



Emerging Markets Queries in Finance and Business

# Business Models for the Internet of Things Environment

Jozef Glova<sup>a,\*</sup>, Tomáš Sabol<sup>a</sup>, Viliam Vajda<sup>a</sup>

<sup>a</sup>*Technical University of Košice, Faculty of Economics, Košice 04200, Slovak Republic*

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## Abstract

Over the past few years, the widespread use of the Internet and rapid development of Internet-based technologies has resulted also into shorter life cycles of product and services, requiring thus faster changing business models. This paper provides an overview of business models for Internet of Things, Services and People applications. The concept of the Internet of Things and Services envisions physical devices and appliances to be used as easily as a web service and seamlessly integrated into networked applications with required functionality. Technologically this concept is clear, and several smart applications are currently under development (see e.g. iCore, Hydra, Confidence or IoT@Work projects). However, the business perspective of information as an asset in its own right remains an open issue. To handle this issue we apply an originally value-based requirement technique, e3-value, to model value creation and value exchange within an e-business network of multiple business actors. Using this approach the business activity can be reduced to its core elements, which in the simplest case comprise the value proposition, distribution channels and the customers of the company, explaining how a multi-actor network creates, distributes and consumes value by production of a good or providing a service.

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\* Jozef Glova. Tel.: +00421-55-602-2157; fax: +00421-55-633-0983.  
E-mail address: [jozef.glova@tuke.sk](mailto:jozef.glova@tuke.sk).

## 1. Introduction

In the last decades science and technology have experienced an impressive advance and many new business opportunities emerged in different enterprise environments. The introduction of new technologies like radio-frequency identification and smart computing has enabled many new application and business propositions in the business systems and domains like logistics, manufacturing and production, industrial automation, environment, transport, maintenance, health-care, services etc. New classes of applications combining virtual and physical world information from users, data repositories, devices and sensors into intelligent services have emerged as mentioned also by Thestrup et al., 2006.

This world-wide network of interconnected objects uniquely addressable, interoperable, and based on standard communication protocols is called “The Internet of Things” (IoT) or “Pervasive Computing”. The term IoT was coined more than 10 years ago by Ashton, 2009 and Brock, 2001, but came into limelight in 2005 when the ITU, 2005 published the first report on the subject. It enables to connect everyday objects and devise for online communication between people and things and between things themselves, based on embedded smart wireless sensors and identification technologies. In this way active participants can share information with other members of the network or with any other stakeholder in their surroundings and of acting and reacting autonomously in an appropriate manner. According to Smith, 2012 there is an enormous effort to create a smart world through the research and development (R&D). A world where the real, digital and the virtual are converging to create smart environments that make energy, transport, manufacturing and many other areas more intelligent. According to Harbor Research, 2011 two major technology developments at the begin of the 21st Century emerged that appear now to be on a path of convergence – The Internet of Things and The Internet of People or more familiar social networking (Web 2.0). We can also see the enormous value that can be derived from collaboration on the Internet now. As the Harbor Research expects in the long run any manufactured object, which possesses inherent data processing capability, has potential to be networked. Such “invisible” machine-to-machine (M2M) applications will create many new automated services. These services will be much more important to business and to the whole economy.

These new inventions have change the way how products and services are marketed and distributed. These changes have affected the traditional business models and led to a series of new types of models. Alt and Zbornik, 2002 defines a typical business transaction through a physical product, information stream, and money stream. The product stream includes order processing from procurement via storage and production to distribution of products to the customer. The information stream includes processes, such as order processing, supply chain and product life cycle data sharing. The IoT may be seen as an approach to align these different streams. It provides a higher level of visibility and control mechanism. In the IoT, information itself may become a major source for value creation and thus also for the value proposition. Traditionally, the money stream is exclusively dependent on the product stream prices as mentioned in Andrejovska, 2011. A separate price for the information is not defined. Instead, information is most often expected to be free of charge. It is obvious that costs of information are hidden in the product price. However, the reluctance to pay for information may change over time.

## 2. Business Model and Its Application in Internet of Things Environment

The expression “business model” is frequently used in research and practice, a common definition is missing as mentioned in Morris et al., 2005. Probably the most cited definition can be found in Timmers, 1998, who defines a business model as “an architecture of products, services and information flows...”, what includes the involved actors and their roles as well as the potential value created for all participants and the sourced of revenue. Negelmann, 2001 provides another definition, where “a business model defines and structures the fundamental way and form of the aspired added value of a firm. It contains the description of the exchange

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