Business Horizons (2017) xxx, xxx—xxx

Available online at www.sciencedirect.com

ScienceDirect

KELLEY SCHOOL OF BUSINESS
INDIANA UNIVERSITY

www.elsevier.com/locate/bushor

The Internet of Things: Are you ready for what's coming?

Ted Saarikko*, Ulrika H. Westergren, Tomas Blomquist

Umeå University, 901 87 Umeå, Sweden

KEYWORDS
Internet of Things;
Product digitization;
Value creation;
Co-creation;
Smart appliances;
Product development;
IoT development

Abstract Are you ready for what's coming? As senior managers look to connect products, processes, and services to the growing field of the Internet of Things (IoT), this is an important preliminary question. Leveraging the IoT for firm benefit involves revisiting certain ideas that may have gone unquestioned for a long time. In this article, we begin by reviewing the complexity of the IoT, the complexities of an increasingly interconnected environment, and the increasing need to develop partnerships in order to create innovative solutions. We then offer practical insights from a case in which three actors with reciprocal specialties cooperated to create an IoT solution in the form of a connected appliance. While a shared spirit of optimism prevailed throughout the endeavor, reaching the finish line meant jumping a few hurdles along the way. Finally, we describe a number of fundamental issues related to business models, partnership strategy, data ownership, and technology diffusion that every enterprise should address before diving headfirst into the Internet of Things.

1. Lost in the woods

Are you ready for what's coming? As senior managers look to connect products, processes, and services to the growing field of the Internet of Things (IoT), this is an important preliminary question. Analysts—including Gartner (2015) and McKinsey (Manyika et al., 2015)—have predicted significant growth in the number of connected devices and areas of application, creating value for both private consumers and businesses. Connected devices are currently attracting a significant amount of attention among practitioners as well as researchers. IoT is often spoken of with the same reverence that the World Wide Web enjoyed in the late 1990s and cloud computing just a few years ago. However, as the promise of a hyperconnected future in which everything is connected to everything else appears to be drawing ever closer, we appear to become less and less certain regarding just what this future will look like. Estimates for the number of connected devices range from 25 to 50 billion by the year 2020

* Corresponding author
E-mail addresses: ted.saarikko@umu.se (T. Saarikko), ulrika.westergren@umu.se (U.H. Westergren), tomas.blomquist@umu.se (T. Blomquist)

0007-6813/$ — see front matter
http://dx.doi.org/10.1016/j.bushor.2017.05.010

(Lee & Lee, 2015; Weinberg, Milne, Andonova, & Hajjat, 2015). While the hefty margin of error might provoke a smirk or be dismissed as the result of pure guesswork, it is also symptomatic of a deeper, more serious issue. What can be gained by directly connecting products to the internet that cannot already be attained with the current range of gadgets and contraptions? What are the consequences and critical issues of a transition to a connected world? Are firms obligated to incorporate another feature into their products 'just because,' or is there an actual rationale somewhere behind the hype?

Leveraging the IoT for firm benefit involves revisiting certain ideas that may have gone unquestioned for a long time. As Erik Brynjolfsson and Andrew McAffee (2014) outline in their book *The Second Machine Age*, radical innovations such as electricity and computers were slow to yield proper dividends. It took many years for people to realize how to use the new technology to their advantage, and those who got there first enjoyed a significant competitive advantage while the competition scrambled to mimic their approach. While it is not our intention to overinflate the significance of the IoT by making direct comparisons to the introduction of electricity or the proliferation of computers, we can make a direct comparison concerning the initial confusion and inability to see the full potential of a new innovation. Researchers and practitioners are still in the midst of making sense of the IoT. The attachment to existing norms, value chains, and business models casts long shadows that prevent proper exploitation of products that can continually disclose how, where, and when they are used. Realizing the idealistic notion of a smart product is as much about exploring motives and expectations as it is about resolving technical issues.

In this article, we begin by briefly reviewing what has been written about the IoT and the immense complexity of seamlessly integrating products, people, places, and processes that will require both high volume and high customization. We then proceed to outline value creation and the increasing necessity to form partnerships in order to develop intricate solutions that extend well beyond the product itself. Next, we present practical insights from three enterprises that pooled their know-how of product development, communication infrastructure, and information management to furnish an appliance with online capabilities. Finally, we offer a number of fundamental issues related to business models, partnership strategy, data ownership, and technology diffusion that every enterprise should address before diving headfirst into the IoT.

2. The Internet of Things

We will briefly review two essential aspects of the IoT: the technical advances in remote connectivity itself and the potential business consequences of digitizing products.

2.1. It has been a long time coming

Despite the massive amount of attention given to the IoT over the past couple of years, connected products are essentially old news as large and expensive industrial equipment has been supervised remotely for many years (Wünderlich et al., 2015). The novelty associated with IoT stems from its potential for widespread application as technical barriers associated with automated surveillance have been gradually eroding, drastically decreasing the associated costs in its wake. The requisite technical equipment, such as computers and sensors, has gotten smaller and more power efficient. The rates for data traffic have decreased as an infrastructure of wireless, high-capacity networks has expanded at breakneck speed. The ability to create interfaces between network types (middleware) has improved, making it possible to accommodate multiple standards and formats and provide seamless connectivity.

The IoT's coming of age may be attributed to a generic technical development where smartphones and tablets have served to propel miniaturization of components so that more and more capacity may be crammed into devices that weigh ounces rather than pounds. However, there are also less noticeable drivers for high capacity with a small footprint. Companies involved with logistics and warehousing have a comparatively long history of assigning a digital identity to physical objects (e.g., via Radio Frequency Identification tags) (Atzori, Iera, & Morabito, 2010). In doing so, they have been able to cultivate long and winding logistical chains while still providing quality assurance at a low cost. In addition, firms involved in product development pay earnest attention to connectivity and remote access. A constant threat of new entrants coupled with the modest return on investment from incremental product development spurs even the more confident enterprises to diversify their offering beyond the product itself. The race is on to find new additions and ways to compete based on experience and expertise rather than merely retail price.

While technology evangelists claim that everything will be connected in the near future, it is more accurate to say simply that everything can be connected. For instance, recent advances in low-power wide area network (LPWAN) technology serve to