



Torsten J. Gerpott/Sebastian May

**Integration of Internet of Things Components into a Firm's Offering Portfolio
– A Business Development Framework**

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Abstract

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In quite a number of industries, many firms have started to equip physical objects (e.g., heaters, production machines) with sensors and actuators and to connect them among themselves and with higher-level control units over ubiquitously available wireless data networks. This development is summarized under the heading of Internet of Things (IoT). Companies try to revise or extend their current portfolio of products and services by using IoT-components in order to achieve competitive advantages. However, an unsystematic and autotelic addition of connected sensors and actuators to current offerings does not necessarily lead to great market success. Hence, the purpose of this paper is to (1) identify different roles which IoT-components can play in offering portfolios, (2) clarify business development objectives, which can be achieved by the combination of products and services with IoT-components, and (3) report case examples which help to highlight how business development objectives can be reached with the help of IoT-components fulfilling specific roles.



**Univ.-Prof. Dr.
Torsten J. Gerpott**

Chair of Corporate and Technology Planning, Mercator School of Management, University Duisburg-Essen, Lotharstr. 65, D-47057 Duisburg.



Dipl.-Ök. Sebastian May

Research assistant at the Chair of Corporate and Technology Planning, Mercator School of Management, University Duisburg-Essen, Lotharstr. 65, D-47057 Duisburg.

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1. Introduction

The term “Internet of Things” (IoT) was introduced by Kevin Ashton (2009) already more than 15 years ago but both management scholars and practitioners largely ignored the concept. However, recently the popularity of the IoT paradigm, which describes the self-organized interconnectivity of uniquely identifiable everyday objects (e.g., cars, home appliances, clothing), has soared. Communications modules embedded in the objects make it possible to exchange data concerning the objects themselves or their environment without direct human intervention across various networks and, thus, enable innovative applications (Gubbi et al., 2013, pp. 1646-1647). IoT subsumes a vast variety of technology subfields, such as cyber-physical systems, smart objects, smart grids, or smart meters (e.g., Li et al., 2011; Li et al., 2015; NIST, 2015; Wilson et al., 2015). Triggered by the development of low-cost sensors and actuators, possible IoT applications have evolved from digitally enhanced barcodes, such as radio-frequency identification (RFID)-tracking technology (Welbourne et al., 2009), to adjunct product or service features, which promise to provide substantial value added to customers and open up new business perspectives for suppliers of industrial and consumer products and services.

There are plenty of recent examples of how the use of the IoT changes existing offering portfolios of established firms. For example the e-commerce retailer Amazon announced a program called Amazon dash button. It allows consumers to order household goods such as detergent or bottled water by pressing a branded, wirelessly connected single-function button that can be mounted anywhere in the household. The items are then delivered to the customers’ home via Amazon’s prevailing distribution chan-

nels (Economist, 2015). Another more complex example for IoT integration is a smart home platform, which enables users to remotely and/or automatically control and monitor home appliances, such as the heating and lighting (Balta-Ozkan et al., 2014). These examples show how the IoT enables companies to extend their existing offerings by incorporating previously uncharted complementary or new product or service features. Home deliveries of commodities or electronically controlled household appliances themselves are long established service or product categories, respectively. However, IoT-based amendments enable firms to offer them in a way, which may provide significant additional benefits for the customers. Hence, IoT applications can serve as a driver for the transformation of a firm’s product and service range.

A comprehensive survey of the scientific literature by Whitmore et al. (2015) concluded that, in spite of an exponential recent growth in the number of scientific articles on *technological* issues of the IoT on the one hand, there is a lacuna of scholarly work on IoT in a *business* development context on the other. In this regard, Whitmore et al. (2015) identified only four articles on IoT business models, half of which date back to 2009 (Bohli et al., 2009; Haller et al., 2009; Fu et al., 2011; Li et al., 2012). Bohli et al. (2009) distinguish between three different protagonists of the IoT-market, i.e., hardware suppliers, consumers, as well as intermediaries and service providers. However, the authors limit their analysis to wireless sensor networks and, thus, discuss the IoT isolated from the products and services it enhances. Haller et al. (2009) predict the impact of the IoT on various industries, i.e., manufacturing, logistics, energy, health, automotive, and insurance. Fu et al. (2011) examine

the roles of Internet service and content providers and their contractual relationships with their counterparts in a B2B and B2C context. Li et al. (2012) focus on drivers of IoT strategies for firms based on their internal capabilities (e.g., the firms’ knowledge and skills) without tying well-known business strategy concepts (e.g., push vs. pull, innovator vs. imitator) to the innovative capabilities of IoT applications.

Additional reflections on IoT business models by Bucherer & Uckelmann (2011), Leminen et al. (2012), and Westerlund et al. (2014) are built on Osterwalder & Pigneur’s (2010) groundwork of business model generation. Bucherer & Uckelmann (2011) focus on the impact of IoT on the core elements of business models, i.e., value proposition, distribution channels, and (targeted) customers. Leminen et al. (2012) and Westerlund et al. (2014) evaluate business models within the context of (IT-)ecosystems and customer types. Additionally, Porter & Heppelmann (2014) discuss how existing product categories and technologies are transformed by IoT implementation. Finally, Fleisch et al. (2014) indicate how the extension of physical products by a digital dimension may boost the value added for customers.

While prior analyses argue that the IoT can be used as a lever to improve various business models, the mechanisms of *how* IoT-components affect a firm’s offering portfolio and thus generate customer value remain rather unclear. Our key tenet is that the revision of existing and the development of new product offerings by means of implementing IoT-elements requires to differentiate between various roles or functions, which IoT can play in supplementing or expanding a firm’s product portfolio against the background

of processes of service transformation (e.g., Cusumano et al., 2015; Porter & Heppelmann, 2014; Bruhn et al., 2015). Consequently, the present paper develops a conceptual framework, which enables scholars and practitioners to identify specific roles of IoT in changing a firm's sales program and to categorize IoT-related business development efforts in the light of restructuring or expansion targets concerning its product portfolio.

The article proceeds as follows: In the second section, we introduce the three different roles which IoT-component integration can play in a firm's current and potential product/service portfolios. The third section structures the potential directions for a firm's portfolio development strategy. The fourth section comprises an analysis of actual examples of IoT-integration against the background of the previously introduced IoT-roles and business development targets. The final section summarizes the insights derived from our analytical framework and suggests directions for future management research in the IoT-field.