

Digitalization and servitization: Opportunities and challenges for Italian SMES*

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Abstract

Purpose: Servitization has presented a series of persistent shortcomings for manufacturing companies that have dramatically slowed down its adoption. Recently, the digital transformation (digitalization) is posing a very similar challenge to manufacturing. Technologies like the Internet of Things (IOT) are forcing firms to create entirely new business models, migrating from the product-centric approaches to (digitally-based) service-oriented ones. This paper aims at describing the impact of digital transformation on the adoption of service business models in manufacturing, with a particular focus on problems, challenges and opportunities for Small- to Medium-sized Enterprises (SMEs).

Design/Methodology/Approach: Given the exploratory aim of the research a qualitative research method has been deployed. The analysis is based upon six archetypal case-studies regarding different types of manufacturing companies involved in digital transformation, and 10 interviews with business and industrial experts.

Findings and implications: In our research, connected products offered by industrial machines, cooking appliances and home appliances manufacturers can trigger new service offerings. Predictive maintenance, accurate warranty modeling, consumption control, energy saving, and customer customized utilization of the product allow unprecedented relations with customers. In one case, the connected product is the base of a machine-as-a-service (MAAS) model, with invoicing based on uptime and process efficiency. In all the cases the importance of data analytics is deemed to be strategic for the near-future business model changes.

Originality/Value: Digital disruption and transformation is a quite recent research stream, and at the best of our knowledge no research has been made on the topic with specific attention to its impact on service business models and servitization in SMEs. The paper contributes in this research stream describing main challenges and opportunity faced by firms engaged in projects and experiments of digital transformation and service transition.

Keywords

Digitalization, digital transformation, servitization, SMEs, Italy

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1. Introduction

Since its first steps in the '80s the challenge of manufacturing servitization has been to leverage on what happens after the product's sale, not just thinking of how to produce better products and sell them with a profit. The reason why of this strategic change, we all know it, is that crafting an excellent product was (and still is) no longer enough to survive in many industries. Notwithstanding, servitization processes have encountered a series of persistent shortcomings that have seriously hindered their potentially revolutionary importance (Gebauer et al., 2005), and have dramatically slowed down the pace of the transformation; as a result, only a few number of selected manufacturers have successfully transitioned to services.

Nowadays technologies like IOT are posing a similar challenge to firms: instead, this time the change is going to be disruptive and companies that don't realize its importance are going to strive to survive in the very near future. In fact, digital transformation is pushing innovative firms to leverage on services in order to create entirely new business models, finally migrating from the product-centric approaches to (digital) service-oriented ones. 93% of manufacturing leaders are planning to use digital technologies in order to unleash the service model (Cisco, 2015). But without a clear consciousness of the different implications of digital transformation and a specific organizational operationalization, digital initiatives will be disappointing too. In fact, first experiences in digital transformation have clearly demonstrated that digital opportunities are accelerating dramatically faster than firms' capacity to change.

The object of this research is to study the technology-driven (digital) transformation of firms' business models towards services, with a special attention to small- to medium-sized companies. The research questions underlying this works are related to discover what are the main impacts on the servitization dilemma, looking at it through the lens of digital transformation, and what are the main challenges and problems facing Small- and Medium-Enterprises (SMEs) in the transition to digitally-based service oriented business models.

The research is in its first and exploratory phases. To date, we have encountered and directly interviewed many entrepreneurs and top managers whose companies are facing this transformation. A series of meetings with industry experts and knowledgeable technology consultants allowed us to identify a number of firms involved in the abovementioned transformation process: the analysis of the information gathered preparing those case-studies is at the base of the empirical descriptions reported in section 3.

2. The changing landscape: digitalization, servitization and business models

Connected products are transforming both business and consumer markets landscapes, making space for brand new data-based service-oriented business models (Porter and Heppelmann, 2014 and 2015). Companies must adopt the "big data mindset" and think about their long-term strategy for data (Mayer-Schonberger and Cukier, 2013): none of the transformations that IOT is like to bring about in the next years would be possible without being able to analyse and understand the potentially enormous flow of data that the Internet Of Things and the Industrial Internet Of Things (IOT and IIOT, briefly IOT) technologies are capable to generate.

Data gathering (via IOT) and data analysis are therefore becoming of strategic importance, since they can offer fine-grained and complete information that can be capitalized in different areas: - enhance the product and or the system/solution; - develop new products and services; - optimize customer segmentation, positioning and pricing strategies; - develop the capability of dynamically modify business models' component configurations over time (SAS, 2015, 2016; Cisco, 2015).

For many manufacturers, this is definitely the time for Business Model (BM) experimentation, especially regarding BM that traditionally don't belong to the manufacturing culture, such as service-based ones. In the new landscape, companies which succeed in extending the service business are the ones that obtain comprehensive information on customer needs and use them to reshape their strategy. Traditional methods of obtaining such information (wide-ranging market research, workshops with selected customers, etc.) - that have always been important sources of ideas for developing new services (Gebauer et al., 2005) - are now being transformed and amplified by the nature and the magnitude of new sources of business information such as IOT.

This transformation will involve both service domains of Services Supporting the Product (SSP) and Services Supporting the Customer (SSC). If we consider that these are the basic means in which suppliers explore new relationships with customers and change their way of supporting customers' organizations (Mathieu, 2001), or even "move into the solution business" (Gebauer et al., 2013; Davies et al., 2007; Baines et al., 2009), we can perceive the importance of the transformation underway.

Digitalization may actually introduce a new breed of SSP and SSC, as highlighted by recent field researches (Noventum, 2016). As regards SSP, IOT-based preventive maintenance services and IOT-based availability services are catching on; on the SSC side, IOT-based process optimization services, IOT-based business optimization services and IOT-based business transformation services are gaining momentum. In strategic terms IOTs are acting as service innovation engines, service profitability and growth boosters and change factor in competitive environment, gradually performing new and important roles also in service innovation and in shaping evolution path for the firms (Noventum, 2016; Noventum, 2015). In many different industries, the use of data coming from sensors embedded in machines and products is enabling new forms of relations with key clients.

As regards SSP, starting from a comprehensive study that lists 55 of traditional inter-sectorial BMs (Gassmann et al., 2014), Fleisch et al. (2014) have selected the ones that are going to be influenced the most by IOT technologies. They constructed an original business model pattern dedicated to IOT they named "Digitally charged products", and highlighted BMs that we found useful in order to understand how products and services can change with digitalization.

But technology is only a part of the picture. In Chesbrough's (2010) words: "a mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model". This means that the very firm's BM has to be innovated in order to conform it to the new digital processes and services. As BM innovation is a very challenging activity, digitalization doesn't remove classical difficulties in approaching servitization. Certainly, it poses a definite urgency on it. BM transformation poses serious challenges to firms: a strategic model has to take into account major impacts on value drivers such as efficiency, complementarities, lock-in, and novelty—and the linkages among them (Amit and Zott, 2001).

Changes to business model design can be subtle, and even when they might not have the potential to disrupt an industry, they can still yield important benefits to the innovator (Amit and Zott, 2012). But this fascinating perspective often conflicts with current value chains configurations, and the resistance to experimentations that different firms may oppose to change. According to Christensen (1997, 2003) the disrupting force of the new technology-based BMs lies in the conflict with the established ones within the actual technological context. Corporate selection and valuation mechanisms (cognitive functions) applied to information about new BMs are based on the dominant logic of old successful ones (Chesbrough, 2010). Following the dominant logic established, firms are led to miss potentially valuable uses of technologies that don't fit the current BM.

In fact, the digital transformation is driving a “two-front war” in manufacturing (Cisco, 2015): firstly, firms are to maintain a legacy business while moving to a new territory populated by services. Moreover, digital disruption is increasingly requesting manufacturers to be technology companies, since companies that make the best use of data will be the most successful. Consequently, companies have an urgent need of digital capabilities, necessary for managing a greater volume and variety of data, and leveraging on analytics to create new business insights (Noventum, 2015). But, moreover, somebody noticed that IOT-enabled service portions of the BM are always digital in nature (Gassmann et al. 2014). This means that companies have to manage an additional service orientation: also in this context, extending the service business requires a new service-development process similar to that used in service companies (Gebauer et al., 2005).

Literature highlights also a list of other challenges awaiting minor manufacturers approaching digital service BMs. Competences requirements will probably affect the value chain, since most successful manufacturers orchestrate ecosystems of partners in order to fill capability gaps, create new experiences and insights, and add value to end customers (Gebauer et al., 2013, Gebauer et al., 2012; Paiola et al., 2012; Paiola et al., 2013). Unfortunately, this can be far outside the comfort zone of many manufacturers. Contracting and pricing are other relevant issues: pricing of new services must be done on the basis of equipment availability, leading the service provider to assume the equipment’s operating risk, requesting to establish an ongoing relationship with the customer (Gebauer et al., 2005). Contractual agreements are subsequently to be modified in order to accommodate a new breed of supply relations.

Finally, different problems are pointing also to firms’ dimensions and the topic of SMEs (for a review see Gebauer et al. 2010). Unlike large corporations, SMEs are less certain about what their business is going to become and what will their position be in the new scenarios. In fact, the need to continue to perform well in the current business while simultaneously conducting the experimentation of new BM is particularly challenging for smaller firms. In addition, the earnings coming from the new experimental models are far less than those coming from established ones and that is an additional reason that calls for caution. Also the professional competences inherent in activities such as big data analysis, highlight a critical competence gap for SMEs. As previous studies have pinpointed, other relevant critical points may arise in relation to the distance from the end-customers, the type and nature of distribution channels and the articulation of the value chain, in which frequently SMEs have limited bargaining power. Service business development in SMEs depend on the value chain position and the business environment, and in particular on the sales model, where suppliers and OEMs selling through distributors do not primarily extend the services offered, but rather reconsider service process configuration together with distributors (Gebauer et al. 2010).

3. The empirical research

3.1 Methodology

As digitally-based BMs are still in their introductory phase in Italy, we managed to design an exploratory research based on a cross-analysis of a multiple-case study. Consequently, in order to consistently arrange a selection criteria for cross-case analysis, we managed to gather and use information coming from 10 expert interviews: indications and suggestions coming from this phase have proven precious in order to select firms that already implemented IOT-based solutions in Northern Italy.

The aim of the field research was to get detailed information on decision making processes related to BM changes due to IOT in the firms: between the end of 2016 and the beginning of 2017, we collected data coming from several in-depth face-to-face semi-structured interviews

(duration between 1 hour to 2 hours each) with firms' key-informants like CEOs or top managers in charge of IOT-related activities. In almost every case 2 or more people have been involved in the interview. Those interviews are the initial part of a more complex and articulated investigation program that will have subsequent meetings in the forthcoming months. Research methodology is in line with prescriptions coming from well-known specific literature on case-study research (Eisenhardt, 1989; Yin, 1994).

The involved firms are all Italian manufacturing BtoB or BtoC firms, that operate in industries that are seriously affected by technological developments related to digital transformation and in particular IOT and IIoT-based solutions. We deliberately excluded large MNEs, since their extended resource-base and their market position allow them to deal with IoT-based innovation in a way very different from SMEs (Laudien and Daxbock, 2016). See table 1 for an overall representation of firms' basic features.

Given the aim of the research and its exploratory nature, our empirical setting followed conceptual considerations: instead of building a statistically representative sample we aimed at depicting the variety of situations and challenges posed to SMEs by the above described transformation (Miles and Huberman, 1994). As one can notice (Table 1) interviewed firms are different in sizes, industry, value chain positions and sales models.

Table 1. Firms outline

Case	Size (€Mio 2016)	Position	Distribution	Activity
A	50-100	OEM BtoC, national	Indirect	Heating devices
B	100-200	OEM BtoB, international	Direct	Packaging machines
C	50-100	OEM BtoB, international	Mixed	Professional cooking appliances
D	100-200	Ist tier supplier, international	Indirect	Technological control systems
E	0-50	Ist tier supplier, national	Indirect	Technological control systems
F	0-50	KIBS, (sub-) system integrator, local	Direct	Innovation consultancy and solutions

3.2 Findings and discussion

During our research we have observed some of the transformations described in the preceding literature section at work (see table 2 for a summary). Home appliances manufacturers, industrial machine builders, and specialized sub-systems producers are offering services that can be the base for new value-added offerings: predictive maintenance, warranty modelling, consumption control, energy savings, and customized utilization of the product. In some cases, SAAS, PAAS and MAAS concepts (Software-, Product- and Machine-As-A-Service) can be introduced, with a completely new billing system based on equipment's efficiency (better uptime and improved process efficiency) or actual rate of utilization. In these cases service BMs experimentation has led to a completely new (and deeper) relation with key clients.

Nevertheless, the transition poses different challenges to SMEs. A first mention goes to the financial challenge: unfortunately, a full-scale adoption of the service revenue model is such a radical transformation for which not even the most innovative of the investigated firms are ready. Substituting the service revenue model for the product's one poses big financial problems for a medium-sized company, even if lock-in effects on consumables can help. Financial pressures may contribute to force firms to build an ecosystem with partners and other manufacturers, in order to enlarge the installed base. Collaborative relations with customers are

in any case mandatory, also because of the inherent complexity of new IOT based services contractual agreements. The lack of experience make contracts very difficult to set and let them always incomplete and thereby subject to adjustments and upgrades overtime; these are all circumstances very unlikely to happen without a long-lasting mutual collaboration with the customer. Positive experimentations can lead to some standardization and replication for other customers and business opportunities.

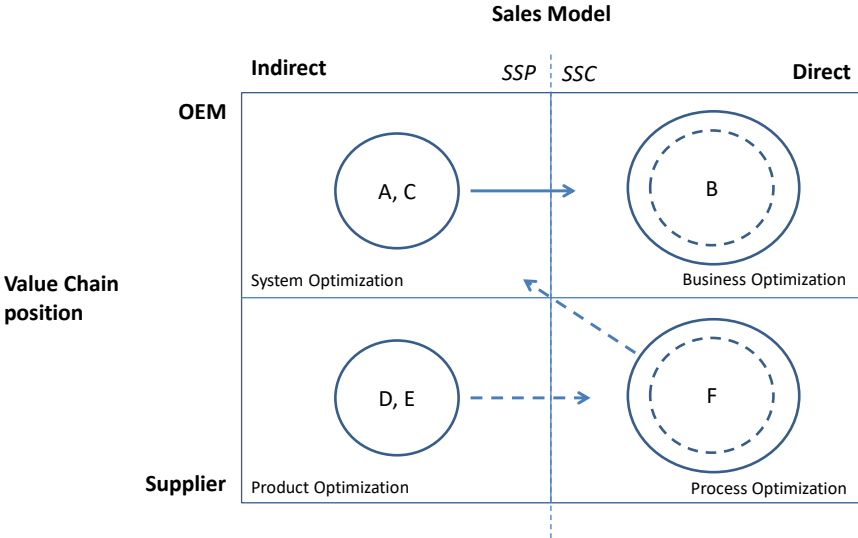


Figure 1: The Business Model change matrix

According to our research, two main factors may condition firms’ adoption of IOT-based service BMs: the position in the value chain; and the distance from the end-customers, that is the type and nature of distribution channels, i.e. the sales model (see figure 1). Companies can play different roles in the often very articulated BtoB production chains: OEMs producing complex solutions or product-service sub-systems may compete with system integrators and sellers for the attentions of the manufacturing end-users. On the other hand, specialized components producers may have to confront and integrate their operations with those of the former category: when the product is a stand-alone part or a sub-system in a more complex offering, large key (intermediate) clients with big bargaining power can control the business, dictating specific requisites for products and functions, not necessarily in advantage of best technological solutions: preferences can be frequently driven by mere cost considerations where very little space is left for upgraded features that allow new or augmented digitally-driven functions. On the whole, the value chain can count the presence of multiple intermediate subjects that take charge of different tasks - such as system design, technological integration, installation and maintenance. In such a complex and articulated picture, SMEs that craft specialized components normally cannot boast a direct relation to the end user and any connection with its needs and wishes.

Table 2. Description of firms' business models, main problems and solutions envisioned

Case	Current BM	Experimental BM	Problems encountered	Envisioned solutions and BM developments
A	Produces and sells durable goods for final users via indirect distribution system; being the distribution channel the "real" customer, it defines itself a BtoB business: no services are provided by A, since the distribution is in charge of them.	Physical freemium: the product is sold along with a dedicated app. Connected products are envisioning the creation of big data regarding customers' use of selected product-lines.	Data analysis in its first steps, reveals typical defensive (reactive) services and solutions, such as warranty control and products-use optimization. Unprecedented relation with end users causes an "identity crisis" in the firm, but also envisions new and unexpected opportunities.	First attempts in redesigning the strategy and BM in order to exploit direct relation with customer, for example with approaching the consumable Business (Razor and Blade).
B	Traditional equipment manufacturer specialized in a niche segment, selling directly to end users. Traditional SSP like maintenance and spare parts selling. Long lasting relationships with customers.	Performance-based contracting experimentation with one key-client, with remote equipment management and remarkable productivity gains granted and honoured.	Approaching the service revenue model poses big financial problems: MAAS's annual revenue is a little share of the of the equipment's market value. Contractual agreements are very difficult to set and frequently incomplete, asking for recurrent adjustments impossible without collaborative relationship. In some cases MAAS is not requested, but the customer is willing to pay for learning how to improve OEE from B.	B aims at engineering the experimental solution in order to replicate it for other customers, in order to exploit its international installed base. Locked-in auxiliary consumables is a complementary business that will have a role in establishing the financial equilibrium. Crafting an ecosystem of partners is imperative in order to grow the installed base.
C	Professional appliances are sold via direct and indirect channels to end users (BtoB), with different services being provided in pre- and post- sale situations.	Experimental digitization via connected machines IOT has led to the offer of new services allowed by data analysis, in order to improve customers' OEE.	IOT-based strategies are in stand-by due to the weak reaction of the market, while data gathering is underway. MAAS business model is prevented by products' low rate of utilization and by the current structure of distribution channels.	Building a direct distribution structure, also in view of the international markets expansion. Extend the line downwards from cooking to food conservation.
D	Differentiated digital control systems for refrigeration and conditioning industry with a varied customer base, and articulated distribution channel.	Small machines are being equipped with TCP/IP protocol and WIFI gateways in order to access cloud services. At the moment maintenance ticketing and management support are in place.	Due to value chain structure and costs importance, direct customers have little interest in advanced service extensions. This is a transition phase in which the firm "hasn't find out what the future's business model is yet".	A new product-service solution based on amazon cloud is in the pre-launch phase. A couple of additional experimentations are underway.
E	Multi-purpose digital control systems for heating, refrigeration and conditioning industry are sold to a highly-differentiated customer base, through an articulated and variable distribution structure.	Specific projects linked to customers' needs are being put in place; regulations in some industries has shaped sophisticated information needs that are the base for current transformation.	Hindering role of the distribution systems and general contractors, due to cultural factors and contractual power. In some cases also key end customers are not ready for a service-based BM yet. E's strategic vision is partial, having not clear what role to play in the value system.	Technological solutions are ready for plug and play also using the cloud; critical agreements and partnerships with OEMs are underway. The fundamental activity is deemed to be data management and analysis, in which some lock-in positions may be developed.
F	Local specialized technological supplier and system integrator with direct contact with customers. Software competences are complemented with hardware ones.	Currently F is passing from selling software to SAAS and cloud services, together with smart plug-in products that standardize specific services and allow pay-per-use contracting. BM is evolving from selling a project to selling a customizable modular solution, PAAS plus consulting.	Technology is quite ready, unlike customers (manufacturing SMEs, both suppliers and OEMs). Some solutions regarding predictive maintenance are being implemented.	IOT are a strategic touch point. Apps and other products can act as introductory initiatives. In F's opinion, it is necessary to combine different BMs in this transition phase.

IOT-based service BMs emerging in this initial phase depend heavily on the position of the supplier in the value chain and the organization of the distribution. For OEMs and suppliers with no or episodic contact with end user manufacturers novelty regards merely some SSP applications, affecting products or systems optimization such as: IOT-based warranty optimization, preventive maintenance services, or projected forms of IOT-based availability services (see the left side of figure 1). For OEMs and suppliers with direct contact with end customers, a more advanced and complex experimentation is in place, due to the different opportunity of changing and upgrading the relation with the customer (and therefore relating to SSC). In this case, IOT-based process optimization services or initial IOT-based business optimization services are in place in some restricted nonetheless already durable experimentation. Overall, those experimentations are blurring some categories in the value chain and are slightly changing the BMs of the firms in the sample, as shown in figure 1. OEMs with indirect sale models are showing a clear move towards SSC, partially bypassing the distributor for some services, while suppliers have a hard time in doing a similar step. Firms with direct sale models, in particular OEMs, are in a privileged position in order to unleash the potential of BMs based on a reinterpreted relation with the end customer.

In this picture, a particular role is being played by distribution channels, affecting companies that have uniquely or prevalently indirect contacts with end users. Some firms report that their interest in the new digital service BM is conflicting with their distributors' aims and complicated by the circumstance that distributors change a lot depending on the actual market. In this picture, services added to the product (e.g. maintenance and warranty) are frequently outsourced to third parties, since "OEMs are used to sell machines and not to supply services". The same happens to the real occasion to stay in contact with the customer: a situation that IOT are going to change likely, since firms in our sample are reconsidering the overall service approach of the distributor, designing initiatives that enhance its customer services and, under the surface, making steps downstream.

Finally, interviews with specialized Knowledge Intensive Business Services (KIBS) companies have permitted us also to depict a parallel change regarding specialized services players involved in the value chains we observed. Small and medium consulting firms and system integrator that possess specific knowledge on applications technology and customer needs seem now capable of competing with international consulting MNEs. In some cases OEMs supplying industrial equipment are requested to act themselves as KIBS: even if MAAS is not requested, the customer is willing to pay for learning how to improve Overall Equipment Efficiency (OEE) from the supplier.

4. Conclusions and future research

Data coming from IOT devices and regarding the use of the products are opening an entire new world of possibilities and activating interest and experimentation by companies of any dimensions. But unlike large corporations - that have started to take over IOT-related firms and incorporate precious capabilities - SMEs are striving to understand the change and possible consequences for their businesses.

The study presented in this paper is still in its initial phases. Therefore, the limited number of cases and examples collected seriously discourage a consistent generalization of the results achieved so far, that will have to be confirmed by further investigations. Nevertheless, we believe that our research has a valuable potential impact both on theory and practice. We underscored different problems that firms face in the transformation: even if these problems are not completely new to the servitization literature, their weight and intensity are being redefined in the new technological landscape, where value chains' actors and roles are reshaping. In

particular, in this study the position in the value chain and the sale model have shown to be critical variables for manufacturing SMEs in the adoption of new IOT-enabled service-based BMs. This has a profound impact on managerial considerations regarding the future shape of the business for every SME involved in the transformation, since the ability to govern the change instead of being disrupted by it will depend on how firms will use products, services and data to influence (and even change) its own and other players' positions in the ecosystem.

As one interviewed CEO said: "it all depends on the customer: if he hasn't changed his business model, no appreciation of innovation efforts will be encountered by suppliers". In this picture, the pace and extent of the evolution is driven by end customers' and end user manufacturers' needs and sensitivity, and intermediate actors like distributors will follow accordingly.

Future research may therefore be focused on the roles of the different parties (installers, system integrators, OEMs, maintenance companies, component suppliers) in the process of BM transition in the ecosystem. Which is the subject that is more capable of and interested in using the data coming from the customer? What is the role in the value chain that can act as change-enabler? Who is going to take advantage of the change? These should be some of the questions to answer in further developments of this research.

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Biographical sketch

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