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Demystifying the benefits and risks of Lean service innovation: a banking case study

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Abstract

Purpose – The purpose of this paper is to demystify Lean for service innovation by investigating its benefits and risks. Lean innovation is a relatively new approach which is advocated in management literature. Little scientific work about its practice exists in the field. Although the Lean innovation principles are clear, there is limited evidence about their impact on service innovation processes.

Design/methodology/approach – From the knowledge-based view (KBV) of the firm, a framework for understanding Lean innovation is developed. Using this framework, the benefits and risks of Lean innovation are analyzed in a case study.

Findings – The case study not only shows that Lean service innovation can have many advantages, but also draws attention to the risks. The risks might result in the inability to follow Lean principles and might hamper the realization of the benefits. Using the case studies, study mitigation mechanisms are identified.

Originality/value – This research offers a new knowledge perspective and a better understanding of Lean service innovation. There are two main contribution of this paper. First of all, it reports on the impact of Lean innovation on a bank's innovation processes, both its benefit and risks. This has a contribution to understanding the innovation process in service organizations. Second, this paper extends Lean innovation to a service context and contributes to the knowledge basis of Lean innovation.

Keywords Lean, Knowledge-based view, Service innovation, Lean innovation, Continuous delivery, Omni-channel

Paper type Research paper

Introduction

Innovation processes are critical in achieving a company's service innovation objective. The strategic need for flexibility and value creation requires companies to develop effective innovation processes. *Lean innovation* advocates the use of Lean thinking in innovation, and it is a relatively new concept that can be used for improving innovation processes (Sonnenberg and Sehested, 2011). In recent years, Lean has become a popular management philosophy for organizations to improve their operational performance. Although traditionally Lean is focused on well-structured processes, currently, the focus has shifted toward less structured processes, including the Lean startup (Ries, 2011) and innovation (Ismail *et al.*, 2014). Lean might allow organizations to turn passive and defensive organizational cultures into proactive and open cultures that promote

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organizational learning and innovation (Dahlgaard and Dahlgaard-Park, 2006; Johnstone *et al.*, 2011; Bhasin, 2011). However, publications that connect Lean and innovation are still relatively few in number and most of them focus on production innovation (Hoppmann *et al.*, 2011). The application of Lean innovation in a service context is an emerging topic. This gives rise to research that explores Lean innovation approach in a service context.

The services sector is distinct from other industrial sectors (Grönroos, 2001). Along with the growth of the services sector and its use of information technology (IT), there is a rise in needs for effective methods to enhance service innovation by means of IT. While traditional product innovation emphasizes on the design of tangible and relatively static products, services are often intangible and customers are involved in the service delivery process (Bitner *et al.*, 2008; Oliveira and Hippel, 2011). Grönroos (2001) identified three basic characteristics of services:

(1) services are processed using a series of activities (a business process) rather than things;

(2) services are to some extent produced and consumed simultaneously; and

(3) the customer participates in the service delivery process.

Taking the characteristics of service into account, a service innovation can be regarded as a new service experience or service solution in one or more of the following forms:

- new service concepts;
- new customer experiences; and
- new delivery systems (Den Hertog *et al.*, 2010; Wooder and Baker, 2012).

The intangible nature, the interactivity characteristic and the different forms of service innovation bring a great challenge to the application of Lean innovation approach in a service context, as Lean is often used in the production environment. The research questions addressed in this study is to gain an understanding of the benefits and risks of Lean innovation in the service industry.

Although Lean innovation is often advocated, to our knowledge, there is no research that investigates the use of Lean innovation in the practice of service organizations. This article is aimed at demystifying Lean for service innovation by investigating its benefits and risks. For this purpose, a framework for examining Lean in the services sector is developed based on literature. We use this framework to analyze Lean innovation in digital banking service innovation by conducting a case study of the ING Bank. The framework is based on the *knowledge-based view* (KBV) of the firm. The KBV considers knowledge as the most strategically significant resource of a firm, and the source of competitive advantage resides in the application of the knowledge rather than in the knowledge itself (Alavi and Leidner, 2001). From a KBV point of view, Lean innovation is not only a management philosophy and a terminology for continuous improvements, but also a set of specific methods for knowledge sharing and management (Sonnenberg and Sehested, 2011). This specific strength makes Lean innovation appreciative when it comes to commitment and learning and, therefore, a promising approach for enabling effective innovation processes.

This article is extended from a prior publication of the authors in the 13th IFIP Conference on e-Business, e-Services and e-Society (Gong and Janssen, 2014). The prior

article presents the findings of an explorative case study about Lean innovation within an insurance company. This article shifts to banking industry to seek further insight of the application of Lean innovation. Both case studies are within the knowledge-intensive business service (KIBS) environment. In this way, the understanding on Lean innovation in a service context is extended. The contribution of this article is twofold. First of all, it reports on the impact of Lean innovation on a bank's innovation processes, both its benefit and risks. This has a contribution to understanding the innovation process in service organizations. Second, this article extends the application of Lean innovation approach to a service context and contributes to the knowledge basis of Lean innovation.

The following content of this article proceeds with a background on service innovation, KBV of the firm and Lean innovation in Section 2. Based on these three pillars, a conceptual framework for Lean innovation in service organizations is developed in Section 3. Section 4 presents the case study by applying the proposed framework. Section 5 then concludes this article by means of a discussion, addressing the implications of this research, followed by a conclusion, limitations and directions for future research.

Background and related work

Service innovation

Innovation concerns the generation of a new idea and the way to implement it into a new product, process or service (Urabe, 1988). The study of innovation rapidly grew as an area of research, but it has been often remarked that research has been dominated by a focus on manufacturing domain (Bitner *et al.*, 2008) and especially by some "*high-technical*" industries, such as aerospace, automotive and pharmaceuticals (Djellal *et al.*, 2013). The term "*service innovation*" refers to innovation taking place in the various contexts of services which include the introduction of new services or improvements of existing services. In a comparison with manufacturing innovation, service innovation has the following typical differences (Mina *et al.*, 2014):

- the traditional distinction between product and process innovations becomes weaker in a service context, as services often consist of processes that are hardly separable from the outcomes they produce;
- service innovation has been found to involve, more frequently, collaboration with customers; and
- service innovation tends to imply greater emphasis on intangible factors, such as organizational and human capital, than tangible assets (Gallouj and Savona, 2009).

Given these distinguishing characteristics, innovation approaches that predominate in manufacturing may not be applicable to services, and it will be proven to be useful to draw distinctions between the two areas (Ettlie and Rosenthal, 2011). According to the classification by Djellal *et al.* (2013), stressing the different forms of innovation and the distinctive innovation processes in service industries is an identical research stream of service innovation. The essential task of this research stream is to provide a useful heuristic for deductively analyzing the impacts of the characteristics of service specificities on innovation process (Djellal *et al.*, 2013; Hidalgo and D'Alvano, 2014). Accordingly, the key issue of the innovation management study in a KIBS environment

is to understand how knowledge is generated and utilized in the innovation process (Santos-Vijande *et al.*, 2015; Randhawa and Scerri, 2015).

Although there is no consensus on the definition of service innovation, some scholars have proposed similar multi-dimensional concepts of service innovation by its distinct forms. According to Den Hertog *et al.* (2010) and Wooder and Baker (2012), a service innovation can be in one or more of the following forms:

- new service concepts;
- new customer experiences; and
- new delivery systems.

The *first* form of service innovation is the new service concept, also called business concept and/or value proposition. A service concept describes the value that is created by the service provider in collaboration with the customer (Chen *et al.*, 2014). A service concept innovation is often a new idea of how to organize a new solution to a problem or a need of customers. A typical example of service concept innovation is that a landline telecom company provides telephone, TV and Internet "all-in-one" solution to its customers, or a mobile telecom company enables its customers to pay public traffic fee by using their mobile phone account and the NFC technology.

The *second* form is the new customer experience, also called customer interaction (Den Hertog *et al.*, 2010). In this kind of service innovation, the service concept might remain mostly unchanged, but the way how the customer interacts with the service provider differs. A typical example of this type of service innovation is the self-service in processes ranging from booking flights or hotels to submitting tax return applications.

A *third* form is the new service delivery system which often are predominated by the introduction of new information technologies. There are numerous examples of this kind of service innovation ranging from electronic banking and mobile banking to advanced multi-channel management which enable consistent customer service.

A service innovation can have a single form or a combination of the several forms previously outlined. The appearance of those forms and the combination between them will vary in different service innovation context. It is important to mention that a service concept innovation can be regarded as a strategic level innovation with which (almost) every other forms of innovation will come along (Den Hertog *et al.*, 2010; Wooder and Baker, 2012).

KBV of the firm

The requirement of understanding how knowledge is generated and utilized in the service innovation process leads to the theory of KBV of the firm. KBV of the firm is an outgrowth of the resource-based theory (RBT) of the firm, which was initially proposed by Penrose (1959). The RBT explains that firms create a sustainable competitive advantage by possessing inimitable, non-substitutable, rare and valuable resources and capabilities (Barney, 1991). The KBV considers knowledge as the most strategically significant resource of a firm, because knowledge-based resources are usually difficult to imitate and socially complex; the KBV of the firm posits that these knowledge assets may produce long-term sustainable competitive advantage (Alavi and Leidner, 2001). However, no one resource or knowledge asset may lead to a sustained competitive advantage in a long term. A knowledge-intensive firm must be willing to innovate to remain competitive. The source of competitive advantage resides in the application of

the knowledge rather than in the knowledge itself. Therefore, the firm's ability to effectively apply the existing knowledge to create new knowledge and to take action that forms the basis for achieving competitive advantage from knowledge-based assets (Alavi and Leidner, 2001).

Focusing upon knowledge as the primary productive resource, KBV considers the challenge of the coordination for service innovation is to devise mechanisms through which the knowledge resources of many different individuals can be deployed in the production of a particular product or service (Grant, 2013). There are several knowledge-sharing barriers, including technology, professional skills, cost and methodology of software development (Wendling *et al.*, 2013), Two critical knowledge-based processes are surrounded in the coordination of service innovation: knowledge accessing and knowledge integration to the production of services. While *accessing knowledge* can be considered as the learning activities of the organizations in an innovation process, *knowledge integration* are the organizational activities to transform knowledge assets into services (Grant and Baden-Fuller, 2004). Knowledge integration in the service process is the mechanism built within the service organization that enables all the involved departments and staff to share and offer the required expertise which can be used to internalize and facilitate innovation.

Lean innovation

Innovation has been a subject of scientific research for many years. Since the past decade, however, scientific literature started to report about the connection between Lean and innovation. Publications that connect Lean and innovation are still relatively few in number. According to Hoppmann *et al.* (2011 Exhibit 1), till 2011, only 27 publications can be found about Lean-driven innovation. In those publications, general Lean principles, such as "*create value for the customer*", "*think systematically*", "*flow and pull*" and "*continuous improvement*" (c.f. Womack and Jones, 2003; Shingo, 2012), are widely used to guide the implementation of Lean thinking. In a manufacturing context, Smeds (1994) argued that reorganizing manufacturing according to Lean principles can trigger a techno-organizational change toward a Lean enterprise, with a new structure, strategy and culture. In the research and development (R&D) domain, Schuh *et al.* (2008) revealed the benefit of implementing Lean thinking principles in innovation management to achieve incremental process and product innovations. Besides the manufacturing industry, Lean is also applied in the health care and pharmaceutical industry to stimulate incremental process innovation (Johnstone *et al.*, 2011; Garcia-Porres *et al.*, 2008). Despite its significance, there are hardly any publications about Lean innovation after 2011, and we recommend more research in this important field.

The idea of Lean innovation is emerging and reported by Schuh *et al.* (2008), who defined that Lean innovation system represents the systematic interpretation of Lean thinking principles regarding to innovation and development. Lean can drive innovation because (Johnstone *et al.*, 2011):

- it encourages root-cause analyses of problems, creating a rich and constructive stimulus for new ideas;
- it can create the autonomy and flexibility for people to proactively solve problems;

- it values and encourages relentless reflection for learning and views risk-taking as opportunities to learn; and
- it creates a more involved, engaged and committed workforce that takes pride in their achievements, promoting self-confidence and further cycles of ideation and innovation.

These benefits make Lean innovation a possible answer to the question of how to make innovation processes more efficient (Sonnenberg and Sehested, 2011). According to Sonnenberg and Sehested (2011), Lean innovation is also a set of specific methods for knowledge sharing and management in innovation. From a KBV perspective, Lean innovation has a potential to provide mechanisms to support knowledge accessing and knowledge integration. However, to our knowledge, this has not yet been proved in a KIBS environment. It is interesting to investigate how to apply Lean innovation in a KIBS context to devise those mechanisms, and what are the benefit and risk out of them.

Although Lean innovation has the above benefits, there is also criticism on Lean management. Competitive advantages are the final target of a company in its effort to pursuit innovation. Critics indicate that the Lean management literature has not, so far, demonstrated the ability to enhance the competitiveness of companies (Arlbjørn and Freytag, 2013). This holds a risk that employees might be demotivated by spending their valuable time on an innovation approach that does not provide expected positive final result. Some other risks of Lean innovation are identified in the need for management support (Sonnenberg and Sehested, 2011), such as in the way of encouraging novel ideas to be proposed, risk might also rise as the implementation of different good ideas might fright for resource; and involving customers in the innovation processes can increase the chance of a successful innovation, but it also displays the weakness of the product or the company to the customer. The latter also raises the expectation from customers and a failure in achieving expected improvement in a tolerable period to the customers might run a risk of losing their loyalty. These negative aspects of Lean innovation has not yet comprehensively discussed in literature and need to have further investigation in practice.

Research approach

This paper is aimed at demystifying Lean for service innovation by investigating its benefits and risks. A Lean innovation framework is developed based on the methodology of information system design theory (Walls *et al.*, 1992). Normative and descriptive were integrated in a single framework to understand Lean innovation in organizations. The framework is designed by using the KBV perspective and drawing upon Lean principles as found in the normative literature. KBV was used as the kernel theory, whereas Lean principles and methods were used to construct the framework.

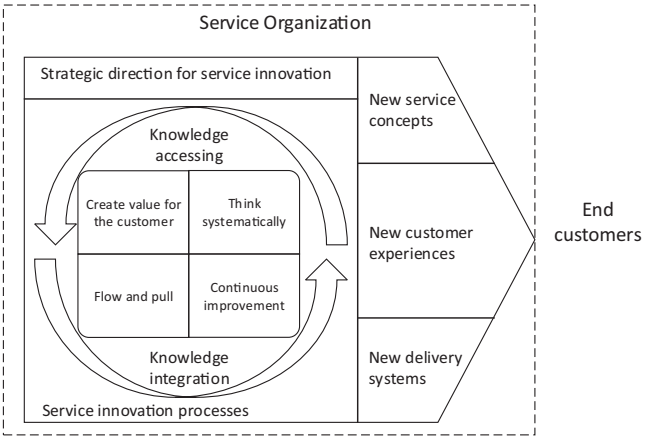
This study is exploratory in nature and utilizes the framework to investigate an in-depth case study to investigate the use, benefits and risks of Lean innovation. A case study will enable us to put Lean innovation in a realistic perspective which might be different than the advocated perspectives. A case study is an appropriate research method for an exploratory study and is suitable to answer "How?" research questions (Yin, 2009). The question "how Lean innovation was used" was answered.

As the case study, ING, a large, multi-national financial organization utilizing lean innovation, was selected. The selection criteria were based on being a frontrunner in this

field of Lean innovation, and we had access to this case study. The use of a single case study limits the generalization to analytical generalization (Yin, 2009). Consequently, the results are only applicable to large, multi-national financial organizations. The case study was investigated by collecting and analyzing documents followed by interviews with developers, IT manager and the Chief Information Officer (CIO). These interviewees were selected with the intention to obtain the information about Lean innovation from different organizational levels, including the operational, tactical and strategic level. The interviews lasted between 60 and 90 minutes. The interviews were semi-structured in which all aspects of the framework were discussed and the interviewees had also the opportunity to discuss other elements. The Lean innovation framework was used to analyze the interviews, by examining whether each Lean principle in the framework are applied in the case study, and whether the use of Lean principles enables different forms of service innovation outcomes.

A Lean innovation framework for service organizations

A framework for analyzing Lean innovation for the service organization (Figure 1) is developed to explain how Lean impacts service innovation processes. Information system design theory specifies that a design product should draw upon kernel theories in specifying prescriptive hypotheses that enable designers to evaluate whether the product satisfies the theory. As we intent to observe Lean innovation in KIBS environment in which knowledge accessing and integration is the key issue, this framework drew upon the KBV of the firm as a kernel theory. The KBV suggests that service innovation processes need specific mechanisms to support efficient knowledge accessing and integration. The evidence reported by existing literature and the theoretical body of knowledge on Lean innovation indicates that Lean is able to underpin knowledge accessing and integration and results in different kinds of innovation outcomes. This enables the creation of a framework to investigate the impact of Lean innovation on service innovation processes from a lens of the KBV of the firm.



Source: Based on Gong and Janssen (2014)

Figure 1.
A conceptual framework of Lean innovation for service organizations

In this framework, knowledge accessing and integration are underpinned by four Lean principles. Lean principles are summarized from industrial Lean practices and are widely used to guide the implementation of Lean thinking (Womack and Jones, 2003; Shingo, 2012). The four Lean principles presented in Figure 1 are selected, as they concern specific areas where service innovation processes should pay attention to avoid waste and focus on creating value in the knowledge accessing and integration.

In the framework, knowledge accessing and integration are facilitated by the four Lean principle: "creating value for the customer", "think systematically", "flow and pull" and "continuous improvement". These four principles facilitate knowledge accessing and integration by supporting the service innovation processes which result in different forms of service innovation, including new service concepts, new customer experiences and new delivery systems. These principles are selected, as they are advocated in Lean innovation literature and more process related. Other principle, such as "lead with humility" and "respect every individual", are culture enablers (Shingo, 2012), and their effect on service innovation is indirect and hard to measure.

Create value for the customer concerns everyone knowing what the customer desires and demands. This means people begin with the final result in mind and focus on doing the right things to reach this desired result. Value is typically defined as something for which customers are willing to pay. This indicates the underlying significance of service innovation which would be considered to be useful and accepted by the market. By focusing the value of the customer, the service organization knows what the customer considers to add value and what is considered waste, thereby allowing service concept innovation to meet the changing demands of the customer.

Flow and pull are the ways of working that strive to align everybody's job in different business processes of the service organization to delivery services to the customer. After having a clear target that creates value for the customer, this principle aligns involved people on the same direction and makes them interacted in a smooth way. The ideal flow should be an uninterrupted progression of services and information and pull signals initiate work to eliminate interruptions in the flow. Typical interruptions in a flow are delays, rework and waiting. For example, reworking a software application because of unclear business requirements or handling too many proposed requirements at the same time.

Similarly, *continuous improvement* concerns the continuous effort of people to shift from reactive firefighting to proactive problem-solving and having the aim of relentlessly improving the execution and efficiency of processes in an ongoing manner. In this way, a flow and pull way of working would be implemented and improved. By focusing on flow and pull, as well as continuous improvement, waste is gradually eliminated causing everyone in the service innovation process to focus more on better customer service delivery systems and innovation.

Think systematically focuses on viewing the interconnected processes that make up the entire value stream, while being aware of the cause-and-effect interdependencies that either add value or create waste. All people involved in providing customer services should have a holistic view of the services to fully comprehend how specific activities for innovation relate to the greater whole, rather than existing in isolation. In this way, new customer interactions and experiences can be created by reordering and streamlining the service resource and functions that are used to be distributed in different

departments or teams in the service organization. This principle unifies the above three principle and allows organizations to sustain their Lean innovation processes.

Case study

A case study was investigated using the framework to analyze the benefits and risks of Lean innovation. We will first provide the background of the case studies and the digital banking innovation strategy. This is followed by the innovation process for new service concepts, customer experiences and new delivery systems.

Case study background and service innovation strategy

ING is a Dutch retail bank and part of the ING Group, a global financial institution that provides banking, investment, life insurance and pension services. ING has over 85 million customers across the world in Europe, the USA, Canada, Latin America, Asia and Australia. ING has a CIO responsible for driving ING's strategic innovation agenda, developing and promoting innovative ideas and solutions, applying new technologies and delivering speed-to-market of successful ideas.

ING bank's strategy for service innovation aims to create a differentiating customer experience by utilizing IT and striving for operational excellence and enhancing the performance. This aim is achieved by simplifying and streamlining the organization and enhancing the customer experience. The latter is done by listening to the needs of customers, following up on their expectations and offering them digital products and services that are suitable to their need. Banking should be available at anytime, anywhere and as easy as possible. A challenge is to get rid of the batch-oriented systems that are not available 24 hrs $\times$ 7 days a week. The vision is to transform form closed IT structures to structures that are more "open", connected and better able to communicate with each other. Another challenge is dealing with the international payments in the Single Euro Payments Area (SEPA). For this purpose, more and more data of customers are used and the banking applications are continuously improved. The applications landscape has been rationalized and stand-alone applications have been reduced, which resulted in a 17 per cent decrease of operating costs according to the interviewees. Lean innovation is achieved by using a continuous delivery strategy, in which apps are frequently updated. For this purpose, the board and management structure was changed to create strong leadership in facilitating new ways of working.

Innovation process for new service concepts

ING offers its customers extra financial management functions based on their data, such as the creation of a household book and the analysis of how money is spend. Innovating requires a combination of different disciplines, including software engineering knowledge, banking knowledge and client needs. IT and banking are both viewed as core knowledge domains. Brainstorm sessions with both IT and business personnel stimulate creative ideas and enable new services to be generated. These service developments were guided by the principle of creating value for the customer. For example, the creation of a search option on the app was driven by customer request and enabled via the discussion among customer service and IT staff. One interviewee commented "we listen carefully to our customers and ask for feedback on various options before rolling out new services". Furthermore, the guiding principles' continuous improvement is a key aspect in which news services are founded, tested and enrolled for a limited number of customers. After several iterations, the service is mature

enough to be released for all customers. In contrast to traditional service innovation, in which each stage occurs in linear order and might last for a long period, new services are developed in short, repeated cycles and tested on a small customer base.

Innovation process for new customer experiences

To increase customer experience and accomplish operational excellence, ING bank wants to further expand digital banking and to strengthen local advisory capabilities in the branch network at the same time. They make large investment to further simplify and automate IT systems and processes. ING states that "our ambition is to use 40 per cent of the application in multiple division by standardizing processes". Furthermore, an *Omni-channel* approach to create consistent customer service is created. ING bank still uses different IT systems for mobile app, Web site, call center and branches. As a consequence, not all customer information is readily available. By moving to an omni-channel approach, customers can do all their banking digitally, and the information will be available across all channels to provide a better, more seamless service.

To support the omni-channel approach and to increase the reliability, efficiency and agility of its IT systems and operations in The Netherlands, ING has changed its IT-innovation process. This results in a more simplified IT landscape with standardized IT systems and highly automated processes. By embracing the think systematically principle, the multiple channels are slowly integrated. First, those parts that directly affecting the customer experience are targeted and made consistent. Thereafter, the backend systems are connected to enable the seamless service across the channels.

Innovation process for new delivery systems

ING used to adopt a classical waterfall model for software development, in which the teams were working in isolation and did hardly communicate with each other (Westerveld, 2014). Each team focused on its own task and to meet the predefined agreements to move to the next stage. The teams were focused on doing their own work without looking at other consequences. There were hardly any interactions between the teams. This siloed way of working frequently resulted in failures. Furthermore, this structure was not able to deal with the fast-changing market dynamics and the speed of development required by their customers. ING wanted to move to customer-centric operation by (Molenaar, 2014):

- reducing bureaucracy;
- stimulating entrepreneurship in the teams;
- improving internal cooperation;
- moving toward personalized marketing; and
- delivering with a faster time-to-market.

To reach these goals, ING used Agile Scrum software development method in its software development team for its mobile banking application. Sprints, namely, short repeatable work cycles, are used to develop system by teams. The use of sprints has the risk of focusing on short-term goal over long-term goals, whereas the use of many developments teams has the risk of having not coordinated actions by the software developments teams. Although Agile development is a common practice in software

development jobs, ING needs a customer-centric operation that goes beyond its IT department. This has resulted in a transformation of the organization and new leader who was able to handle this new way of working. To manage the diversity and parallel developments and to rationalize the application landscape, standards are defined and software applications are reused among processes. Furthermore, for accessing knowledge from the typical Agile Scrum way of working, ING integrated its software development teams with marketing teams and others, such as the mail service team, call center and sales force. This was achieved by applying Lean principle "flow and pull" and "continuous improvement" together with the Agile software development method. At the same time, knowledge integration is achieved by sharing and exchanging the knowledge about the market situation and the development capability to reach agreement on a common expectation on the next version of the mobile banking application. Such a mutual learning is iterative with the feedback from the salesforce, mail service and call center. At the end, this enabled a new service delivery system. The mitigation require an inflow of high-class engineers, the stimulation of existing staff to improve their skills and the release of staff who could not develop required competencies. For this purpose:

> […] we created an engineering culture by providing a working place in which the number one engineers want to work and collaborate with each other […] culture is the key as great engineers attract great engineers.

To enable a streamlining end-to-end service delivery system, a *Kanban pipeline* was used as a tool. A Kanban is a visible signaling system to trigger action and achieve just in time production. A deployment pipeline provides visibility into the production readiness of the applications by giving feedback on every change to the system. The deployment Kanban pipeline is the key pattern that enables continuous delivery. Continuous delivery (CD) aims to deliver new features to users as fast and efficiently as possible. The core idea of CD is to create a repeatable, reliable and incrementally improving process for taking software from concept to customer (Humble and Farley, 2011). The goal of CD is to enable a constant flow of changes into production via an automated software production line. The CD pipeline is what makes it all happen (Humble and Farley, 2011). The pipeline is created by breaking down the software delivery process into several stages and by utilizing Scrum teams. Each of the stages aims at ensuring quality and preventing errors. The pipeline provides feedback to the stages and the teams. In this way, the Scrum teams are able to work together with marketing and other business people, as well as the business analysts and software quality control teams.

CD is centered on the software development team using visual control boards to outline the various steps that software goes through during development. Anyone in the organization can look at the board at any time to view the status. The software development team's Scrum boards are integrated in the Kanban board showing the various phases. The pipeline is visualized by showing at which stage a card is and how it progresses from one stage to another stage. A card starts at the beginning of the pipe and flows till the end. This flow is enabled via the pull system that happens at the end of the pipe. When a customer requests a given feature for a software product, they want to pull that feature out of testing, so that they can start using it.

Findings and discussion

The case study findings provide us the evidence of the impact of Lean principles on service innovation. In the ING case study, all three forms of innovation (Den Hertog *et al.*, 2010; Wooder and Baker, 2012), as discussed in the second section, were found. First, there is service concept innovation by attempting to offer customers more financial management functions based on their data, like the creation of a household book, the analysis of how money is spend, etc. The second form is the offering of a new customer experience by offering the omni-channel approach, in which seamless banking service can be used on any device at any location at any time. The third form is the use of continuous delivery way of working to enable a new service delivery system that develops and delivers up-to-date mobile apps to the customer.

The impact of using the four Lean principles – "creating value for the customer", "think systematically", "flow and pull" and "continuous improvement" – are also followed in the case study. The principle creating value for the customer allows personnel working in different departments to cooperate in the innovation process to create new service concepts. The value of new innovations is evaluated by a small customer base before scaling up. The think systematically principle enabled the integration of multiple customer service channels and taking an omni-channel approach. In this way, all information is available, and a platform is created enabling new customer experiences. The principles of flow and pull and continuous improvement together support the continuous delivery way of work and result in a new service delivery system.

In our research, we viewed Lean service innovation as adhering to the Lean innovation principles. In this case study, we found that Lean and Agile were used at the same time. In literature, there is a continuous debate on the difference and similarity between Lean and Agile, and some scholars believe that their philosophy are overlapping and their tools and methods are compatible (Mason-Jones *et al.*, 2000). Lean thinking can be used a lens to analyze implementation variations of agile (Durrani *et al.*, 2014). Although we did not investigate Agile development, there seems to be an overlap between the two approaches. For example, the principle of creating value for the customer is embraced by both approaches, whereas the principle of systematic thinking seems not to be a part of Agile development, and Lean has a different toolset than Agile development. As our objective is to investigate Lean innovation, we did not delve into these issues and recommend further research to systematically analyze similarities and differences between both approaches to better understand possible synergy effects between the two approaches.

In the literature, Lean innovation's main benefit is viewed as making the innovation processes more efficient (Sonnenberg and Sehested, 2011). In contrast, we found several other benefits, including: quick reaction to customer wishes by releasing new functionality and experimenting-based approach to gain feedback about the benefits and drawbacks of changes. In this way, it facilitates quick learning. As such, a broader range of benefits is realized than advocated in the literature.

In the case, we also found that some risks can hamper the use of the Lean principles. Risk can be defined as "an undesired outcome that has a known or estimated probability of occurrence and impact based on experience or some theory" (Charette, 1991). Table I summarized the main risks and also the mitigation measures to deal with these risks. Having the commitment from the teams is a key aspect. We observed very strong

Table I. Overview of risks and mitigation mechanisms

Risk	Description	Mitigation mechanisms
Short-term focus	The focus is on innovating quickly and achieving short-term results The long-term objective might be lost	Communication mechanisms in place for ensuring knowledge about the long-term goals, discussion contribution toward long-term goals
Working in isolation	In the initial situation, the teams worked in isolation The risks are that the teams remain working in isolation and not contributing to a shared vision	Rotations among team members, various disciplines on one team, meetings to coordinate activities, leadership emphasizing collaboration
Lack of professional skills	Lean innovation poses high requirements on the staff The staff needs to develop professional skills to be able to innovate	Training and development sessions Replacing old staff and hiring new staff Creating engineering culture in which experiences are shared and professionalism is important
Poor quality	Speed might be preferred over a well-thought idea and concepts The risks are that poor-quality ideas are implemented and tested which does not stand a chance	Testing on a small user group and only enrolling to a large audience after several iterations of improvement and users are positive
Lack of standardization	New ideas and innovation is preferred over standardization and efficiency of systems' control and maintenance	Defining standards and reusing software applications
Inward focus	The risk is that the inward focus remains instead of an outward customer focus is created	Rotation of team members, regular customer surveys and focus groups Evaluation by customers
No detailed planning	No detailed planning to guide the prioritization among the implementation of different new ideas	Plans are changed all the time and shaped by a repeatable and scalable organization
Hard to control and maintenance	By working agile, deliveries are frequently versioned	Developing for maintenance, retaining knowledge, separating building blocks

leadership supporting the practices and motivating teams to work together. At all levels on the board, there was full support for the Lean service innovation approach. These efforts result in knowledge-stimulating teams and staff to share expertise needed to internalize and facilitate innovation. The organization is not static, but dynamic, as staff rotates and adopts new roles. This poses higher requirements on the knowledge requirement of the staff.

This list is derived from the case study, and there might be other risks like the lack of alignment between software development method and Lean innovation (Wendling *et al.*, 2013). In other case study, other risks might be found, and to generalize the finding, we recommend developing a survey to generalize and prioritize the risks. The list of risk can help to understand the probability, the impact of the potential risks and the taking or organizational mitigation efforts.

Conclusion

Lean innovation, advocated by the research, has been anecdotal, and no systematic research was conducted. Even less attention has been given to Lean innovation in the services sector. In this paper, an in-depth case study was analyzed to understand and demystify Lean service innovation in practice. A framework was developed based on the KBV; taking the KBV has the advantage that it identifies knowledge accessing and knowledge integration as the two critical knowledge-based processes surrounded in the coordination of Lean service innovation. Using the framework, more insight is created in the case study, and this helped us to put Lean innovation in a realistic perspective that goes beyond those who advocate it. The case study confirmed that Lean innovation has advantages over the innovation approach that was used before. Whereas Lean innovation is focused on creating a more efficient innovation process, we found a broader range of benefits, including faster reactions and quicker learning cycles. However, the case study also shows that there are many risks associated with Lean innovation and that mechanisms have to be introduced to deal with these risks. This suggests that introducing Lean innovation might be difficult. In our case study, the Lean service innovation is dependent on how the risks are handled and strong leadership and top-management support. The risks can be managed in various ways suggesting that there is no single way to realize Lean innovation, instead there are many variations possible dependent on how organizations mitigate the risks.

An overlap between Lean service innovation and Agile software development was found in the case study. Lean Innovation and Agile development seem to be not only similar on some aspects, but also different on other aspects. We recommend more research in the similarities and differences between these two streams and to investigate how these approaches can strengthen each other.

At least two limitations to this research should be taken into account. First of all, we did not assess the performance of the new service delivery system and customer experience to measure the financial effect of the innovation. Second, a single case study does not provide the opportunity for us to address external validity of the findings. In particular, other risks might be found when surveying other situations. For the future study, research can be conducted to investigate whether the findings about the combination of Lean innovation and Agile development can be generalized to the service sector and applied in other service organizations.

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