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## The Framework of Business Model in the Context of Industrial Internet of Things

Sylwia Gierej\*

*Faculty of Management, Bialystok University of Technology, Wiejska 45A, 15-351 Bialystok, Poland*

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### Abstract

The purpose of this article is an attempt to develop the concept of a business model dedicated to companies implementing technologies of the Industrial Internet of Things. The proposed concept has been developed to support traditional companies in the transition to the digital market. The study was based on the available literature on the impact the Industrial Internet of Things has on the economy and business models.

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*Keywords:* business model; Business Model Canvas; Lean Canvas; Industrial Internet of Things (IIoT); outcome economy

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### 1. Introduction

The digital revolution changes the perception of the economy and business. The current rate of technological development makes the standard IT business systems considered unsatisfactory. Nowadays, the goal of most IT providers is delivering systems as much as possible intelligent. Increased use of mobile technologies and cloud computing initiates changes in the design and ways of using applications. The possibility of communication between machines without human intervention and analysis of the acquired data in this way allows monitoring and automating many processes. It drives to the growing importance of the Internet of Things [1, 2]. It causes, that companies are somehow forced to redesign their products and to reorganization activities, aimed at provide the client specific benefits and survive in the market [3].

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\* Corresponding author. Tel.: +4-851-793-4196.  
E-mail address: [gieraj.sylwia@gmail.com](mailto:gieraj.sylwia@gmail.com)

## 2. The Industrial Internet of Things

The concept of the Internet of Things was first used by a British entrepreneur, Kevin Ashton, in 1999. He used it to name the communication system of the material world with computers by using sensors. This concept involves combination clearly identifiable devices via a computer network. Objects thus have the possibility of direct or indirect data collection, processing or exchange. Beyond smartphones and tablets, devices connected within IoT are also household appliances, lighting and heating as well as wearable devices [4]. At the turn of 2008 and 2009, the number of devices connected to the Internet exceeded 7 billion. This moment is considered appropriate to initiate the development of the Internet of Things. CISCO Systems Inc. has formulated a broader concept for this phenomenon – the Internet of Everything. This concept defines the connection of people, processes and data via the Internet [5].

IIoT (Industrial Internet of Things) is a concept based on the same principles as the IoT, but for the connection of machines in the factory. IIoT is primarily communication between machines (M2M) and autonomous action based on the information exchanged with each other. An extremely important role in this type of communication plays a layer of high availability software. It makes the Internet of Things can be used in all of industries It allows the network system to work with other systems to provide information, e.g. about any problems on the state of the equipment, etc. Employees receive them on mobile devices and can appropriately react quickly. The information is provided in a right time, without delay. Another element having a crucial impact on the increased use of IoT in industry is to equip factories with large quantities of sensors. In the industrial centers began to use signals from a large number of connected sensors, combining them with high power computer, which began building the foundations of a new generation of intelligent factories. Once all the data industry, will eventually be connected online, comprehensive software will be able to be used to optimize exactly everything [6].

IIoT ecosystem consists of several layers of hardware and software. The first consists of many sensors, which collect data relating to processes. Then, the data using a communication hub, gateways and switches, are sent as Big Data to the cloud computing or intranet. Transferred data can be analyzed using a variety of analytical and optimization programs, and then uses them to increase the efficiency of production for a lot of types of tasks that make up the production and service, and better use of resources. IIoT provides the ability to integrate data from the production software with ERP and CRM systems. The production activity can not only be used effectively in the planning and evaluation of processing costs, but also to use information from buyers, enabling real-time to make changes to the assembly lines and process parameters [6].

The main risks of the development of IIoT are related to the exclusion of a large part of employees as a consequence of the high level of automation. Probably they will be forced to raise their skills and to get knowledge of advanced tools. The second most frequently mentioned threat is the risk of interception of data stored in the cloud by unauthorized persons. It should be noted, however, that the works on the development of this technology, and thus also increase the security of stored data [7].

Analyzing publications related to the development IIoT, we can often meet the term Industry 4.0. It is a term for generalizing the concept relating to the “industrial revolution” in connection with the modern mutual use of automation, processing and exchange of data and techniques. Differences between IIoT and the Industry 4.0 are not large, and these concepts are often considered equivalent. Still, we can venture the opinion that the way to Industry 4.0 lead by IIoT. Industrial Internet brings together numerous applications and operating on a smaller scale (sensor), which becomes the infrastructural base for larger applications (automation) associated with Industry 4.0 [8].

## 3. The phases of Industrial Internet evolution

Companies are beginning to see the potential in the Internet of Things using in order to optimize production. However, this is a big challenge. Implementation IIoT requires appropriate infrastructure, as well as a change in the approach to the management of the organization. It should focus on delivering value for customers. Figure 1 shows four predicted phases of the IIoT development.

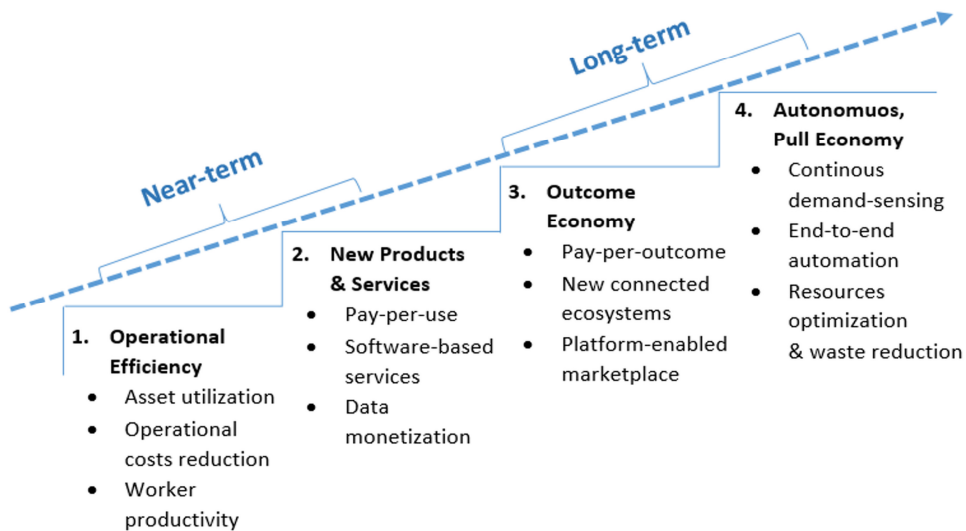


Fig. 1. The phases of IIoT development.  
Source: [9].

Phases 1 and 2 include measures feasible in the near future. The first step is to improve operational efficiency. Presented activities are currently being implemented, and will probably accelerate in the next two years. In phases 3 and 4 are included forecasted trends, resulting from the growing influence IIoT. They are referred to as the outcome economy and pull economy. Outcome economy is based on the quantitative capabilities arising from the application IIoT. Economy based on sales products and services will change the direction of development towards selling measurable outcomes. This is a big change that will bring modification of the basic structures of industry and market competition. So far, the company based its operation on delivering high quality products or services, competitive prices, creating brand by building relationships with customers. The current development of technology forces producers to draw towards a more precise knowledge of preferences and attempts to predict of customer needs. An important issue in the economy development will be running business based on cooperation. Experts from Accenture, telling about the outcome economy, use the wording: “Hardware producing hard results”. Enterprises operating in the traditional market will have to cooperate with partners who will provide them with the appropriate hardware and software. This will help move products from the physical business world to the digital market. The main purpose is no longer the new products and services design. Companies will seek to improve current offer by digital technology. These activities will provide the customer with the best value proposition resulting from the purchase of goods offered. The above-mentioned actions will lead to phase 4, which is spread IIoT in every industry. As a result, it leads to the possibility of determining the level of demand in real-time and highly automated and flexible production networks. The described phenomenon is referred to as pull economy [9, 14].

#### 4. The concept of outcome-based business model

Referring to the outcome economy idea, companies will be forced to change existing business models. The value propositions designing and cooperation with partners from the IT sector will play a key role. The dynamics of the digital market determines the choice of techniques that allow you to make quick changes in the business model.

The business model is one of the three main determinants of economic efficiency (the other is the environment and the factors change), [16]. By analyzing the available literature, we meet many different ways to create business models [15]. A multitude of concepts affect the lack of originality of the presented models, because in many cases they are based on earlier publications. At the same time, each of the authors presents a different view on certain issues.

Researchers involved in the systematization of issues related to the modeling business suggest that there is no single best approach. Often the best solution is to mix different concepts and adapting to the company's needs [17]. The author tries to modify the selected concept of the business model, taking into account the key issues IIoT and outcome-economy.

Analyzing the available literature, the author decided to rely on the concept of Business Model Canvas by Osterwalder. The arguments for choosing indicated concepts are as follows [10, 18, 19]:

- It has a large support in theory of management science, because it is derived from the author's PhD thesis
- It offers a tool for visualizing the business model
- It puts special emphasis on the creation of value proposition, which is important for the outcome-economy conception
- It is constantly evolving and enriched with innovative solutions, facilitating the creation of business models (web-platform strategyzer.com)
- It can be successfully used in practice (the concept was developed in collaboration with 470 practitioners from 45 countries).

The author of the Business Model Canvas defines the business model in the following way: “It describes the rationale of how an organization creates, delivers and captures value”. The main objective of this idea is the joint of the business model development by all members of the organization in a simple and understandable way. The business model is a kind of strategy scheme, to be introduced in the framework of structures, processes and systems in the enterprise. According to the concept of Business Model Canvas business model consists of nine fundamental elements that show the logic of developing profit for the company. These elements are: Customer Segments, Value Proposition, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partners, Cost Structure. In order to facilitate the use of this method the special tool was developed. It shows all nine parts of the business model in an orderly fashion (Fig. 2), [10].

<b>Key Partners</b>	<b>Key Activities</b>	<b>Value Proposition</b>	<b>Customer Relationships</b>	<b>Customer Segments</b>
	<b>Key Resources</b>		<b>Channels</b>	
<b>Cost Structure</b>			<b>Revenue Streams</b>	

Fig. 2. Business Model Canvas.

Source: [12].

Business Model Canvas was adapted to the needs Running Lean methodology. It is defined as “the systematic process of iterative transition from plan A to plan effectively, even before run out of resources”. Ash Maurya, the author presented a methodology, based on the original template business model, has developed a tool adapted to Running Lean. The Lean Canvas remains some elements consistent with the original, while the rest was transformed to fully support the startups founders. Fig. 3 shows Lean Canvas [11].

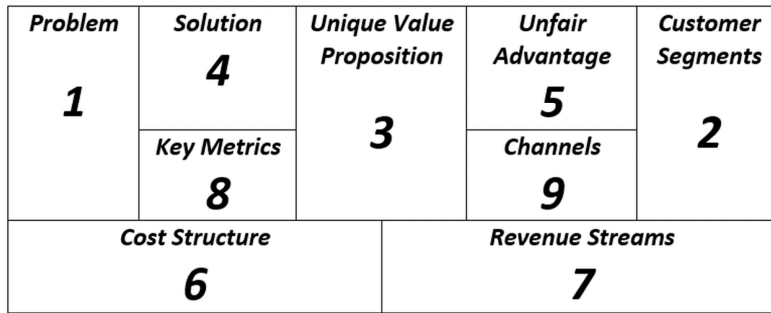


Fig. 3. Lean Canvas.  
Source: [13].

Lean Canvas focuses heavily on the most accurate understanding of customer needs. It begins by defining the problem or need (1), then discovers a potential customer segments (2) in order to verify the assumed hypotheses. The next step is to define a unique value proposition based on the information or return to the first point to redefine the problem. After verification of interest from clients it starts work on the solutions creation. The author justifies this proposed workflow that most digital businesses collapses, because they do not verify their customers' needs before creating the product. As a result of launch a product, it proves that customers are not interested in the solution because it does not meet their needs.

Despite many advantages, these models are not without disadvantages. Table 1 shows the strengths and weaknesses of the presented concepts [20].

Table 1. The comparison of Business Model Canvas and Lean Canvas.

	Business Model Canvas	Lean Canvas
Strengths	- simplicity – the concept is simple, clear and transparent	- simplicity - the concept is simple and easily digestible
	- universality – is appropriate to the different types of business	- concept uses natural business logic – <i>problem-solution</i>
	- inserting value proposition in the center of the model	- each in its own logic, focus on human-client, not the concept or technology
Weaknesses	- static image – the concept is a snapshot of reality	- flexible – not close in the structure of resources and organization, but can still think and define human problems
	- lack of feedback mechanism	- begin from the problem – focusing on the customer
	- low adequacy for dynamically changing solutions	- does not encourage bold action aimed at creating radical innovations

Analysing the presented approach to creating business models we can draw some conclusions. Traditional enterprise aiming to the outcome economy should be aware of their capabilities but also must consider the risks and threats arising from attempts to enter the digital market. Companies should focus on creating the most attractive value proposition for the customer, enriching the existing offer on solutions in the field of IIoT. Forecasts show clearly that abandonment of IIoT will be associated with a high risk of collapse of the company. This is the reason why the company should take action towards changing their business models to the outcome economy.

In the context of the presented models you can suppose that the use of only one of them will not be enough. Companies already operating on the traditional market have some information about their clients; they have proven channels and physical products that generate profits. These are the elements present in the Business Model Canvas. But it lacks feedback mechanism, necessary for testing new solutions. Referring to the key issues related to the functioning of companies in outcome economy, author proposed the initial concept of outcome-based business model. Author based on the presented approaches and developed a framework (Figure 4) which takes into account the key elements important from the point of view of traditional enterprises in the process of shift to the digital market.

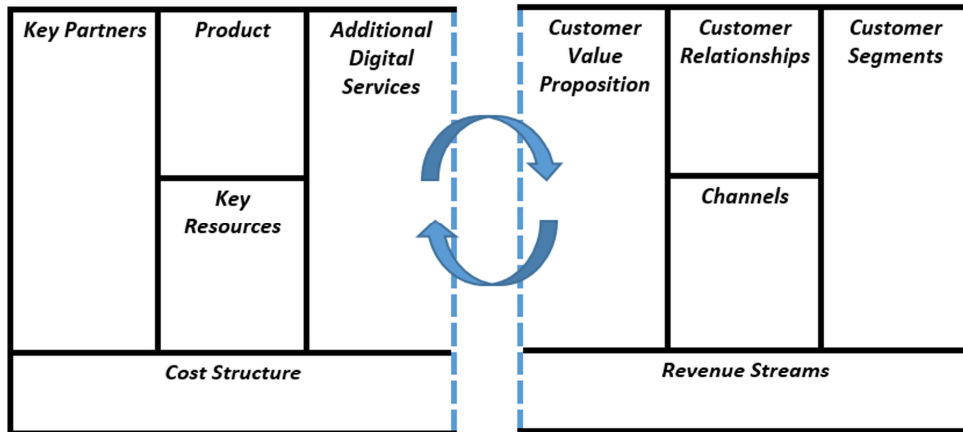


Fig. 4. The concept of outcome-based business model.

The presented framework consists of the following components:

- Key Partners – cooperation with IT companies is essential in order to develop attractive value for the customer by enriching traditional product for digital services
- Product – this item represented the currently product analyzing, which will indicate the directions of the digital product development
- Key Resources – IIoT implementation requires appropriate resources, particularly in the infrastructure and software
- Additional Digital Services – It should be noted additional digital solutions that enhance physical product
- Customer Value Proposition – specific results for the customer resulting from the use of the product
- Customer Relationships – maintaining positive and strong relationships with our customers is important to obtain feedback from customers regarding the product
- Channels – identifying ways of acquiring customers
- Customer Segments – precise definition of target groups allows for more accurate understanding of their needs and problems, which have a significant impact on the design of additional services
- Cost Structure & Revenue Streams – present ways of obtaining profits and spending.

The diagram can be divided into two groups of elements: product and dependent on the market. This division was taken from Lean Canvas to select the interactions identified in the framework of groups of elements, which together make up a coherent business model. The arrows in the diagram indicate the need for reviewing and updating the model, which is forced by high dynamics of the digital market.

## 5. Conclusion

Create smart factories using IIoT is a trend that will undoubtedly grow in the coming years. Changes resulting from this phenomenon will contribute not only to the growth of manufacturing automation, but also will evolve a new forecast of direction of economic development, called the outcome economy. This will be the result of the transition of traditional companies on the digital market. In order to provide the highest value proposition, manufacturers will be forced to redesign their products and changing existing business models. Analysis of the literature showed that there is no concept of a business model that comprehensively supportive of the company passing on the digital market. The researchers suggest combining different concepts. Presented the concept of outcome-based business model has a starting point for discussion on techniques and tools to support the company in the changes on their entry into the digital market.

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