

At the same time, lessons from the studied case also show that development of a modular solution design, and a platform architecture that supports its implementation, is far from simple. It requires the development of inter-organizational and technical interfaces within the network of component providers, so that peripheral solution modules can be efficiently sourced and integrated. Doing so requires extensive work to forge the agreements between the focal firm and providers of peripheral solution modules. Furthermore, such development work is only a starting point for industrial-scale deployment of modular solutions. For instance, when solutions are integrated on a project basis, it is easier for the provider to maintain a dedicated sales force that works in close collaboration with customers to develop tailor-made solutions. When implemented on a larger scale as part of the firm's ongoing product-based operations, ensuring the required customer interfacing capabilities presents a difficult challenge (Salonen, 2011).

Thus, the implementation of a modular solution design requires substantial resource commitments from the focal firm and its partners. These commitments extend well beyond the technical development of the platform. The timing and sequencing of these investments should be carefully considered to ensure that there is sufficient market demand for the derivative solutions. This is likely to require a period of project-based exploration on behalf of the focal integrator. However, once the decision is made, sufficient resources need to be committed, so that the provider has the required capabilities for a large-scale rollout, with development of sales, installation, and maintenance capabilities. These investments far outweigh those made in technical platform development.

6.2   Limitations and avenues for future research

As is typical of exploratory case-based research, we have not sought statistically generalizable results. Instead, we provide a rich and accurate portrayal of a contemporary phenomenon in context. Our study has benefited from unique access to the case firm, encompassing both inside and outside

perspectives, and we draw upon a longitudinal perspective. Nevertheless, a multi-case research design incorporating cases from other industries and contexts would have produced different details for the analysis.

Moreover, despite the benefits highlighted in this study, we do not expect modular solution designs to be applicable for all types of solution providers. For instance, if the solution is integral (Salonen & Jaakkola, 2015), implementing a modular solution design would likely be difficult. This is because integral product-service systems may require case-based optimization of each of the integrated components for a configurational fit with a particular context of use (Schilling, 2000). Hence, the value of an integrated solution may depend on the provider's in-depth understanding of the interdependencies between the integrated solution components that drive the system's performance in the customer's process.

We expect findings from this study to be most relevant for providers pursuing the service-growth trajectory of an industrializer, thus providing cost-effective, productized solutions (Kowalkowski et al. 2015). As shown through our case study, a firm pursuing the industrializer path may already have well-established processes to deploy its core product offering. However, to ensure that these processes and capabilities can be used in the deployment of integrated solutions, the firm needs to learn how to integrate previously disintegrated product-based components into functional systems without need for project-specific integration (Matthyssens & Vandenbempt. 2008). Here, implementation of a modular design becomes an important enabler.

In conclusion, we expect our findings to be highly relevant for providers struggling with a clash between what it considers to be its core product business and solution business, with the latter involving a high degree of operational complexity. In such cases, implementation of a modular solution design may allow for a better exploitation of solution business-related market opportunities through closer integration with the provider's core product business operations.

We encourage future studies to investigate the ways a modular solution design affects the

solution provider's effectiveness. This is an important area of further research, because solution

providers need alternative ways of developing industrialization capabilities to ensure their ability to

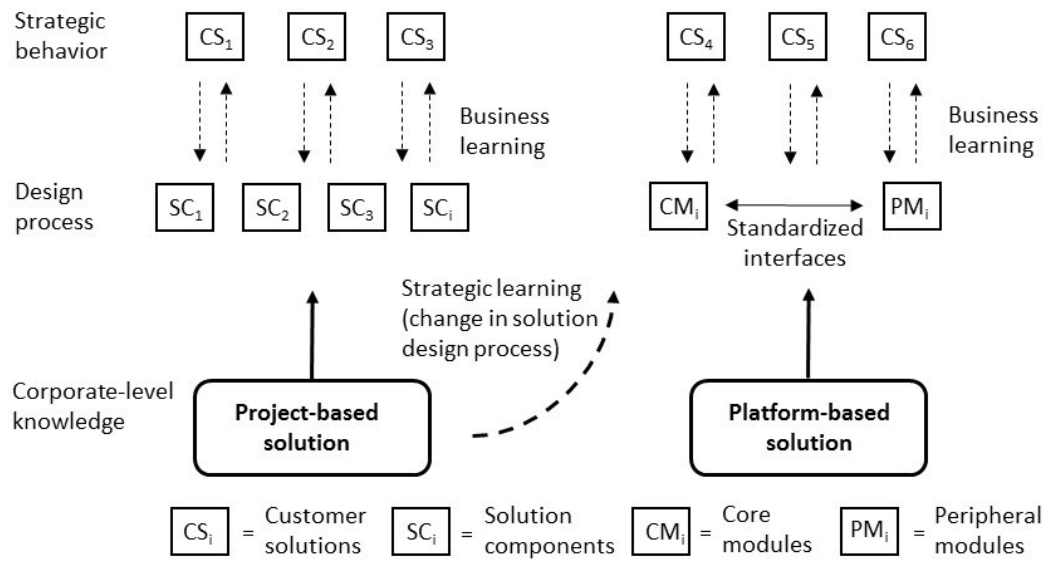create and capture value in solution business (Storbacka, 2011).

References

Baldwin, C. Y., & Woodard, C. J. (2008). *The architecture of platforms: A unified view*. Harvard Business School Finance Working Paper, 9-34.

Baldwin, C.Y. & Clark, K.B. (1997). Managing in an age of modularity. *Harvard Business Review*, September-October, 84-93.

Benedettini, O., Neely, A., & Swink, M. (2015). Why do servitized firms fail? A risk-based explanation. *International Journal of Operations & Production Management*, *35*(6), 946 - 979.

Collins, H. (2004). Interactional expertise as a third kind of knowledge. *Phenomenology and the Cognitive Sciences*, 3, 125-143.

Brady, T. and Davies, A. (2000). Organisational capabilities and learning in complex product systems: towards repeatable solutions. *Research Policy*, 29, 931–953.

Davies, A., Brady, T., Hobday, M. (2006). Charting a path towards integrated solutions. *MIT Sloan Management Review*, 47(3), 39-48.

Davies, A., Brady, T., & Hobday, M. (2007). Organizing for solutions: Systems sellers vs. systems integrator. *Industrial Marketing Management*, *36*(2), 183-193.

Dubois, A., & Gadde, L.E. (2002). Systematic combining: An abductive approach to case research. *Journal of Business Research*, *55*(7), 553-560.

Eloranta, V., & Turunen, T. (2016). Platforms in service-driven manufacturing: Leveraging complexity by connecting, sharing, and integrating. *Industrial Marketing Management*, *55*, 178-186.

Evanschitzky, H., v. Wangenheim, F., & Woisetschläger, D. (2011). Service and solution innovation: Overview and research agenda. *Industrial Marketing Management*, *40*(5), 657-660.

Galbraith, J. R. (2002). Organizing to deliver solutions. *Organizational Dynamics*, 31, 194-207.

Garrett, R.P, Covin, J.G., & Slevin, D.P. (2009). Market responsiveness, top management risk taking, and the role of strategic learning as determinants of market pioneering. *Journal of Business Research*, *62*(8), 782-788.

Gawer, A. (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. *Research Policy*, *43*(7), 1239-1249.

Gebauer, H., Paiola, M., & Saccani, N. (2013). Characterizing service networks for moving from products to solutions. *Industrial Marketing Management*, *42*(1), 31-46.

Gibson, C.B. & Birkinshaw, J. (2004). The Antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal*, *47*(2), 209-226.

Gilbert, C.G. (2005). Unbundling the structure of inertia: Resource vs. routine rigidity. *Academy of Management Journal, 48*(5), 741–763.

Gummesson, E. (2000). *Qualitative methods in management research*. Thousand Oaks: Sage Publications.

Jaakkola, E., & Hakanen, T. (2013). Value co-creation in solution networks. *Industrial Marketing Management*, *42*(1), 47-58.

Jick, T. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative Science Quarterly*, *24*(4), 602-611.

Jorgensen, D. L. (1989). *Participant Observation. A methodology for human studies.* Applied Social Research Methods Series. Vol. 15. Thousand Oaks, CA: Sage.

Kowalkowski, C., Windahl, C., Kindström, D., & Gebauer, H. (2015). What service transition? Rethinking established assumptions about manufacturers' service-led growth strategies. *Industrial Marketing Management*, *45*(February), 59-69.

Kuwada, K. (1998). Strategic learning: The continuous side of discontinuous strategic change. *Organization Science*, *9*(6), 719-736.

Langley, A., Smallman, C., Tsoukas, H., & Van de Ven, A. (2013). Process studies of change in organization and management: Unveiling temporality, activity, and flow. *Academy of Management Journal, 56*(1), 1-13.

Lee, T. (1999). *Using Qualitative Methods in Organizational Research*. Thousand Oaks, CA: Sage.

Levinthal, D.A. & March, J.G. (1993). The myopia of learning. *Strategic Management Journal*, *14*, 95-112.

Locke, K. (2010). "Abduction." In A. Mils, G. Durepos, & E. Wiebe (Eds.), *Encyclopedia of Case Study Research*. Thousand Oaks: Sage Publications.

Lubatkin, M.H., Simsek, Z., Ling, Y., & Veiga, J.F. (2006). Ambidexterity and performance in small to medium-sized firms: the pivotal role of top management team behavioral integration. *Journal of Management, 32* (5), 646-672.

March, J. (1991). Exploration and exploitation in organizational learning. *Organization Science*, *2*(1), 71-87.

Martens, R., Matthyssens, P., Vandenbempt, K. (2012). Market strategy renewal as a dynamic incremental process. *Journal of Business Research*, 65, 720-728.

Matthyssens, P., & Vandenbempt, K. (2008). Moving from basic offerings to value-added solutions: strategies, barriers, and alignment. *Industrial Marketing Management*, *37*, 316-328.

Meyer, M.H. & DeTore, A. (2001). Creating a platform-based approach for developing new services. *Journal of Product Innovation Management*, *18*(3), 188-204.

Min, S., Roath, A. S., Daugherty, P. J., Genchev, S. E., Chen, H., Arndt, A. D., & Richey, R. G. (2005). Supply chain collaboration: What's happening? *The International Journal of Logistics Management*, *16*(2), 237-256.

Morris, P. W. G., (1983). Managing project interfaces – key points for project success. In: Cleland, D. I., & King, W. R., (eds.), *Project Management Handbook*. New York: Van Nostrand.

Nordin, F., Kindström, D., Kowalkowski, C., & Rehme, J. (2011). The risks of providing services: Differential risk effects of the service-development strategies of customisation, bundling, and range. *Journal of Service Management*, *22*(3), 390–408.

Patton, M.Q. (2002). *Qualitative Research and Evaluation Methods*, 3rd ed. Thousand Oaks, London: Sage.

Pekkarinen, S., & Ulkuniemi, P. (2008). Modularity in developing business services by platform approach. *International Journal of Logistics Management*, *19*(1), 84–103.

Remenyi, D., Williams, B., Money, A. & Swartz, E. (1998). *Doing Research in Business and Management*. Thousand Oaks: Sage Publications.

Roehrich, J.K., & Caldwell, N.D. (2012). Delivering integrated solutions in the public sector: The unbundling paradox. *Industrial Marketing Management*, *41*(6), 995-1007.

Salonen, A. (2011). Service transition strategies of industrial manufacturers. *Industrial Marketing Management*, *40*(5), 683-690.

Salonen, A., & Jaakkola, E. (2015). Firm boundary decisions in solution business: Examining internal vs. external resource integration. *Industrial Marketing Management*, *51*, 171-183.

Sanchez, R., & Mahoney, J. T. (1996). Modularity, flexibility, and knowledge management in product and organization design. *Strategic Management Journal*, *17*(S2), 63-76.

Schilling, M. A. (2000). Toward a general modular systems theory and its application to interfirm product modularity. *Academy of Management Review*, *25*(2), 312-334.

Schilling, M. A., & Steensma, H. K. (2001). The use of modular organizational forms: An industry-level analysis. *Academy of Management Journal*, *44*(6), 1149-1168.

Siggelkow, N., (2007). Persuasion with case studies. *Academy of Management Journal*, *50*(1), 20–24.

Simsek, Z. (2009). Organizational ambidexterity: Towards a multilevel understanding. Journal of Management Studies, 46(4), 597-624.

Sirén, C. A. Kohtamäki, M. & Kuckertz, A. (2012). Exploration and exploitation strategies, profit performance, and the mediating role of strategic learning: Escaping the exploitation trap, *Strategic Entrepreneurship Journal*, *6:* 18-41.

Slater S.F. & Narver J.C. (1995). Market orientation and the learning organization. *Journal of Marketing, 59*(3), 63–74.

Spradley, J. P. (1980). *Participant observation.* Orlando, FL: Harcourt Brace Jovanovich College Publishers.

Stanley, J.E. & Wojcik, P.J. (2005). Better B2b Selling. *McKinsey Quarterly,* 3, 15-15.

Stigliani, I., & Ravasi, D. (2012). Organizing thoughts and connecting brains: Material practices and the transition from individual to group-level prospective sensemaking. *Academy of Management Journal,* 55(5), 1232-1259.

Storbacka, K. (2011). A solution business model: Capabilities and management practices for integrated solutions. *Industrial Marketing Management*, *40*(5), 699-711.

Storbacka, K., Windahl, C., Nenonen, S., & Salonen, A. (2013). Solution business models: transformation along four continua. *Industrial Marketing Management,* 42(5), 705-716.

Suddaby, R. (2006). From the editors: What grounded theory is not. *Academy of Management Journal*, *49*, 633-642.

Tuli, K., Kohli, A. & Bharadwaj, S. (2007). Rethinking customer solutions: From product bundles to relational processes. *Journal of Marketing*, *71*, 1-17.

Ulaga, W., & Reinartz, W. J. (2011). Hybrid offerings: How manufacturing firms combine goods and services successfully. *Journal of Marketing*, *75*(6), 5-23.

Valtakoski, A. (2017). Explaining servitization failure and deservitization: A knowledge-based perspective. *Industrial Marketing Management*, 60, 138–150.

Van Liere, D.W., Hagdorn, L., Hoogeweegen, M.R., Vervest, P.. (2004). Embedded coordination in a business network. *Journal of Information Technology*, *19*(4), 261-269.

Vervest, P., Preiss, K., van Heck, E., & Pau, L-F. (2004). The emergence of smart business networks. *Journal of Information Technology*, *19*(4), 228-233.

Windahl, C. and Lakemond, N. (2006). Developing integrated solutions: The importance of relationships within the network. *Industrial Marketing Management*, *35*(7), 806-818.

Windahl, C. & Lakemond, N. (2010). Integrated solutions from service-centered perspective: Applicability and limitations in the capital goods industry. *Industrial Marketing Management, 39*, 1278-1290.

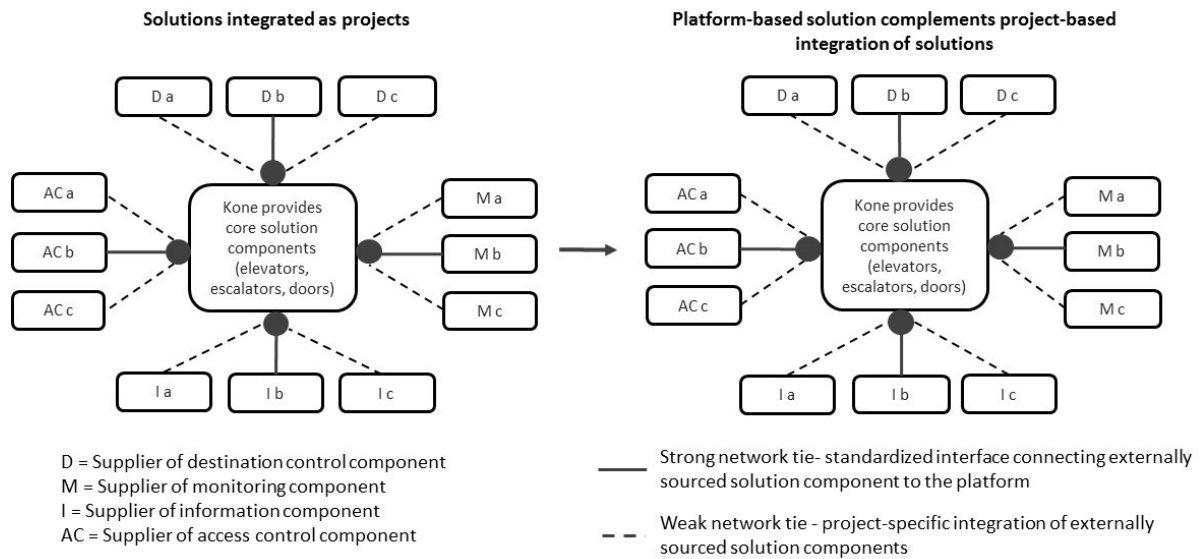Yin, R.K. (2009). *Case study research - design and methods*. Thousand Oaks: Sage Publications.

Figure 1: Learning to implement a modular solution design (adapted from Kuwada, 1998)

Transition stage	Time period	Type of data	Data collection method	Use of the data
Case firm transitions to solution business	2006-2010	12 formal interviews	Interviews with key managers from different functional backgrounds	Understanding the case firm's initial rationale and transition process to solution business.
Case firm begins to build a modular solution approach	2011-2015	Notes from participant observation by internal researcher	Participant observation by inside researcher, including collection of documents related to the change initiative to develop a modular solution approach.	In-depth managerial insights into the organizational processes related to transition towards modular solutions
	2013-2014	15 informal meetings, extensive note taking	Discussions between inside and outside researchers to gain greater understanding of the process of implementing a modular solution design.	Aligning practical and theoretical understanding of the transition to modular solutions
	2013-2015	9 formal interviews	Interviews of key managers to deepen insights gained through participant observation. Interviews not attended by inside researcher.	Ensuring studied phenomenon is understood from multiple functional and hierarchical perspectives: data triangulation
	2013-2015	Internal company documents and marketing material	Collection of an extensive set of secondary data, including internal and external communications material.	Enhanced understanding of the studied phenomenon; data triangulation

Table 1: Data Collection

Figure 2: Network management during implementation of a modular solution design.

Solutions integrated as projects

D a   D b   D c

AC a

AC b   Kone provides core solution components (elevators, escalators, doors)   M a
                                                                                 M b
AC c   M c

I a   I b   I c

D = Supplier of destination control component
M = Supplier of monitoring component
I = Supplier of information component
AC = Supplier of access control component

Platform-based solution complements project-based integration of solutions

D a   D b   D c

AC a

AC b   Kone provides core solution components (elevators, escalators, doors)   M a
                                                                                 M b
AC c   M c

I a   I b   I c

_____ Strong network tie- standardized interface connecting externally sourced solution component to the platform

– – – Weak network tie - project-specific integration of externally sourced solution components

Explorative learning – market value creation opportunities through solution business

Fully customized, integrated solutions offered through a project-based business unit

Kone People Flow vision introduced

Competitor's "Turnstile Solution" introduced

Perceived future gap in Kone's solution platform

2007   2010   2011   Development of solution platform   2013   2016   Solution platform upgrade

Development of sales, delivery, and maintenance capabilities for derivate solutions (PFI offering)

Initial launch of KONE PFI solution offering in selected markets

Platform-based solutions offered through the core product business

Strategic learning: Ability to deliver integrated solutions with the same operational effectiveness as the core product offering

Exploitative learning – market value capture opportunities through solution business

Figure 3: Kone's transition into an industrialized solution provider

Integration level	Integration mechanism for a modular solution	Objective and rationale	Empirical insights
Strategic	Formation of *a vision supporting a modular solution*	Integrating internal network actors to advance the creation of a new business model (around an integrated solution)	Creation of the Kone People Flow Intelligence platform was an investment that would not have taken place without a vision and commitment from the top management of Kone and its partners.
Strategic / operational	*Reconfiguration of the partner network* around a focal actor	Integration of inter-firm activities to strengthen the network ties among the core solution component providers and the focal organization	Kone forms strategic partnerships with selected suppliers of peripheral solution components to facilitate collaboration, resource commitments, and information flows between Kone and its partners.
Operational / technical	Formation of a *platform for the functional integration of the solution components*	Identification, articulation and design of the interconnectedness of the core and peripheral components forming the solution and its possible derivatives	Kone acts as a focal actor responsible for choosing and integrating the modules acquired from the partner network. The platform is designed in such a way that it can incorporate extensions by inclusion of new peripheral solution modules.
Technical	Creation of the *interfaces* that facilitate the efficient integration of necessary components into the core	Development of standard interfaces for cross-functional integration of varied modules	Kone has designed the solution components to be integrated mainly through electronic and software interfaces.

Table 2 Integration mechanisms for a modular solution (cf., Morris, 1983; Min et al., 2005)

Appendix 1: List of interviews

Respondent	Date of interview	Duration of interview (min)
Vice President, Design	Dec 13, 2006	109
Vice President, Sales & Marketing	Nov 3, 2006	91
Managing Director, R&D	Dec 20, 2006	107
Vice President, Global Customer Management	Nov 8, 2006	38
Head of Product Business BU	Nov 2, 2006	131
Senior Vice President, Technology	Nov 20, 2006	155
Senior Vice President, Marketing	Nov 30, 2006	42
Assistant Vice President, Product Porfolio Management	Nov 14, 2007	30
Assistant Vice President, Product Business	Oct 10, 2007	52
Senior Vice President, Marketing	Jan 31, 2008	32
Assistant Vice President, Product Business	June 28, 2010	52
Senior Executive, Major Projects	Aug 20, 2010	21
Platform Manager, Solution Business	May 7, 2013	74
Senior Executive, Marketing and Communications	April, 2014	59
Project Manager, Solution Business	March 3, 2014	97
Senior Legal Expert	April 11, 2014	46
Platform Manager, Solution Business	March 28, 2014	60
Director, Solution Business	April, 11, 2014	77
Director, Product Business	Oct, 16, 2014	88
General Manager, Sales	June 5, 2015	35
Sales Support, Product Business	May, 29, 2015	57