An Exploratory Study of the Impact of the Internet of Things (IoT) on Business Model Innovation: Building Smart Enterprises at Fortune 500 Companies

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ABSTRACT

This paper introduces IoT categories used to build smart enterprises and discusses how Fortune 500 companies may use various IoT applications to innovate their business models. The authors' analysis reveals that there is a significant relationship between the type of IoT applications and the IoT adoption rate and there is also a significant relationship between the type of business model innovation and the IoT adoption rate. Finally, five implementation strategies for smart enterprise development are discussed.

KEYWORDS

Business Model, Business Model Innovation, Fortune 500, Internet of Things, IoT, Smart Enterprise

INTRODUCTION

As the IoT is gaining an increasing attention as a new paradigm in the industries, companies are beginning to capitalize on IoT applications in a variety of ways (Gubbi et al., 2013; Lee & Lee, 2015). The main strength of the IoT is the high impact it will have on several aspects of every-day life and behavior of potential users (Bandyopadhyay & Sen, 2011). Assisted living, smart homes, e-health, and enhanced learning are only a few examples of possible application scenarios in which this new paradigm will play a leading role in the near future (Atzori et al., 2010). Many companies such as Amazon and Home Depot are developing IoT applications to capture real-time consumer data and offer better services.

Recently, the IoT was also recognized as a disruptive technology for supply chain management. The IoT helps supply chain partners monitor the process of a supply chain execution in real time and improve the efficiency and effectiveness of supply chain (Ping et al., 2011). According to Garnter (2014), the IoT is one of the emerging technologies in IT in Gartner's IT Hype Cycle. Specific technologies go through innovation trigger, peak of inflated expectations, through of disillusionment, slope of enlightenment, and plateau of productivity of the hype cycle. As of July 2014, the IoT is at the peak of the inflated expectations of the hype cycle and will take 5-10 years to reach the market plateau (Garnrter, 2014).

It is evident that the IoT will give rise to new opportunities for the Information and Communication Technologies (ICT) sector, paving the way to new services and applications able to leverage the interconnection of physical and virtual realms (Miorandi et al., 2012) and companies in most industries...
will rapidly adopt IoT-enabled applications in order to stay competitive. However, while a large number of technical studies have been conducted in management of smart grid (Bui et al., 2012), and resource constraint devices (Gluhak et al., 2011; Sehgal et al., 2011), the IoT on the management side is yet an underserved area of scholarly investigation. This paper attempts to fill the gap by investigating how the Fortune 500 companies use IoT solutions for business model innovation. This paper lays theoretical foundations for business model innovation, identifies categories of IoT applications for smart enterprises, presents a conceptual model of IoT-based business model innovation, and investigates how the Fortune 500 companies use the IoT to innovate their business models. Five hypotheses are developed and statistical analysis is conducted. This paper also discusses implementation strategies for effective development of smart enterprise.

**BUSINESS MODEL INNOVATION AND THE IoT FOR SMART ENTERPRISE**

Business models have been widely used to set up, review, and refine new business ventures. Business models contribute to the research community as a new unit of analysis, and as a system-level concept, centered on activities and focused on value (Zott et al., 2011). Despite extensive use of the term ‘business model’ in both research and practice, a general agreement on the definition of the business model is still missing due to its complex nature. Despite the partial overlap of definitions, the majority have emphasized the role of competitive advantage by a business model (Afuah & Tucci, 2003; Morris et al., 2005; Shafer et al., 2005). The development of a business model helps managers understand the process of customer value creation, resource acquisition, and value delivery and capture.

While some researchers focus on the characteristics of the business model, others concentrate on the innovation of the business model. Business model innovation is a process of finding innovative ways to create value, delivering value, and capturing value. Like the numerous definitions of a business model, different views on business model innovation have been suggested. Teece (2010) views business model innovation as a type of organizational innovation in which firms identify and adopt novel opportunity portfolios. Matthyssens et al. (2006) view business model innovation as a way to blunt cutthroat competition and achieve competitive advantage. Johnson et al. (2008) describe business model innovation as an outward-facing, highly creative exploratory process. The results of business model innovation often affect the entire firm (Amit & Zott, 2001).

According to Sosna et al. (2010), business model innovation is a trial-and-error learning process and may proceed differently in start-ups compared to established organizations. They note that continuous business model innovation is an important capability for every firm seeking success in the long term. Chesbrough (2007) suggests that enterprises can follow six stages of business model innovation from very basic (and not very valuable) models to far more advanced (and very valuable) models. He suggests that companies can assess where their current business model stands in relation to its potential and then define appropriate next steps for the further advancement of that model. However, no studies have yet investigated the applicability of the IoT for business model innovation. To understand how the IoT can be used to innovate business models, we need to analyze how leading enterprises are currently leveraging the unique capabilities of the IoT for their business model innovation.

Based on the technology trends and literature review, this section discusses three IoT categories for smart enterprise applications: (1) monitoring and control, (2) information sharing and collaboration, and (3) big data and data analytics (Lee & Lee, 2015).

**Monitoring and Control**

According to the Digital Agenda for Europe (European Union, 2015), monitoring and control refers to the control of any system, device or network through automated procedures managed by a control unit with or without the capability to display information. IoT-enabled monitoring and control systems are gaining popularity in the environmental and manufacturing sectors, where companies have
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