Reconceptualizing value innovation for Industry 4.0 and the Industrial Internet of Things

Reconceptualizing Value Innovation for Industry 4.0 and the Industrial Internet of Things

Paul Matthyssens

University of Antwerp and Antwerp Management School

Appeared as: Matthyssens, P. (2019), "Reconceptualizing Value Innovation for Industry 4.0 and the Industrial Internet of Things", Journal of Business & Industrial Marketing, Vol. 34 No. 6, pp. 1203-1209

Abstract

Purpose: Starting from the foundations of value innovation, the article intends to give an idea of the key drivers and barriers -internal and external to the company- and to provide insight into proven capabilities underscoring the ability to create a flow of new value initiatives. These thoughts are then confronted with the present challenges of Industry 4.0 and the Industrial Internet of Things (IIoT). The confrontation leads to the identification of five capabilities for future-proof value innovation.

Design/methodology/approach: Literature review based upon the work of the author with more than two decades of experience within value innovation research. The review is supplemented with recent literature and an overview of the challenges of Industry 4.0/IIoT, which leads into a confrontation of the present status of value innovation with future requirements.

Findings: Value innovation remains important specifically for established companies facing path-breaking digital disruption of their existing business models provoked by Industry 4.0 and IIoT. Five key capabilities are suggested to rejuvenate value innovation and prepare it for the Industry 4.0 challenge: (a) Capabilities for designing, adapting, and marketing product service systems; (b) Capabilities for blending digital strategy and processes with value offerings; (c) Capabilities for designing and mobilizing ecosystems and integrating these into a value-based IIoT platform; (d) Capabilities for combining and integrating technological and value innovation approaches, and (e) Capabilities for linking value creation to value capturing.

Research limitations/implications: This article is more of a "viewpoint" than an empirically based paper presenting new research findings. It is based on expert judgment and confrontation with extant literature. The outlook indicating five key capabilities needs further empirical corroboration.

Practical implications: The overview of barriers and the "toolkit" for value innovation (Figure 1) as well as the five capabilities for future value innovation are expected to be managerially relevant.

1. Value innovation: Concept, Drivers and Barriers

Management and marketing scholars have suggested *value* or *strategic* innovation as a key driver for the creation of competitive advantage (Baden-Fuller and Pitt, 1996) and superior customer value (Kim and Mauborgne, 1999). Simmons, Palmer and Truong (2013) link disruptive digital and business model innovations to the inscription of value by different stakeholders. Zhang et al. (2015) demonstrated that marketing and networking capability build up brand equity via value co-creation and customer value, while innovation capability positively impacts brand equity indirectly by facilitating value co-creation and enhancing customer value. Almquist, Cleghorn and Sherer (2017) claim that as offerings are ever more commoditized, B2B marketers need to address the personal, more subjective value elements purchasers bring to the table.

The aim of value innovation is the creation of new market space (Kim and Mauborgne, 1999) enabling companies *out-competencing* rather than *out-performing* competitors (Pitt and Clarke, 1999). In contrast to 'regular' innovation where emphasis lies on the technological aspects of the

innovation (Chesbrough and Rosenbloom, 2002; Chesbrough, 2010), the focus of value innovation is *not* on the technological aspects, but rather on the re-conceptualization of the industry or business model to create fundamentally new and superior customer value (Matthyssens, Vandenbempt and Berghman, 2008). This latter approach is named radical (managerial) mindset innovation by Ringberg, Reihlen and Rydén (2018). The study of non-technological types of innovation has been growing steadily (Berghman, Matthyssens, Vandenbempt and Streukens, 2013).

Value innovation has gained importance as each business model is challenged or diluted (Chesbrough, 2010) and *commoditized* due to intense rivalry (Kim and Mauborgne, 1999, 2004; Matthyssens, Vandenbempt and Berghman, 2006; Matthyssens and Vandenbempt, 2008). Efficiency and cost control remain important in today's business environment, but the spotlight must be refocused on flexibility, creativity and disruption (Ringberg et al., 2018). The best way to escape hyper-competition and sustain competitive advantage is through launching new value concepts and continuously re-inventing the way customer value is created and delivered. However, the road to value innovation is paved with barriers.

Internal barriers to value innovation are rooted in the lack of an inquiring and non-traditional mindset (Pitt, 1998), the difficulty of unlearning (Sinkula, 2002) and sense making (Day, 2002), marketing inertia, learning myopia (Levinthal and March, 1993), and so forth. The concept of *active inertia*, introduced by Sull in 1999, indicates that even very successful companies and marketers have difficulties in adapting to a new way of doing business.

In diverse studies the author identified specific internal barriers throughout the distinct stages of new value creation (Matthyssens et al., 2006; Matthyssens et al., 2008; Berghman et al., 2006). Table 1 shows that industrial companies might be captured within a technology-centric perspective on innovation and might not be able to break out of their operational product focus. Their internal competences might fall short, or the internal support can be limited. Eventually, they might face difficulties building a trustworthy revenue model and business case.

Table 1: Internal barriers to new value creation

Initiation:

- 'Closed thinking', trapped in industry logic: Incumbents tend towards isomorphism, and live up to standard industry routines and procedures
- Active inertia: Established strategic frames become blinders, processes become routines, stakeholder relations turn out to be shackles and values derail into dogmas (Sull, 1999).
- Operational, technology-based mind and lack of strategic design thinking: Companies tend to overspend on development of the product offering and underinvest in innovation of the configuration and of the experience (see Doblin.com). Design thinking has been suggested as a method for breaking boundaries in the innovation mindset.

Realization:

- Existing partner relations: Vertical supply chain relations often act as hindrances from adding value when the new activities were performed till then by loyal supply chain partners.
- Lacking competences: New value packages might involve additional service activities for which the innovator lacks specific processes, know how, knowledge etc.
- Limited support from management and sales: Decision makers as well as sales persons might be reluctant to support the new offering because the former perceive uncertainties and the latter might expect lower fees per client (selling a service contract rather than new product)

Value capturing:

- Limited solutions credibility at customer: The customer might not believe in the ability of the supplier to take up additional value creation tasks due to missing track record.
- *Service for free* attitude at customer: The customer might not be willing to pay for extra service, expecting the service cost to be part of the product price.
- Benefits only 'soft': The business case for the value concept might not be fully convincing as it lacks a detailed computation of the savings and guarantees the customer might expect when shifting from buying a product to buying a total solution.

At the same time, successful value innovation should be firmly embedded within a company's entire network relationships. It implies the cooperation and commitment of external parties, including a company's suppliers and supply chain partners. Since value innovation implies a redefinition of a business, whereby roles taken up by different firms and relationships among firms are redesigned (Matthyssens el al., 2006, 2008), it implies breaking free from taken-for-granted assumptions about competition, established industry logics and the intra- and inter-organizational ways of working in supply chains. Such deviations from traditional working relations may be blocked by *external barriers*.

Using a rich interpretive method, Matthyssens et al. (2006, p. 757) demonstrate that over various industries value innovation initiatives encounter "inhibitors that are ingrained in the same industry recipe from which the companies tried to break out" such as traditional buying behavior based on requests for quotation with detailed customer specifications rather than on expected performance. Traditional product and supply chain thinking by other industry players inhibit many initiatives, or at least provoke delays in their market introduction or acceptance. This way, interdependencies play a dominant role at various stages of value innovation development. Mistrust and old power games block value creation efforts from becoming successful.

Van Bockhaven and Matthyssens (2017, p. 70) start from the observation that business actors should tackle the behavioral challenges faced when they introduce radical innovations "that go against the institutionalized rules, interests and logics of their field". Value innovations get stuck on the unwillingness of actors to adopt or accommodate the innovation, provoked by the innovations' infringement on actors' behavioral drivers such as existing and shared frames, self-identities, interests and power structures, and thus the risk of unsettling the consensus within an existing field. To move a field implies a challenge to mobilize actors and to guide their sense making (Möller and Svahn, 2009). All relevant interdependent actors need to be convinced of

the innovation's value, and their diverse interests should be aligned. Van Bockhaven and Matthyssens (2015) conclude that “network development seems especially relevant in cases where it serves to innovate the business field, rather than the product or service offerings. When deinstitutionalization, rather than the search for new products or platforms, triggers the development of an innovation network, it involves addressing a higher-level challenge. In this context, managers need to identify specific drivers of deinstitutionalization and then the appropriate levers to address them, so that a new, fitting model of value creation can be co-created” (p. 431).

Consequently, the results of value innovation can be disappointing as companies might not be able to overcome internal and/or external barriers. It should be clear that value innovation implies the willingness and ability to destruct obsolete routines and items in the organizations’ and industry’s knowledge and experience base, enabling the adoption of more effective behaviors.

2. **Value innovation capability**

The capability to realize value innovation or systematically generate value innovation initiatives is closely related to the concepts of absorptive capacity and dynamic capabilities (Matthyssens et al., 2006, p. 752). The former is the ability to recognize the value of new information, assimilate it, and apply it to commercial ends (Cohen and Levinthal, 1990, p. 128). The latter refers to the firm’s processes that use resources – specifically the processes to integrate, re-configure, gain and release resources – to realize change. Dynamic capabilities are organizational and strategic routines by which firms achieve new resource configurations (Eisenhardt and Martin, 2000, p. 1107). Zollo and Winter (2002, p. 340) state that a dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness. Absorptive capacity can be considered as a key dynamic capability needed to keep competitive advantages in markets. Value innovation implies the necessity of absorptive capacity.

It might be difficult to transfer organizational capabilities oriented towards information search and processing from the context of *technological* or *product* innovation to the field of *value* innovation. In the former, emphasis lies often on improving the performance of products and technologies in an incremental way within known technological boundaries. This is done by new product development teams that are well trained and which are backed up by well-developed procedures, project steps and plans. In the latter the information search and processing roles are less defined and managerial interventions combining various levels and divisions are required. Even suppliers, customers, complementors and technology facilitators might need to be involved at an early stage of the value innovation cycle.

This led Berghman, Matthyssens & Vandenbempt (2012) and Berghman et al. (2013) to perform quantitative studies on value innovation capabilities using an absorptive capacity lens. The former study shows how the provision of information from suppliers versus customers in a supply chain affects the relationship between deliberate learning mechanisms for recognition, assimilation and exploitation and a firm's ability for value innovation. This research concludes that “selecting a supplier with strategic ideas on value creation in the supply chain may be more important in the long run than finding the most efficient one. In this way, supplier relationship management (SRM) might be crucial in the context of value innovation. By not serving innovative customers and suppliers, strong existing business relationships risk to make

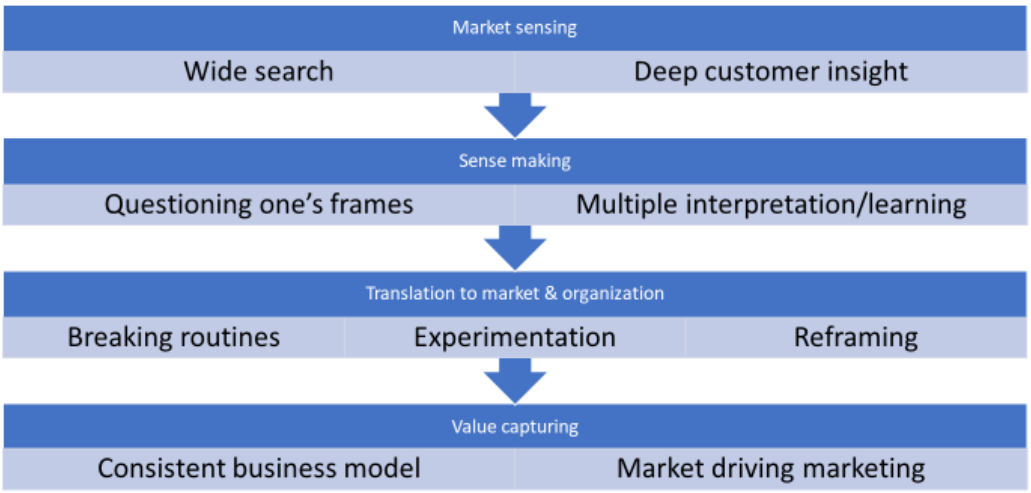
organizations more market-driven than *market-driving* and thus to decrease the value innovation ability of these companies" (2012, p. 35).

The latter study (Berghman et al., 2013) re-interprets absorptive capacity through a cognitive lens and illustrates which deliberate mechanisms affect the different dimensions of absorptive capacity in such a way that the organization's strategic innovation capacity is strengthened. The analysis shows that deliberate mechanisms for assimilation and exploitation can directly foster strategic innovation capacity, but important mediation effects can be discerned. The effect of deliberate mechanisms for recognition seems fully mediated by the two other categories of learning mechanisms. The study also shows specific instruments for *out-of-the-box* trend spotting via the collection of data on customers' customers, and *critical* sense making with the aim of creating value innovation initiatives.

Building upon our series of studies on value innovation, the marketer can be suggested to follow steps such as the ones described in Figure 1 when striving to increase the value innovation output in his/her company. This should be backed by a performing and integrated absorptive capacity process within the company. Also, it can be facilitated by strong and open collaboration in the industry (open information exchange).

Figure 1 highlights "market sensing" as a first step whereby a wide search implying not only deep insight into existing customers is sought, but also behavioral data from customers of customers are gathered. Forecasting studies are used to interpret changing market practices, adjacent and best practice industries are studied, and so forth. The second stage is "sense making" where existing frames on market assumptions and marketing routines are deliberately questioned and multiple interpretations of trends by different business actors within and outside the company are deliberately sought. The third stage is the implementation and execution stage to "translate the new value concept to the market and the organization". Here, routines are deleted and space for experimentation is created. Institutionalized agreements and structures might need to be reframed at this stage. The final stage aims at "value capturing" and concerns the effort to build a convincing business model and "drive" or to educate the market with proactive marketing techniques. Eventually, this should lead to value capturing because the ultimate objective of value innovation is the creation of higher margins in mostly commoditized industries.

Figure 1: A marketer's toolkit for value innovation



3. The context of Industry 4.0 and the Industrial Internet of Things

Almada-Lobo (2015) describes Industry 4.0 as both striking and fascinating as it is a disruptive combination of Cyber-Physical Systems (CPS), the Internet of Things and the Internet of Services. He claims that there is still a lot of confusion about the implications of what matters in Industry 4.0 considering the complexities of technologies such as Mobile, Cloud, Big data, M2M, 3D printing etc. that trigger disruptive transformation. CPS drive smart products and more transparent supply chains mapped on digital platforms. Decentralization, advanced integration of the supply chain, connectivity and cloud computing/advanced analytics are key components of Industry 4.0. As such, experts claim that Industry 4.0 transforms the design, manufacture, operation and service of products and production systems (BCG 2015). They identify nine key technologies (Augmented reality, Additive manufacturing, Big data and analytics, Robotics, Cloud, Cybersecurity, Simulation, the Industrial Internet of Things, and System integration) that in combination lead to connectivity, integration, flexibility, customization, speed, productivity and quality, thereby envisioning fully integrated data and product/communication flows across borders.

Eloranta and Turunen (2018) pinpoint that "IoT increases the availability of data and opens up opportunities for process optimization, collaborative value creation, business model innovation and consequently the restructuring of existing industries" (p.745). Lu (2017) connects unprecedented levels of productivity and efficiency to Industry 4.0: "The development of industry is an integrated process of complexity and agility between human and machine. Industry 4.0 increases the digitization of manufacturing with CPS, in which connected networks of humans and robots interact and work together with information shared and analyzed, supported by big data and cloud computing along entire industrial value chains" (p. 8).

Industry 4.0 and the Industrial Internet of Things (IIoT) provide many opportunities for new value creation and they force established companies to re-think their businesses and industries. Reddy and Reinartz (2017) link digital transformation to value creation as interaction costs and

information asymmetry are lowered. New products and services will enhance customer value and massive amounts of data will be available enabling customization of offerings. A new wave of digital disruptors is challenging established industries. The latter should innovate fast, first in their minds, then in their actions, Reddy and Reinartz (2017) conclude.

Along similar lines, Metallo, Agrifoglio, Schiavone, and Mueller (2018) pinpoint IoT as a novel paradigm leading towards applications in smart industry (Industry 4.0), transportation and logistics, smart cities and so forth. They claim technological aspects have been studied more than managerial in this area, and value creation from IoT needs more research attention. New IoT-based business models must be built with specific focus on value proposition and key activities and resources enabling value creation and capture.

Studying 76 cases in German industry, Kiel, Arnold and Voigt (2017) show the impact of the emergence of the IIoT on established business models (BMs) of manufacturing companies: "Regarding the value configuration, integrative solution packages encompassing a modular combination of hardware and software components require hardware manufacturers in particular to perform respective technology development activities" (p.12). A consequent service orientation and an intensified customer relation lead into optimized customer processes, mainly aiming for value creation and capture. Established companies generally think of offering-driven business model adaptations facing IIoT. Their study concludes that "despite the challenge of giving up mental models and dominant logics, established manufacturers should perceive IIOT as a prospective opportunity for systematically innovating their BMs" (p.15), thereby being aware of the interdependencies among BM elements.

4. Reconceptualizing value innovation

Value innovation was conceived in the nineties and it intends to break industry logics and create new forms of superior customer value thereby *out-competencing* competitors. Over the last two decades, the strategy has been addressing strategic pathways, organizational capabilities and marketing approaches to design, develop and market such value concepts. This approach is still valuable in the new era we are living in. However, the challenges of Industry 4.0/IIoT seem to require further evolution of value innovation theory. Dynamic capabilities and absorptive capacity, customer listening, an experimentation attitude, an open information exchange among supply chain partners, and the fighting of active inertia are still required in the new context, but will not be sufficient anymore. The new era requires *advanced and integrative capabilities* enabling companies to develop and market future-oriented value concepts consisting of unprecedented combinations of products, apps, systems, services, and information. This will require the building of a platform and the integration of distinct functions and skills within the company, the combination of hardware and software, and of different parties and their systems. Metallo et al. (2018) introduce to this end, the "*IoT mindset*" which should replace the traditional product focus. Seeds of this approach consist among others of the following elements:

- Addressing real time and future needs in a predictive manner;
- Continuous refreshing of products by updates using IoT information;
- Enabling recurring revenue;
- Personalization and context-driven adaptations to the offering;

- Coupling and leveraging other ecosystem partners for mutual benefit.

Consequently, we argue that five advanced integrative capabilities are needed to build a robust and future-proof value innovation approach in this context of Industry 4.0/IIoT: (a) Capabilities for designing, adapting, and marketing product service systems; (b) Capabilities for blending digital strategy and processes with value offerings; (c) Capabilities for designing and mobilizing ecosystems and integrating these into a value-based IIoT platform; (d) Capabilities for combining and integrating technological and value innovation approaches, and (e) Capabilities for linking value creation to value capturing. We will look at each of these capabilities that value innovators need to learn and expand.

Capabilities for designing, adapting, and marketing product service systems

Manufacturers increasingly consider a *servitization* approach to remain strategically relevant in times of commoditization, to respond to low-cost competitors or address higher customer expectations (Matthyssens and Vandenbempt 2008; Coreynen, Matthyssens, De Rijck and De Wit, 2018). Servitization is considered a value innovation strategy, whereby a system of products and services (PSS) is offered that enhances customer value. Key authors and their research groups developed a diversity of solutions and service-based business models (e.g., Gebauer and Kowalkowski, 2012; Kowalkowski, Windahl, Kindström, and Gebauer, 2015; Kowalkowski, Gebauer, Kamp, and Parry, 2017; Kowalkowski, Gebauer and Oliva, 2017; Storbacka, 2011; Storbacka, Windahl, Nenonen, and Salonen, 2013). In present days we see ever growing complexity and sophistications in the PSS-based value packages being offered with guaranteed performance, total outsourcing solutions, performance-based solutions and hybrid solutions (Coreynen, Matthyssens and Van Bockhaven, 2017).

Moving towards PSS and designing solution or service-based business, however, is considered as an organization-wide challenge paved by internal and external barriers (Coreynen et al., 2018; Matthyssens and Vandenbempt, 2008). Alignment of strategy and organizational characteristics is a requirement as shown by several studies of Gebauer and co-authors. PSS offerings can be continuously *adapted* and improved in an Industry 4.0 environment using information of products-in-use. On line service opportunities arise and (new) service packs can be developed in real-time or before products fail. Value innovations along the PSS path will require strong ties with existing customers for continuous learning.

Capabilities for blending digital strategy and processes with value offerings

In an Industry 4.0 era, manufacturers can use real-time information to customize PSS offerings in a proactive and even a *predictive* manner leading to *personalized offerings*. This necessitates fast reaction times when logging data and big data analytics skills. Coreynen et al. (2017) indicate how digitization can strengthen the “back end” of the value offering, e.g., through automation of productive tasks leading to shorter lead times or more customization, or the “front end”, e.g., allowing for intensified customer interaction. Digitally-enabled offerings may radically change customer processes and have a more disruptive impact on provider-customer relations. This form of digitization includes digitally-modified businesses combining physical and digital offerings, such as adding online condition monitoring or tracking devices to products. Hasselblatt, Huikkola, Nickell and Kohtamäki (2018) present a holistic framework for digital capabilities in an industrial services context. They identify five capabilities that industrial companies need to possess to be able to offer IoT solutions to their customers: (1) developing a digital business model; (2) building a scalable solution platform; (3) selling IoT value; (4) delivering IoT value, and (5) business intelligence and measurement capability. Such IT enabled

products and processes create opportunities for manufacturers to provide additional and improved services in the areas of assistance, maintenance and retrofitting (Müller et al., 2018). It also enables new digital businesses by adding digital products or services that complement or substitute traditional customer support and customer interaction models. In each case, value innovation in the future implies advanced digital skills related to the design, sales and deployment of hybrid offerings.

Capabilities for designing and mobilizing ecosystems and integrating these into a value-based IIoT platform

According to Kiel et al. (2017) "collaboration and networking" becomes a core component for IIoT triggered business model changes. They see three reasons for these networks:

- Novel solution offers require the integration of partners, such as customers and suppliers, in an interactive and collaborative way;
- Increasing customer integration into product and service engineering and design;
- Novel suppliers compensate for unavailable resources required for the provision of novel products and services.

In fact, given the complexity and multidisciplinary character of the Industry 4.0 environment, companies will have to build new ecosystems consisting of very distinct parties and possessing complementary skills. In Industry 4.0, ecosystems will often be crossing industry boundaries, thereby grouping players with very diverse logics. More than ever, companies aiming at changing their traditional field into an IIoT field, should build network mobilization and orchestration capabilities (e.g., Van Bockhaven et al., 2015, 2017; Möller and Svahn, 2009).

Soon, questions must be asked regarding the type of platform the value innovator seeks to install, or wants to connect to, and which platform role the company is going to play. Perks, Kowalkowski, Witell and Gustafsson (2017) see four higher level orchestration mechanisms for platform development. In a first step, the value innovator should envision and understand the value for the platform and how joined forces might lead to additional value creation for its members. Next, investments and activities of the lead firm to support and direct the innovativeness of network partners towards value for the platform must be unleashed. In a third step the network needs to be legitimized. Finally, the lead firm should adjust its structures and routines towards the emerging value platform.

Eloranta and Turunen (2016) provide mechanisms for leveraging complexity with platforms and suggest three logics in platforms, i.e., connecting, sharing and integrating. In the new era, value innovators need to acquire this type of strategic thinking.

Capabilities for combining and integrating technological and value innovation approaches

In the Industry 4.0/IIoT context, value innovation will outgrow its emphasis on non-technological forms and integrate technological aspects as well. In line with Ringberg et al. (2018), we foresee that ever more innovations will be composed of a combination of two dimensions: managerial mindset transformation and technological transformation, resulting into revolutionary innovation. The latter signifies "the co-occurrence of a radical new mindset and radical new technology. These "new to the world" or game-changing innovations move organizations into uncharted technological and cognitive waters" (Ringberg et al., 2018). This implies new forms of sensing and sensemaking such as serendipity. It also implies above average capabilities in

established companies for cross-functional collaboration and even collaboration with small entrepreneurial groups. Value innovation needs to meet corporate venturing.

Capabilities for linking value creation to value capturing

The IIoT promises changing business models for established companies. However, different authors claim innovators need to enhance their value capturing skills with the ultimate goal of making their new value creation efforts more profitable for themselves and for the ecosystem partners as well. Metallo et al. (2018) see a critical role of value capture and distinguish IoT expert innovators from established companies. They conclude that "IoT-oriented organizations can capture value based on the continuous appropriation and exploitation of knowledge, resources, capabilities available from the creation and maintenance of partnerships. On the contrary, larger and older firms, having a broader range of technological competencies that support extensive diversification processes, are able to exploit more intra-group synergies and complementarities for creating value from the IoT revolution."

Perks et al. (2017) underline the importance of value capture in digital networks. In general, value innovators and disruptors have been slow on developing value capture skills. They should step up their efforts and develop models for sharing value with network partners as well. Müller et al. (2018) see new value capture opportunities as "connectivity along the value chain allows wider customer reach, easier communication processes regarding order placement and fulfilment as well as eased payments. Furthermore, data exchange among the entire supply chain and in real-time allows optimization through data analysis, demand balancing, and predictive analytics". Henceforth, service package and PSS innovators can offer new Industry 4.0 solutions which "allows them, on the one hand, to target new B2B customers, and on the other hand, to switch from payments per product to pay-per-feature, pay-per-use, or pay-per-output models".

Conclusion

Building upon our long research effort in this area, this contribution has reconceptualized the key building blocks of value innovation, a concept focusing on non-technological innovation. The definition, barriers and drivers were reconfirmed. This led to the identification of the (dynamic) capabilities underscoring value innovation capacity.

Value innovation can be tackled in a systematic way when an organization builds absorptive capacity, enables the breaking of industry recipes, creates room for experiments and unlearning, and builds convincing business models.

Next, the characteristics and challenges of Industry 4.0 and the IIoT were introduced. Industry 4.0 and the IIoT force established companies to break their industry recipe and to reinvent their business models. The IoT mindset is totally different from the present frames. This requires per definition value innovation and the learning and building of a new set of capabilities.

The last section closes the gap between existing thinking on value innovation and the requirements for value innovation for Industry 4.0/IIoT. Five key capabilities are introduced that together might form the pillars for a rejuvenation of the concept of value innovation. Some of these were already present in value innovation research of the last decade such as servitization and network orchestration, but the scale and impact are now much bigger. Overall, we talk of challenges marketers cannot take up on their own within existing functional and corporate boundaries. This requires intra and inter organizational collaborative efforts.

References

Abernathy, W.J. and Clark K.B. (1985), “Innovation: mapping the winds of creative destruction”. *Research Policy*, 14, pp. 3-22.

Almada-Lobo, F. (2015), “The Industry 4.0 revolution and the future of Manufacturing Execution Systems (MES)”, *Journal of Innovation Management*, 3 (4), pp. 16-21.

Almquist E., Cleghorn, J. and Sherer L. (2017), “The B2B elements of value”, *Harvard Business Review*, 96 (2), pp. 72-81.

Baden-Fuller, C., & Pitt, M. (1996), *Strategic innovation*. London’ Routledge.

Berghman, L., Matthyssens, P. and Vandenbempt, K. (2006), “Building competences for new customer value creation: An exploratory study”, *Industrial Marketing Management*, 35 (November), pp. 961-973.

Berghman, L., Matthyssens, P. and Vandenbempt, K. (2012), “Value innovation, deliberate learning mechanisms and information from supply chain partners”, *Industrial Marketing Management*, 48(1), pp. 27-39.

Berghman, L., Matthyssens, P., Streukens S. and Vandenbempt, K. (2013), “Deliberate learning mechanisms for stimulating strategic innovation capacity”, *Long Range Planning*, 46 (1-2), pp.39-71.

BCG (2015), Industry 4.0, *The Future of Productivity and Growth in Manufacturing Industries*, April 2015, 20 pp.

Chesbrough, H. & Rosenbloom, R. S. (2002), “The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spin-off companies”. *Industrial and Corporate Change*, 11(3), pp. 529–555.

Chesbrough, H. (2010), “Business model innovation: Opportunities and barriers”. *Long Range Planning*, 43(3–4), pp. 354–363.

Cohen, W.M. and Levinthal, D.A. (1990), “Absorptive capacity: a new perspective on learning and innovation”. *Administrative Science Quarterly,* 35, pp.128-152.

Coreynen, W., Matthyssens, P. and Van Bockhaven, W. (2017), “Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers”, *Industrial Marketing Management*, 60 (2017), pp. 42-53.

Coreynen, W., Matthyssens, P., De Rijck, R. and Dewit I. (2018), “Internal levers for servitization: How product-oriented manufacturers can upscale product-service systems”, *International Journal of Production Research*, 56 (6), March, pp. 2184-2198.

Day, G.S. (2002), “Managing the market learning process”, *Journal of Business & Industrial Marketing* 17, pp. 240-252.

Eisenhardt, K.M. and Martin J.A. (2000), “Dynamic capabilities: what are they?”, *Strategic Management Journal*, 21, pp. 1105-1121.

Eloranta, V. and Turunen, T. (2016), “Platforms in service-driven manufacturing: Leveraging complexity by connecting, sharing, and integrating”, *Industrial Marketing Management*, 55, 178-188.

Gebauer, H., and Kowalkowski C. (2012), “Customer-Focused and Service-Focused Orientation in Organizational Structures”, *Journal of Business & Industrial Marketing,* 27 (7), pp.527–537.

Hasselblatt, M., Huikkola, T., Kohtamäki, M. and Nickell, D. (2018), “Modeling manufacturer’s capabilities for the Internet of Things”, *Journal of Business & Industrial Marketing,* 33 (6), pp. 822-836.

Jing Zhang, Yanxin Jiang, Rizwan Shabbir and Mingfei Du (2015), “Building industrial brand equity by leveraging firm capabilities and co-creating value with customers”, *Industrial Marketing Management*, 51, November 2015, pp. 47-58.

Kiel, D., C. Arnold and Voigt, K-I. (2017), “The influence of the Industrial Internet of Things on business models of established manufacturing companies – A business level perspective”, *Technovation*, 68, 4-19.

Kim, W.C. and Mauborgne, R. (1999), “Creating new market space”. *Harvard Business Review*, 77, pp. 83-93.

Kim, W.C. and Mauborgne, R. (2004), “Blue ocean strategy”. *Harvard Business Review*, 82, pp. 62-76.

Kowalkowski, C., Windahl, C., Kindström, D., and Gebauer, H. (2015), “What Service Transition? Rethinking Established Assumptions about Manufacturers’ Service-Led Growth Strategies.” *Industrial Marketing Management,* 45, pp. 59–69.

Kowalkowski, C., Gebauer, H., Kamp, B. and Parry G. (2017), “Servitization and Deservitization: Overview, Concepts, and Definitions.” *Industrial Marketing Management*, 60, pp. 4–10.

Kowalkowski, C., Gebauer,H. and Oliva, R. (2017), “Service Growth in Product Firms: Past, Present, and Future.” *Industrial Marketing Management*, 60, pp. 82–88.

Levinthal, D. and March, J. (1993), “The myopia of learning”. *Strategic Management Journal*, 14, 95 – 112.Matthyssens, P., K. Vandenbempt and L. Berghman (2006), “Value innovation in business markets. Breaking the industry recipe”, *Industrial Marketing Management*, 35 (August), pp. 751-761.

Matthyssens, P., Vandenbempt, K. and Berghman, L. (2008), "Value innovation in the functional foods industry: Deviations from the industry recipe", *British Food Journal*, 110(1), pp. 144-155.

Matthyssens, P. and Vandenbempt, K. (2008), "Moving from basic offerings to value-added solutions: strategies, barriers and alignment", *Industrial Marketing Management*, 37(3), pp. 316-328.

Metallo,C., Agrifoglio R., Schiavone, F. and Mueller, J. (2018), "Understanding business model in the Internet of Things industry", *Technological Forecasting & Social Change*, In press, corrected proof, https://doi.org/10.1016/j.techfore.2018.01.020

Möller, K. and Svahn, S. (2009), "How to influence the birth of new business fields – network perspective", *Industrial Marketing Management*, Vol. 38, pp. 450-458.

Müller J.M., Buliga, O. and Voigt K.I. (2018, forthcoming), "Fortune favors the prepared: How SMEs approach business model innovations in Industry 4.0", *Technological Forecasting & Social Change*, https://doi.org/10.1016/j.techfore.2017.12.019

Perks, H., Kowalkowski, C., Witell, L. and Gustafsson A. (2017), "Network orchestration for value platform development", *Industrial Marketing Management*, 67, pp. 106-121.

Pitt, M.R. (1998), "Strategic innovation: statements of the art or in search of a chimera?" *Human Relations*, 51, pp. 547-562.

Pitt, M. and Clarke, K. (1999), "Competing on competence: A knowledge perspective on the management of strategic innovation", *Technology Analysis and Management*, 1, pp. 301–316.

Reddy, S. and Reinartz, W. (2017)," Digital Transformation and Value Creation: Sea Change Ahead", *GfK MIR* / Vol. 9, No. 1, Value in the Digital Era, pp. 11-17.

Ringberg T., Reihlen, M. & Rydén, p. (2018, forthcoming), "The technology-mindset interactions: Leading to incremental, radical or revolutionary innovations". *Industrial Marketing Management*, In Press. https://doi.org/10.1016/j.indmarman.2018.06.009

Simmons, G., Palmer, M. and Truong, Y. (2013), "Inscribing value on business model innovations: Insights from industrial projects commercializing disruptive digital innovations", *Industrial Marketing Management,* 42, pp. 744-754.

Sinkula, J.M. (2002). "Market-based success, organizational routines, and unlearning", *Journal of Business and Industrial Marketing*, 17, pp.253-269.

Storbacka, K. (2011), "A Solution Business Model: Capabilities and Management Practices for Integrated Solutions." *Industrial Marketing Management,* 40 (5), pp. 699–711.

Storbacka, K., Windahl, C., Nenonen, S. and Anna Salonen, A. (2013), “Solution Business Models: Transformation along Four Continua”, *Industrial Marketing Management*, 42 (5), pp. 705–716.

Sull, D.N. (1999), “Why good companies go bad”, *Harvard Business Review*, 77, pp. 42-52.

Van Bockhaven, W., Matthyssens, P. and Vandenbempt, K. (2015), “Drivers of institutional innovation in networks: Unleashing the innovation potential of domesticated markets”, *Journal of Business & Industrial Marketing*, 30 (3/4), pp. 414-435.

Van Bockhaven, W. and Matthyssens, P. (2017), “Mobilizing a network to develop a field: broadening business actors' mobilization analysis toolkit”, *Industrial Marketing Management*, 67 (November), pp. 70-87.

Eloranta,V. and Turunen, T. (2018), "Guest editorial", *Journal of Business & Industrial Marketing*, 33 (6), pp.745-748.

Yang Lu (2017), “Industry 4.0: A survey on technologies, applications and open research issues”, *Journal of Industrial Information Integration*, 6, pp. 1-10.

Zahra, S. A. and George, G. (2002), “Absorptive capacity: A review, reconceptualization, and extension”, *Academy of Management Review*, 27, pp.185–203.

Zollo, M. and Winter, S.G. (2002), “Deliberate learning and the evolution of dynamic capabilities”, *Organization Science*, 13, pp. 339–351.