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Understanding business model in the Internet of Things industry

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ABSTRACT

This research presents the results of an exploratory study of how organisations operating in the Internet of Things (IoT) industry are building and innovating their business model (BM). Using an explorative sequential approach through the multiple-case study method, we apply the "Canvas BM" framework to explore the BM of three companies operating in IoT industry, namely Intel, Solair, and Apio. The paper finds the most important building blocks - key activities, key resources, and value proposition - and most critical related factors enabling IoT-oriented organisations to create and capture value. Furthermore, our results also suggest that the main difference in the processes of BM building and innovation depend on the different capabilities and competencies possessed by organisations. This study therefore advances the theoretical understanding of the critical factors for the value creation process in the IoT industry's organisations and offers interesting implications for management theory and practice.

1. Introduction

Over the last two decades, the Internet of Things (henceforth: IoT) has been in a constant state of evolution. Some of the most prestigious management-consulting firms, such as Gartner, McKinsey analysis, and ABI Research, forecast that IoT devices would grow from about 5 billion in 2014 to as many as 20 billion devices by 2020. In terms of hardware spending, consumer applications will amount to $1534 billion by 2020, while the use of connected things in the enterprise will rise to $1477 billion in 2020 (Gartner, 2015). Therefore, IoT is included by the US National Intelligence Council in the list of six "Disruptive Civil Technologies" with potential impacts on US national power (NIC, 2008).

IoT represents a novel paradigm that is rapidly gaining ground in the modern economics, with a high impact on several aspects of the everyday-life of both private and business users (Atzori et al., 2010). IoT describes "the interconnection of objects or 'things' for various purposes including identification, communication, sensing, and data collection" (Oriwoh et al., 2013, p. 122). In particular, it consists of an infrastructure that is able to measure, identify, track, and monitor objects for connecting things, sensors, actuators, and other smart technologies (Uckelmann et al., 2011) as well as simplifying people's lives through tasks automation (Espada et al., 2011). There are several fields of application for IoT technologies, such as the smart industry (or Industry 4.0), transportation and logistics, healthcare, personal life domain and smart cities, emergency management (Atzori et al., 2010; Yang et al., 2013; Kim and Kim, 2016; Suwon and Seongcheol, 2016).

Considering the growing importance of the IoT industry in the global economy, academics are also increasing focusing their attention on several issues within a range of research fields. However, prior literature is concentrated mainly on technological aspects, meaning that managerial issues have been lacking compared to technical research (Kiel et al., 2016). According to the traditional technical approach, IoT technologies and overall digital technologies are studied in terms of technical infrastructure or platform (e.g., Eisenmann et al., 2006; Tiwana et al., 2010; Tiwana, 2014; Eaton et al., 2015; Spagnoletti et al., 2015). Thus, IoT technologies are considered as software-based platforms that that provides core functionality shared by software subsystems that connect to the platform and add functionality to it (Tiwana et al., 2010). This IoT technologies' view emphasises features such as interoperability or complementarity for showing these platforms seldom operate in isolation from other technologies, but generally offer functionality for other platforms or complementary technologies (Eisenmann et al., 2006; Eisenmann et al., 2011; Baden-Fuller and Haefliger, 2013; Tiwana, 2014).

At the same time, there is emerging a managerial research field for exploring how IoT is changing the way of interpreting the business

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process management inside and outside of firms (Del Giudice, 2016a). Managerial literature has pointed out that understanding the main mechanisms to create value from IoT technology is still a critical issue. Overall, the benefits of IoT technologies (e.g., RFID, cloud computing, sensors and many more) for companies are several and can refer to both internal operations and final products for end users (Chui et al., 2010). Through a rapid access to data and information about objects, IoT enables highly innovative and efficient services (Monino, 2016). For example, IoT technologies have a great potential in terms of business value through real-world visibility and business processes, allowing the business process decomposition where each steps can be carried out in a distributed manner (Haller et al., 2008). Leminen et al. (2012) showed that through IoT technologies, all devices would function as a web service, and by adapting manufacturing processes, it is possible to customise products during the production phases.

The managerial literature looks at IoT as the source of the next technological and industrial revolution (e.g., Chui et al., 2010; Trappeniers et al., 2013). In fact, Cheng et al. (2017) showed that disruptive technology, such as IoT, possesses the ability of initiating new markets and changes firms' technological competition status. Such revolution brings about profound organisational and managerial implications at both business-to-business (B2B) and business-to-consumer (B2C) levels. Recently various scholars in technology management analysed and illustrated how IoT can affect the business model (henceforth: BM) (Hui, 2014; Turber et al., 2014; Westerlund et al., 2014). In general, BM refers to "how a business creates and delivers value to customers" (Teece, 2010, p. 173). Many different elements shape organisations' BMs by which they gain profits and value: customer needs, value proposition, key processes, key activities, resources and many others (e.g., Johnson et al., 2008; Shafer et al., 2005; Zott et al., 2011).

Research has reported on the potential influences of IoT applications on existing value chains and opportunities for new BMs (e.g., Solima et al., 2016), offering some systematic literature reviews on links of IoT and BM (e.g. Kiel et al., 2016; Wnuk and Murari, 2016). In particular, Dijkman et al. (2015) by presenting a BM framework for IoT applications showed that BMs has ways to create value for IoT technology that are needed.

This article contributes to the extant literature about IoT-oriented BM by investigating how organisations operating in the IoT industry are building their BMs. In particular, the research question of the study is: how do IoT-oriented companies shape the critical factors of their BMs in order to create and capture value.

Using an explorative sequential approach through multiple-case study method, we apply the 'Canvas BM' (henceforth: CBM) framework (Osterwalder and Pigneur, 2010) to explore the BM of three companies operating in the IoT industry: Intel, a well-established firm in which IoT is an emerging area of business; Solaris, an small Italian company specialising in developing and selling IoT-based services and applications; Apio, a micro and emerging Italian start-up company specialising in developing highly customized IoT solutions for B2B markets.

The study seeks to make important contributions to the existing literature. Despite the debate on the consequences of the IoT revolution, such as a change of existing BM, new revenue opportunities from the existing product/services, or new business processes, until recently there has been very little empirical evidence which has tested these claims (e.g., Wnuk and Murari, 2016). Moreover, through the three firms selected, which have different entry modes into the IoT industry (well-established vs independent ventures), we contribute to the ongoing debate in the emerging research stream about incumbent/newcomer behavior with regards to responses to disruptive technology in terms of business model change (e.g., Christensen and Raynor, 2003). Thus, we deepen IoT-oriented BM with a managerial perspective, contributing further to the debate called for in Del Giudice (2016a, 2016b).

The article is organised as follows. Section 2 briefly reviews the main literature about IoT-oriented BM. Section 3 reports the research method used to investigate the three case studies selected, the data analysis, and the results of the study. Finally, Section 4 presents the discussion and conclusions, with particular reference to research and managerial implications, the limitations of the study and directions for future research.

2. Business model innovation in IoT industry

The notion of BM in management literature has emerged and become increasingly popular over the last 20 years (e.g., Chesbrough and Rosenbloom, 2002; Chesbrough, 2007a, 2007b, 2010; Zott et al., 2011; Trimi and Berbegal-Mirabent, 2012; Agrawal and Gugnani, 2014; Carayannis et al., 2015; Batocchio et al., 2016; Solima et al., 2016). Within organisations, BM plays a critical role because it enables entrepreneurs and managers to create and capture value through activities (Zott et al., 2011). As Chesbrough (2007a, b, p. 12) suggested, "Every company has a business model, whether they articulate it or not. At its heart, a business model performs two important functions: value creation and value capture". Value creation and value capture mechanisms have received increasing attention from management scholars who are interested in explaining firms' performance and competitive advantage (see Zott et al., 2011 for a review). Indeed, some literature on the business model tends to concentrate on value creation in networked markets, showing that organisations create value in concert with partners. In this regard, organisations should design and/or innovate their business models taking into account that value creation and value capture occur in a value network that includes suppliers, partners, distribution channels, and coalitions that extend the company's resources (e.g., Hamel, 2000; Zott et al., 2011).

Other scholars, have paid increasing attention to business models in the domains of innovation and technology management (e.g., Chesbrough, 2007a, 2007b, 2010; Chesbrough and Rosenbloom, 2002; Johnson and Suskewicz, 2009). Such a perspective views the BM as a mechanism to connect firm technology and customer needs, thus enabling organisations to exploit the value potential embedded in new technologies and converting it into market outcomes. Still others have focused on the interplay between mode of innovation, and 'open innovation' in particular, and BMs (e.g., Chesbrough, 2007a, 2007b, 2010; Miles et al., 2006; Mitchell and Coles, 2003). Open innovation provides new scenarios for organisations prompting them to look outside their boundaries in order to create value from the external activity of innovators who are sharing information and knowledge (Chesbrough, 2003). From this point of view, BM was recognised as a subject of innovation (well-known as the open business model or business model innovation), whose design and innovation must also take account of collaborative relationships between the company, the market, and communities (Chesbrough, 2007a, 2007b, 2010; Mitchell and Coles, 2003; Zott et al., 2011).

Academic literature has proposed a number of different frameworks for BM design and innovation (e.g., Bereznoy, 2015; Carayannis et al., 2014; Chesbrough, 2010; Osterwalder and Pigneur, 2010; Toro-Jarrin et al., 2016). Among them, the most frequently mentioned framework used for understanding BM's critical factors in creating and capturing value by organisations is the CBM (Osterwalder, 2004; Osterwalder and Pigneur, 2010). Osterwalder (2004), which compared the most mentioned BM frameworks and deduced nine critical elements (known as the business model building blocks) constituting a CBM, such as key partners, key resources, key activities, value proposition, customer segments, customer relationships, channels, costs structure, and revenues streams. Such elements are related to four areas (product; customer interface; infrastructure management; financial aspects) recognised as particularly suitable for understanding how an organization creates, delivers, and captures value (Osterwalder, 2004). Fig. 1 shows the Canvas BM's four pillars and the nine building blocks.

The product refers to 'what' the business offering, in terms of the products and services that are of value to the customers (value proposition). Customer interface refers to 'who' the company's target