

Business Models of Internet of Things

Dariusz Kralewski^(✉)

Faculty of Management, Department of Business Informatics,
University of Gdańsk, Gdańsk, Poland
dariusz.kralewski@ug.edu.pl

Abstract. *Background.* This article focuses on one of the most important topic for future life and economy – Internet of Things.

Research aims. Indicate business models that apply to the Internet Things.

Method. Theoretical analysis of the phenomenon of Internet of Things. Analysis of fifty-five business models. Indication of thirty-three models of the Internet of Things.

Key findings. Analyzing a broad variety of companies (up to 400 cases) Gassmann, Frankenberger and Csik identify fifty-five business model patterns that either individually or together build the fundament of the majority of currently existing business models. These models can be the basis of creating business models Internet of Things. The author of this article from fifty-five models selected thirty-three models and pointed their application in the field of Internet of Things. These thirty-three models can be successfully used in the Internet of Things on four specified layers and in eleven areas. These models may also be the starting point for creating new business models or inspiration for the creation of a completely new, innovative models. Specification of these new models will be the target for further studies.

Keywords: Business models · Internet of Things

1 Introduction

There are many papers and articles on business model innovation and the Internet of Things (IoT). They share a common consensus that the IoT will enable companies to create new business models. Suitable business models will play an important role when it comes to leveraging the opportunities of the Internet of Things. But what is the basis for these new business models? How will the IoT provide us with these many business opportunities?

This article analyzes the innovative aspects Internet of Things. Article begins with defining the Internet of Things. Analysis of applications associated with detailing the layers of the Internet of Things is the basis to indicate the places where they can be used or created models of the Internet of Things. Then focused on the theme of business models and business model canvas described by the nine elements.

Analyzing a broad variety of companies (up to 400 cases) Gassmann, Frankenberger and Csik identified fifty five business model patterns that either individually or together build the fundament of the majority of currently existing business models [1]. These

models were the base of this study. Instead of reinventing the wheel, when identifying a new business model it is often sufficient to (re-) combine (i.e., transfer, combine, or repeat) these existing patterns [2]. Of course, these patterns are helpful for creating Internet of Things business models as they cover diverse industries and sectors and layers of Internet of Things. Internet of Things has of course the potential to create completely new business model patterns. This article is the beginning of research on the exploration of such models.

2 Review of Background

2.1 Internet of Things

Internet of Things is the networking of almost all types of devices. Behind this concept lies the vision of a future world in which digital and physical device or everyday objects are connected through appropriate infrastructure, in order to provide a whole range of new applications and services [3]. Internet of things is a combination of two worlds known to us (digital and physical), and in the coming years, we will have the opportunity to observe how fundamentally changing the way we use and interact both with the outside world of digital devices and the physical world [4].

The Internet of Things is an extension of networking and computing capabilities on objects, devices and sensors that are not normally considered to be computers. These intelligent objects require minimum human intervention to create, exchange and retrieval of data. The concept of Internet of Things is based on three concepts: anytime, anywhere, anything [5] (Fig. 1).

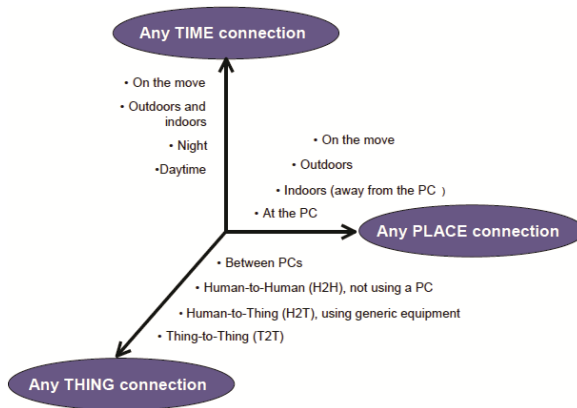


Fig. 1. Communication on the Internet of Things, the source: ITU-T

The definition of Internet of things is based on three pillars relating to the characteristics of smart objects: allow for the identification of himself (everything is able to introduce), provide communication (everything can communicate) and interact (everything can interact).

Implementing the concept of Internet of Things we can observe every day. Systems for remote meter reading, monitoring resource consumption or environmental conditions, health monitoring, are just some of them [6]. What we see today is just the beginning, and the range of potential applications seems to be endless [7]. At the moment, the Internet is used by over two billion people around the world: web browsing, sending and receiving e-mail, browsing the various types of multimedia content, playing, using social networks and many other. In addition, the number of people having access to a global network will increase. Soon we will see a big technological leap, when the Internet will be not only a global platform for users, but also for machines, sensors, smart objects that will be able to communicate with each other, exchange information, count and initiate a number of different kinds of activities. It is said that the fastest growing group of “users” of the Internet are just objects [8].

Many companies and research organizations are trying to predict the potential impact of the Internet of Things on the Internet and the economy in the next five to ten years. Cisco, for example, predicts more than 24 billion objects with Internet access until 2019 [9], Morgan Stanley 75 billion networked devices by 2020 [10] and Huawei expects 100 billion connected devices by 2025 [11]. Although these predictions are inconsistent and difficult to indicate precise calculation, however, they present a picture of a significant increase of Internet of Things [12].

2.2 Applications of the Internet of Things

In order to fully imagine the scale of the phenomenon and the number of devices that can be found within the Internet of Things, here we are potential areas [13].

Smart Environment includes automated systems used to monitor the current status and estimate the probability of natural disasters (e.g. the risk of fire, earthquake), control of air pollution (CO₂ emissions), life protection of wild animals (e.g. tracking them with GPS/GSM) or tourism.

Smart Water Management includes, for example the impact of water resources on the environment, their use and protection, deficits, regulation of rivers and protection against floods, waterways, hydropower or security. With solutions Internet of Things is possible live management of the process water supply, starting from the control of its suitability for consumption and storage, through supply and water supply tightness, after monitoring the consumption of end users. Use of the Internet of Things can have of great importance for the protection of the environment (e.g. monitoring the state of the soil), industry and agriculture (including issues such as the degree of fertilization and pollution, fields irrigation and greenhouses) or in solutions for water management in smart cities (e.g. monitoring of fertility and irrigation green areas).

Smart Industry is an area of the Internet of Things entering into solutions for various sectors of the national economy. Possible areas of application include monitoring the state of resources (e.g. the state of cisterns - water, fuel, gas), silo solutions (filling level of storage and weight of stored goods), diagnostics (e.g. self-diagnostics of machines, system failure detection), working conditions (e.g. monitoring inflammatory and dangerous gases, temperature) or processing of products (e.g. detection level of ozone, which is particularly important in plant foods).

Smart Manufacturing, like smart industry, includes solutions that fall within specific sectors of the economy. These include issues related to agriculture (e.g. temperature control and irrigation in order to avoid drying out or becoming moldy), breeding (monitoring living conditions and grazing livestock), and control production lines (readers, sensors, video surveillance - useful in the management and inspections) or control the rotation of products on store shelves and in warehouses.

Smart Transport is next to the above mentioned, the key segments of supporting the economy. This category includes such issues as: the location of transported goods (e.g. control of routes of hazardous materials, delicate or precious), control of transport conditions (e.g. hit, shock) or storage conditions (e.g. flammable materials). The Internet of Things comes also in issues related to the organization of transport, which is, for example reservation of seats at charging stations for electric vehicles, automatic tolls in congested places and self-diagnostics. This way of using the Internet of Things can be critical for fleets, car rental, and even defense systems.

Smart Energy covers a range of solutions that enable you to manage the media. These include the monitoring of electricity consumption of households, businesses, factories and processes for its production and use (e.g. in solar systems, windmills and water management).

Smart City is another area in which the Internet Things can play an increasingly important role, starting with the organization of the movement of pedestrians and traffic (such as monitoring traffic congestion, parking spaces, intelligent road, informing about the state of the road surface, traffic alerts, weather or accidents on the road) diagnosis safety (e.g. vibration and strength of materials in buildings, bridges, historic buildings), noise, lighting (e.g. adaptive to the level of cloud cover) and waste management (e.g. filling level of containers). This area is particularly important in areas such as security (video monitoring, alerting fire), the city's image and comfort of residents and tourists (e.g. tourist information).

Smart Building is a whole range of facilities, such as monitoring the property (fences, windows, doors), motion sensors, smart irrigation, thermostats with automatic learning. Possible solutions include surveillance of external conditions and internal (e.g. to detect the presence of water in buildings and threats installation, supervision, level of temperature, lighting). Monitoring can also include information about location-specific risks (e.g. smoke, CO₂).

Smart House is a category of equipment, which are typically individual use, such as refrigerators (informing about content, shelf life, the need to replenish inventories), remote washing machines (enabling the use of lower energy tariffs), cookers (for remote setting of the oven). With solutions in this category, it is possible to control media consumption (by controlling light bulbs, thermostats, air conditioning) and security (surveillance of child, camcorders, alarm).

Smart Health covers a wide range of applications used in the monitoring of the health and physical activity (e.g. the elderly), vitality (e.g. people active in sport), patient safety (both in hospital and at home). Thanks to the Internet of Things it is possible to e.g. control of sleep (thanks to intelligent mattresses) and teeth (using the smart brushes). For applications at industrial level is the monitoring of hygiene (e.g. informing about

the need to wash hands in factories), the state of the goods (e.g. refrigerators medical monitoring) and security (e.g. the level of UV or radiation in nuclear power plants).

Smart Life is a whole range of consumer solutions for comfort and safety. These include e.g. support purchases (compliance with the preferences of purchasing, monitoring the presence of the allergic components, expiration date), remote control equipment to avoid accidents, monitoring weather conditions (temperature, humidity, atmospheric pressure, wind strength and rain) and protection of personal rights (wallets, jewelry).

2.3 Architecture for Internet of Things

Chen Min [14] presents a four-layer architecture for Internet of Things (Fig. 2):

- Object sensing and information gathering: The first step of enabling smart services is to collect contextual information about environment, “things” and objects of interest.
- Information delivering: Various wireless technologies such as wireless sensor networks (WSNs), body area networks (BANs), WiFi, Bluetooth, Zigbee, GPRS, GSM, cellular and 3G, etc. can be used for delivering the information.
- Information processing: Pervasive and autonomic services are provided through ubiquitous machines in both “autonomic” and “smart” way.
- Application and smart services: Heterogeneous network performance in terms of bandwidth utilization, computing capability and energy efficiency are improved according to different users’ requirements, and application-specific design.

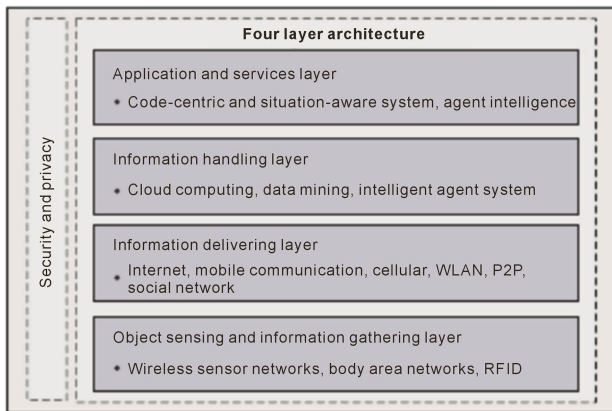


Fig. 2. Layers of Internet of Things

Each company can participate into more than one layer, and create its own business model [15]. The combination of the Internet of Things applications with layers indicates the location of a potential business models (Fig. 3).

Layers	Smart										
	Environment	Water Management	Industry	Manufacturing	Transport	Energy	City	Building	House	Health	Life
Object sensing and information gathering	x	x	x	x	x	x	x	x	x	x	x
Information delivering	x	x	x	x	x	x	x	x	x	x	x
Information processing	x	x	x	x	x	x	x	x	x	x	x
Application and smart services	x	x	x	x	x	x	x	x	x	x	x

Fig. 3. The use of business models on different layers

2.4 Business Model

Business models is a way to describe activities of the company permanently operate in the landscape business. Also in Poland, this concept is constantly present in the discussions between the beginner start-ups and investors. One of the most popular concepts in defining the business model is a business model canvas by Alexander Osterwalder. This model accurately describes how organizations create and deliver value to its customers. The concept has been lined in the book “Business Model Generation”, released in 2010, which Osterwalder wrote with Yves Pigneur, Alan Smiths and 470 business practitioners from 45 countries [16].

Before starting explaining the operation of the concept of business model canvas must first understand exactly what is the business model. As already mentioned, we can say that it describes the behavior of the company. At a more general level of understanding it is a system of assumptions, concepts and relationships between them allowing to describe (to model) in the approximate way some aspect of reality. In this case, the business reality. This can be both theoretical and physical object, whose analysis or observation allows learning characteristics different examined (modeled) phenomenon, process or object. Models are commonly used in business. Model at the same time simplifying and clarifying the reality and allows people to take right decisions thus allowing management. The aim of creating models include leveling knowledge so that all participants in the decision making process started from the same point and said the same thing. Looking at the business model “X”, everyone should see clearly where the company takes the money, what sells, to whom it sells and when it recognizes that it has achieved success. What in that case should be a good business model? Ideally, to be

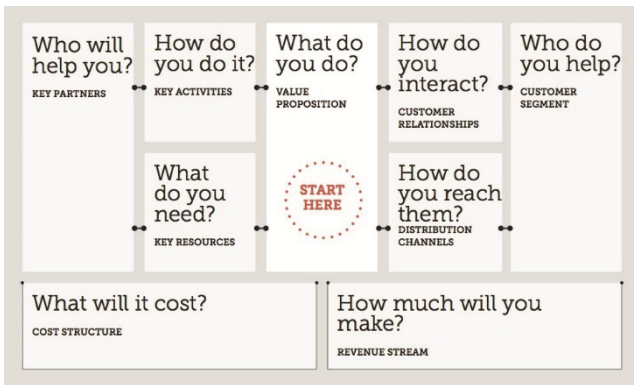


Fig. 4. Business model canvas

simple, adequate to reality and understand. It can not simplify and falsify the complex reality in which the enterprise operates. As adopted by Alex Osterwalder approach, called business model canvas the reality in which the company operates is described by the nine elements that illustrate the following graphics (Fig. 4).

The nine blocks are the elements that represent different aspects of the enterprise. Filled with the content, connected elements describe the product or service that the company provides to its customers.

2.5 Elements of the Business Model Canvas

The business model proposed by Alex Osterwalder was built as the sum of resources and activities, which the company organizes and implements in order to provide a specific value for a particular client. The template is divided into nine interdependent components: Key Partners, Key Activities, Key Resources, Value Proposition, Channels, Cost Structure, Revenue Streams, Customer Segment and Customer Relationships. Description of individual components should start from the most important of them, customer segmentation.

Customer Segmentation (Customer Segment). This is the basic element of the model. It defines the different groups of customers, which provides the added value produced by the company. Customers are the heart of every business model. Without them and without their finances no company can exist. To better understand and more effectively meet the needs of customers, businesses divided them into groups differing from each other needs, behavior or other properties. In the business model, you can define one or more customer segments. The basis for distinguishing customer segments may be such features as:

- Satisfying the needs of the customer segments requires a reasonable business and a distinctive offer.
- Customers in this segment be reached through the use of specific distribution channels (Channels).
- Characterized segment generates specific patterns of behavior and build relationships with customers (Customer Relationship).
- Each customer segments has a separate profitability.
- Customers from different segments are unable to pay differently for different services of the company.

Considering the above criteria clients can be divided for example:

Mass customer. The business model focused on client mass does not make explicit target groups. Value Proposition, Distribution Channels and Customer Relationship focuses on a large group of customers with similar problems and needs. An example of such a business can be a client in the field of consumer electronics, as well as most of the fast moving products (FMCG).

Niche market. Companies operating in niche markets supplying specific, specialized customer segment. In this case, the added value (Value Proposition), distribution

channels (Channels) and Customer Relationships are adapted to the needs and requirements of specific market niche. An example can be specialized thematic channels (STAR Cricket - TV sports for lovers of cricket).

The market segmented. Some business models exude segments differ slightly from each other's needs and problems. Most banks segments of its customers for large groups with less assets and fewer of the larger portfolio. For example, Polish bank PKO BP for nearly half a million customers, with a monthly income of 3 to 20 thousand PLN offers service under personal banking. In contrast, private banking covers only 60 thousand customers. Both of these segments have similar, but differentiating their needs and problems. This has an impact on other elements of the business model, such as the Value Proposition, distribution Channels and Customer Relationships or the Revenue Streams.

Diversified. A company with a diversified segment provides product several target groups with different needs and problems. A good example is the company Amazon, known as the largest online bookstore in the world. Using its experience in the field of conducting a powerful website, Amazon began selling cloud computing services. In this way, he began to share virtual servers and data storage to companies in Internet industry.

Value Proposition. Services or products that the company provides to customer segments make up the so-called value proposition. That value proposition is the reason why customers choose one company over another. The value for the customer is to satisfy their specific needs or solving his problems. In other words, the value proposition is a set of benefits that the company offers to its customers. Sometimes the value proposition can be innovative and offer benefits previously unheard of in the market. Another added value is to offer products or services already existing in the market fortified by a certain characteristic or attribute. Value proposition can be expressed quantitatively (price, delivery time of service) or quality (design, customer experience in dealing with the product/service, full service). When determining the value added for a given segment we must ask the question: what problems or what needs meets a particular product or service that helps solve the problems of potential customers. In the case of innovative value may be the freshness of the product (e.g. new features in mobile phones). Qualitative value can emphasize its uniqueness by associating with the desired feature of (e.g. a manufacturer of electronic equipment Apple combines its products with feature of creativity) or a shift towards socially desirable values (e.g. the ethical investment funds). Quantitatively added value can be expressed by the speed of execution of services (FedEx), or the promise of high income (Forex).

Value proposition can promise perform the work for the buyer. A good example is the rental company of car fleets. In this situation, customers do not have to think about the technical condition of the car or other similar matters. Another added value is the appropriate design, an important example in the fashion industry or consumer electronics. The element that adds value is also a brand. All well associated brands, such as Rolex and Harley Davidson products companies have long been symbols of personal success. In turn, offer similar value-added at a lower price is a typical way of satisfying the customer's needs, which draws attention to the price. An example is Ryanair, which designed their business model to be able to provide service flights at competitive prices. He homesteaded customer segment, which was far excluded from the market of

passenger air transport. In the B2B segment firms often offer their clients added value in the form of cost reduction, such as companies providing software CRM (Client Relationship Management - systems that enable the company in an orderly manner to develop a relationship with the client which translates to greater satisfaction with customer service, and hence reduction of costs associated with the loss of a client, customer acquisition, etc.). In creating value by reducing the risk of helping all kinds of warranties on products purchased. Another element is the availability of value-added services, as in the case of urban bicycle loan scheme.

Channels. Channels is the way the company communicates and tries to segment customers (Customer Segment) to provide added value (Value Proposition). Communication, distribution, sale are the places where the company is in contact with the client, and therefore play an important role in making the consumer experience. Channels fulfill several functions:

- They provide customer knowledge of products and services
- Help customers evaluate the Value Proposition of company
- Allowing users to purchase products or services
- They provide after-sales support

According to convention, business model canvas channels have five phases. The channel may contain some or all of them. The key is finding the right channel configurations in order to provide added value to the market (Value Proposition). In the first phase channel provides the client information about the products or services so as to be aware of their existence. In the second phase it should allow the customer to verify the added value (Value proposition). The next step is the purchase and delivery of the product. The last stage is the after-sales support. Good business model covers all five phases.

Customer Relationships. Customer relationships describe the type of interaction that the company establishes with separate customer segments. The relationship can range from personal, direct contact to the fully automated contact. It all depends on the expectations of customers segment. Personal relationship is based on direct customer interaction. The client can communicate with the consultant - supervisor, who will advise when selling a product or service. Dedicated personal contact is far more common in the B2B industry where customer relationships are built for a long time and decision about buying by the customer requires a lot of support from the dealer. A completely different type of relationship is self-service. We can meet it in the car wash or bike rentals. Another type of contact: co-creation goes beyond the traditional types of relationships. In this type, the customer co-creates value of the company. Examples are reviews of books in bookstores or online consumer reviews such Opineo.pl. Choosing the type of relationship also depends on cost, and integration with other elements of the business model.

Revenue Streams. This element describes the way in which the company generates revenue from various segments (Customer Segments). The company must ask the question: at what Value Proposition the Customer Segment really want to pay? The mechanisms may be different, based on a single purchase of the customer or multiple purchase.

Probably the most popular model is the sale of rights to ownership of physical goods. Another way to generate a revenue stream could be the fee charged for using the service or product. The more or frequently you use of the service, the more you pay. The simplest example are the hotels, movie rentals, courier companies and mobile operators. Another type is a subscription fee - in this case the company charge a fee for access to the service. In this way operate fitness clubs or online games where you pay for access to the server and the ability to play. Licensing is a stream of income, which is widely used in the media industry. Applications created by corporations like Adobe or Microsoft are available on the license terms. Copyright is retained by the manufacturer and the user can use the product according to the agreement. Another revenue stream is to generate funds from advertising, for example, in the software industry. Internet services: Google or Facebook generates its revenue primarily from advertising. Revenue streams can be combined. For example, car rental may charge a fee for signing up and for the use of the car. Computer game can be purchased physically in the box and pay extra for the opportunity to play on the network in the other levels.

Key Resources. This element describes the key resources needed to generate Value Proposition and to reach Customer Segments through distribution Channels. Key resources can be divided into the existing physical, that are machines, car, sales, servers. They are usually very capital intensive. Tesco has a huge network of warehouses and logistics infrastructure. Facebook must have a large and very expensive server farms. Another important source are the intellectual resources. Brand, patent, copyright or customer data are a very important part of any business model. These resources are difficult to manufacture, but owned able to build a very strong value. Microsoft and SAP base their strength on intellectual property developed over the years. Resource of very great importance are also people: especially in innovative companies or based on knowledge distribution. The last resource is money. Certain business models require a large amount of money in order to deliver a new product to market or gain new distribution Channels.

Key Activities. It's the most important steps that a company must perform in order to provide added value (Value Proposition), establish a relationship with the customer (Customers Relationship) and generate revenue structure (Revenue Streams). Key activities can be divided into production, troubleshooting and operating the platform/network. Production is nothing like the design, manufacture and supply of products in specified amounts. Troubleshooting is an activity consisting in the support of the client in understanding the ambiguity or help with unexpected situations. In this way, operate consulting companies, hospitals, third sector institutions. Business models of these organizations require activity such as knowledge management or regular staff training. The business model of Allegro.pl or eBay needs to constantly modernize. Platforms for e-learning (LMS) also constantly developing its solutions to fit the new requirements of technology and customers.

Key Partners. The concept of key partners describes the network of suppliers and contractors, who make the company operates. This could be the most important supplier, joint venture established to provide a new product or service, the strategic partnership

between competitors or strategic alliance with a company from another industry. The motivations for creating partnerships can be different. Sometimes it's about optimization and economies of scale. The company that makes cars does not produce all the parts on their own, because often it is simply profitable. It includes strategic partnerships with manufacturers of necessary parts, which are delivered just-in-time. Another reason for the creation of partnership agreements is the need to acquire specific resource needed to improve business efficiency. Affiliation in order to reduce the risk and uncertainty when introducing a new product or service is more frequent. This was the case for optical media Blu-ray. Companies producing Blu-Ray joined forces to promote the new technology, so that it displaced the DVD. All the while they competing with each other in the sale of its own products Blu-ray.

Cost Structure. The cost structure describes all the costs, which generates business model. Creating and delivering additional value (Value Proposition), maintaining relationships with customers (Customer Relationships) and generating revenue (Revenue Streams) generate costs. It can easily be calculated by defining Key Resources, Key Activities and Key Partnerships. Business models are focused on minimizing costs wherever this is possible. Typical examples are bus lines Polski Bus or airline Ryanair. On the other hand, companies whose business model is based more on providing value could care less about its cost. This category includes luxury hotels and Rolex watches type.

Described in this way, the business model is intuitive and easy to present. Presented in the article approach it is also characterized by high flexibility, which allows you to describe business models operating in different industries. Another advantage is its location in the center of the value proposition. In this perspective, the organizations' efforts are focused on providing the customer what you really want or need.

3 Method

A necessary condition for accurate and reliable research, next to correctly formulated problems and hypotheses is the choice of appropriate methods, techniques and research tools. Methods and research tools are determined by the research problem. In this study, literature analysis, analysis of business models and inference was used.

Analyzing a broad variety of companies (up to 400 cases) Gassmann, Frankenberger & Csik identify 55 business model patterns that either individually or together build the fundament of the majority of currently existing business models. These models are: Add-on, Affiliation, Aikido, Auction, Barter, Cash Machine, Cross-selling, Crowdfunding, Crowdsourcing, Customer Loyalty, Digitisation, Direct Selling, E-commerce, Experience Selling, Flat Rate, Fractional Ownership, Franchising, Freemium, From Push to Pull, Guaranteed Availability, Hidden Revenue, Ingredient Branding, Integrator, Layer Player, Leverage Customer Data, Licensing, Lock-in, Long Tail, Make More of It, Mass Customisation, No Frills, Open Business, Open Source, Orchestrator, Pay Per Use, Pay What You Want, Peer to Peer, Performance-based Contracting, Razor and Blade, Rent Instead of Buy, Revenue Sharing, Reverse Engineering, Reverse Innovation, Robin Hood, Self-service, Shop in Shop, Solution Provider, Subscription, Supermarket, Target

the Poor, Trash to Cash, Two-sided Market, Ultimate Luxury, User Design, White Label [17]. A description of all these 55 models would be too extensive for this article.

These models were the base of this study. Instead of reinventing the wheel, when identifying a new business model it is often sufficient to (re-) combine (i.e., transfer, combine, or repeat) these existing patterns. Of course, these patterns are helpful for creating Internet of Things business models as they cover diverse industries and sectors and layers of Internet of Things. Internet of Things has of course the potential to create completely new business model patterns. This article is the beginning of research on the exploration of such models.

The conceptualization of the business model consists of four central questions (Fig. 5): (1) Who is the customer? In other words, What are the distinctive customer segments; (2) What is being offered? In other words, What is the value proposition?; (3) How is the value proposition to be fulfilled? In other words, What are the organization’s activities, processes, resources and capabilities for delivering what it promises?; (4) How is (financial) value created? In other words, What are the cost structure and the income flows: the earning model?

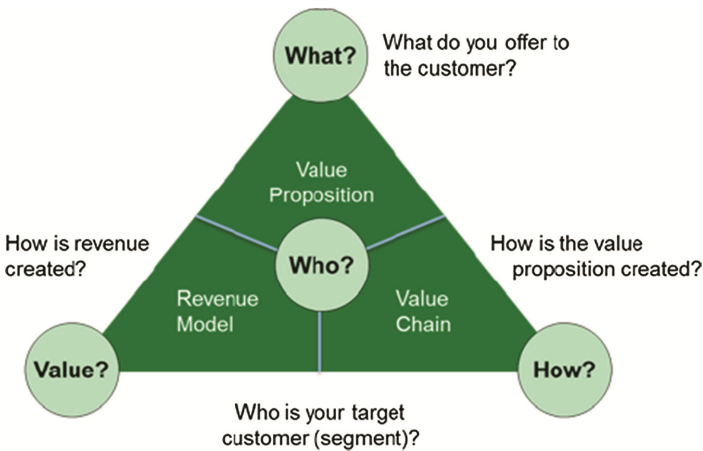


Fig. 5. Business model definition – the magic triangle.

A concrete pattern example is “add-on” – performed, e.g. by Ryanair – where customers are offered a very price competitive basic offering (What?) with additional, variable, and (generally) expensive options to book on top (Revenue?). This business model attracts price sensitive customers, who intend to only pay for what they consume (Who?) and is based on very cost conscious processes (How?).

4 Results

Based on the analysis and reasoning, the following are the business models that are applicable to the Internet Things. Next to their names find a short description. From the 55 business models, 33 models can be applied to the Internet Things.

Add-On - The core offering is priced competitively, but there are numerous extras that drive the final price up. In the end, the customer pays more than he or she initially assumed. Customers benefit from a variable offer, which they can adapt to their specific needs. Internet of Things devices can activate their activities with expressed needs of the user. For an additional fee, they can be activated e.g. elements of artificial intelligence, or delivered to the customer additional data.

Affiliation - The focus lies in supporting others to successfully sell products and directly benefit from successful transactions. Affiliates usually profit from some kind of pay-per-sale or pay-per-display compensation. The company, on the other hand, is able to gain access to a more diverse potential customer base without additional active sales or marketing efforts. The company also can get access to the data, the ownership of which can significantly increase the value of its own data and thus offer a more complete service.

Cross Selling - In this model services or products from a formerly excluded industry are added to the offerings, thus leveraging existing key skills and resources. In retail especially, companies can easily provide additional products and offerings that are not linked to the main industry on which they were previously focused. Thus, additional revenue can be generated with relatively few changes to the existing infrastructure and assets, since more potential customer needs are met. Companies can addition to their own devices, sensors and data sources to offer an external device and the data expanding its offer and making it more comprehensive.

Digitization - This pattern relies on the ability to turn existing products or services into digital variants, and thus offer advantages over tangible products, e.g., easier and faster distribution. Ideally, the digitization of a product or service is realized without harnessing the value proposition which is offered to the customer. In other words: efficiency and multiplication by means of digitization does not reduce the perceived customer value. Many things that are currently performed manually sensors, devices and data from Internet of Things can realize for us.

Direct Selling - Direct selling refers to a scenario whereby a company's products are not sold through intermediary channels, but are available directly from the manufacturer or service provider. In this way, the company skips the retail margin or any additional costs associated with the intermediates. These savings can be forwarded to the customer and a standardized sales experience established. Additionally, such close contact can improve customer relationships. Internet of things devices themselves can order supplies and replenish stocks when they are below the minimum directly from the manufacturer. The devices can themselves be ordered at the time of injury.

Experience Selling - The value of a product or service is increased with the customer experience offered with it. This opens the door for higher customer demand and commensurate increase in prices charged. This means that the customer experience must be adapted accordingly, e.g., by attuning promotion or shop fittings. More information drawn from the Internet of Things devices and in-depth analysis by the company are direct increase in the customer experience.

Flat Rate - In this model, a single fixed fee for a product or service is charged, regardless of actual usage or time restrictions on it. The user benefits from a simple cost

structure while the company benefits from a constant revenue stream. The customer can pay a fixed fee for the use of the Internet of Things devices and aggregates.

Fractional Ownership - Fractional ownership describes the sharing of a certain asset class amongst a group of owners. Typically, the asset is capital intensive but only required on an occasional basis. While the customer benefits from the rights as an owner, the entire capital does not have to be provided alone. In this model, e.g. city districts, companies can co-create the network of the Internet of Things for the achievement of the common good.

Freemium - The basic version of an offering is given away for free in the hope of eventually persuading the customers to pay for the premium version. The free offering is able to attract the highest volume of customers possible for the company. The generally smaller volume of paying 'premium customers' generate the revenue, which also cross-finances the free offering. For example, the company can provide the client basic information obtained from the Internet of things devices, while accurate, aggregated, combined with artificial intelligence may offer a fee.

From Push-To-Pull - This pattern describes the strategy of a company to decentralize and thus add flexibility to the company's processes in order to be more customer focused. To quickly and flexibly respond to new customer needs, any part of the value chain - including production or even research and development - can be affected.

Guaranteed Availability - Within this model, the availability of a product or service is guaranteed, resulting in almost zero downtime. The customer can use the offering as required, which minimizes losses resulting from downtime. The company uses expertise and economies of scale to lower operation costs and achieve these availability levels. In this model, the company may charge a fee for the guarantee of continuous operation of devices Internet of Things.

Hidden Revenue - The logic that the user is responsible for the income of the business is abandoned. Instead, the main source of revenue comes from a third party, which cross-finances whatever free or low-priced offering attracts the users. A very common case of this model is financing through advertisement, where attracted customers are of value to the advertisers who fund the offering. This concept facilitates the idea of 'separation between revenue and customer'. The value for the company will be the same data obtained from the Internet of Things devices. The company having the data can monetize.

Ingredient Branding - Ingredient branding describes the specific selection of an ingredient, component, and brand originating from a specific supplier, which will be included in another product. This product is then additionally branded and advertised with the ingredient product, collectively adding value for the customer. This projects the positive brand associations and properties on the product, and can increase the attractiveness of the end product. The attractiveness of the product can be enhanced through embedding the device the Internet of Things, which will be supported by a well-known brand.

Integrator - An integrator is in command of the bulk of the steps in a value-adding process. The control of all resources and capabilities in terms of value creation lies with the company. Efficiency gains, economies of scope, and lower dependencies from

suppliers result in a decrease in costs and can increase the stability of value creation. Integration of devices, data from different devices Internet of Things is its core.

LAYER PLAYER - A layer player is a specialized company limited to the provision of one value-adding step for different value chains. This step is typically offered within a variety of independent markets and industries. The company benefits from economies of scale and often produces more efficiently. Further, the established special expertise can result in a higher quality process. The company, through its pioneering approach to the Internet of Things can use this model. Other companies that wish to enter the market will use its ideas and products.

Leverage Customer Data - New value is created by collecting customer data and preparing it in beneficial ways for internal usage or interested third-parties. Revenues are generated by either selling this data directly to others or leveraging it for own purposes, i.e., to increase the effectiveness of advertising. This model is the core of the Internet of Things.

License - Efforts are focused on developing intellectual property that can be licensed to other manufacturers. This model, therefore, relies not on the realization and utilization of knowledge in the form of products, but attempts to trans-form these intangible goods into money. This allows a company to focus on research and development. It also allows the provision of knowledge, which would otherwise be left unused and potentially be valuable to third parties. Ideas, licenses, property rights can be the basis for the functioning of some of the companies involved in Internet of Things. This field is new and innovative, and appear and will appear new solutions and patents.

Lock-In - Customers are locked into a vendor's world of products and services. Using another vendor is impossible without incurring substantial switching costs, and thus protecting the company from losing customers. This lock-in is either generated by technological mechanisms or substantial interdependencies of products or services. The lack of standards and the lack of interoperability may cause lock-in devices Internet of Things.

Long Tail - Instead of concentrating on blockbusters, the main bulk of revenues is generated through a 'long tail' of niche products. Individually, these neither demand high volumes, nor allow for a high margin. If a vast variety of these products are offered in sufficient amounts, the profits from resultant small sales can add up to a significant amount. Such a large range of applications the Internet of Things will generate a lot of market niches.

Make More of it - Know-how and other available assets existing in the company are not only used to build own products, but also offered to other companies. Slack resources, therefore, can be used to create additional revenue besides those generated directly from the core value proposition of the company. Cooperation and sharing knowledge certainly will take place on a new, innovative market, the Internet of Things.

Mass Customization - Customizing products through mass production once seemed to be an impossible endeavor. The approach of modular products and production systems has enabled the efficient individualization of products. As a consequence, individual customer needs can be met within mass production circumstances and at competitive prices. This is the basic premise of Industry 4.0 and industrial Internet of Things.

Open Business Model - In open business models, collaboration with partners in the ecosystem becomes a central source of value creation. Companies pursuing an open business model actively search for novel ways of working together with suppliers, customers, or complementors to open and extend their business. Create Internet of Things ecosystem is the foundation of its development.

Open Source - In software engineering, the source code of a software product is not kept proprietary, but is freely accessible for anyone. Generally, this could be applied to any technology details of any product. Others can contribute to the product, but also use it free as a sole user. Money is typically earned with services that are complimentary to the product, such as consulting and support. Interoperability and related open standards are the basis for the dynamic growth of the Internet of Things. McKinsey Global Institute report states that interoperability can generate 40 percent of the Internet of Things and generate income of over 4 billion USD per year in 2025, with total revenue of 11.1 trillion [18]

Pay Per Use - In this model, the actual usage of a service or product is metered. The customer pays on the basis of what he or she effectively consumes. The company is able to attract customers who wish to benefit from the additional flexibility, which might be priced higher.

Pay What You Want - The buyer pays any desired amount for a given commodity, sometimes even zero. In some cases, a minimum floor price may be set, and/or a suggested price may be indicated as guidance for the buyer. The customer is allowed to influence the price, while the seller benefits from higher numbers of attracted customers, since individuals' willingness to pay is met. Based on the existence of social norms and morals, this is only rarely exploited, which makes it suitable to attract new customers.

Peer-To-Peer - This model is based on a cooperation that specializes in mediating between individuals belonging to an homogeneous group. It is often abbreviated as P2P. The company offers a meeting point, i.e., an online database and communication service that connects these individuals (these could include offering personal objects for rent, providing certain products or services, or the sharing of information and experiences). Companies can exchange with each other data gathered from the Internet of Things.

Razor and Blade - The basic product is cheap or given away for free. The consumables that are needed to use or operate it, on the other hand, are expensive and sold at high margins. The initial product's price lowers customers' barriers to purchase, while the subsequent recurring sales cross-finance it. Usually, these products are technologically bound to each other to further enhance this effect. The basic version of the Internet of Things can be very cheap, but its any reconfiguration may require large expenditures.

Reverse Engineering - This pattern refers to obtaining a competitor's product, taking it apart, and using this information to produce a similar or compatible product. Because no huge investment in research or development is necessary, these products can be offered at a lower price than the original product. The dynamic growth of the Internet of Things can lead to the popularization of this model.

Reverse Innovation - Simple and inexpensive products, that were developed within and for emerging markets, are also sold in industrial countries. The term

‘reverse’ refers to the process by which new products are typically developed in industrial countries and then adapted to fit emerging market needs. Internet of Things devices can be produced in a variety of markets. May differ craftsmanship, sensitivity of sensors and collected data.

Self-Service - A part of the value creation is transferred to the customer in exchange for a lower price of the service or product. This is particularly suited for process steps that add relatively little perceived value for the customer, but incur high costs. Customers benefit from efficiency and time savings, while putting in their own effort. This can also increase efficiency, since in some cases, the customer can execute a value-adding step more quickly and in a more target-oriented manner than the company. Future model Build Your own The Internet of Things (BYIoT) is slowly becoming the present. Are becoming increasingly popular. For example projects Arduino and Raspberry Pi in some dimension are BYIoT.

Solution Provider - A full service provider offers total coverage of products and services in a particular domain, consolidated via a single point of contact. Special know-how is given to the customer in order to increase his or her efficiency and performance. By becoming a full service provider, a company can prevent revenue losses by extending their service and adding it to the product. Additionally, close contact with the customer allows great insight into customer habits and needs which can be used to improve the products and services.

Subscription - The customer pays a regular fee, typically on a monthly or an annual basis, in order to gain access to a product or service. While customers mostly benefit from lower usage costs and general service availability, the company generates a more steady income stream.

User Designed - Within user manufacturing, a customer is both the manufacturer and the consumer. As an example, an online platform provides the customer with the necessary support in order to design and merchandise the product, e.g., product design software, manufacturing services, or an online shop to sell the product. Thus, the company only supports the customers in their undertakings and benefits from their creativity. The customer benefits from the potential to realize entrepreneurial ideas without having to provide the required infrastructure. Revenue is then generated as part of the actual sales. This is the basic premise of Industry 4.0 and industrial Internet of Things.

5 Limitations on the Research Design and Material

Quite a few limitations have been identified with this research.

- Article is the beginning of in-depth research on models of the Internet of Things,
- Research method is based on inference and deduction of the author. Another part of the study will also include the appropriate use cases.
- The article includes only the business models of the Internet of Things based on already known business models. No new business models of Internet of Things. Their occurrence will be part of further research.

6 Conclusion

The business model is adopted by the company the long-term method to increase and use of resources in order to provide customers the offer exceeding the offer of competition, while ensuring the profitability of the organization. Good business model is to obtain and maintain at a later stage, a competitive advantage. Business models are constantly transformed. What constituted a good solution several years ago, can not check the current reality, which is why it is so important to keep track of changes and trends in your market. Keep in mind that each newly formed model is burdened with more or less defects, which is soon captured by his opponents. Analyzing a broad variety of companies (up to 400 cases) Gassmann, Frankenberger & Csik identify 55 business model patterns that either individually or together build the fundament of the majority of currently existing business models. These models can be the basis of creating business models Internet of Things. The author of this article from 55 models selected 33 models and pointed their application in the field of Internet of Things. These 33 models can be successfully used in the Internet of Things on four specified layers and in 11 areas. These models may also be the starting point for creating new business models or inspiration for the creation of a completely new, innovative models. Specification of these new models will be the target for further studies.

References

1. Gassmann, O., Frankenberger, K., Csik, M.: The St. Gallen Business Model Navigator, University of St. Gallen. www.bmi-lab.ch
2. Rudny, W.: Business models and the process of value creation in the digital economy. *J. Manage. Finan.* **13**(3), 1 (2015)
3. Bucherer, E.: Business models for the internet of things. In: Uckelmann, D., Harrison, M., Michahelles, F. (eds.) *Architecting the Internet of Things*. Springer, Heidelberg (2011)
4. Waher, P.: *Learning Internet of Things*. Packt Publishing, Birmingham (2015)
5. Vermesan, O., Friess, P.: *Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems*. River Publishers, Aalborg (2013)
6. Jamoussi, B.: *IoT Prospects of Worldwide Development and Current Global Circumstances*, Communication Standardization Bureau (2010). www.itu.int/ITU-T/go/IoT
7. Greengard, S.: *The Internet of Things*. The MIT Press, Cambridge (2015)
8. Thierer, A., Castillo, A.: *Projecting the Growth and Economic Impact of The Internet of Things*, George Mason University, Mercatus Center (2015). <http://mercatus.org/sites/default/files/IoT-EP-v3.pdf>
9. Cisco: *Cloud and Mobile Network Traffic Forecast Visual Networking Index (VNI) (2015)*. <http://cisco.com/c/en/us/solutions/serviceprovider/visual-networking-index-vni/index.html>
10. Danova, T., Morgan, S.: *75 Billion Devices Will Be Connected To The Internet Of Things By 2020*, Business Insider (2013). <http://www.businessinsider.com/75-billion-devices-will-be-connected-to-the-internet-by-2020-2013-10>
11. Huawei Technologies Co. Ltd., *Global Connectivity Index (2015)*. <http://www.huawei.com/minisite/gci/en/index.html>
12. Fleisch, E., Weinberger M., Wortmann, F.: *Business Models and the Internet of Things (2014)*. www.iot-lab.ch

13. Vermesan, O., Friess, P.: Internet of Things – From Research and Innovation to Market Deployment. River publishers, Aalborg (2014)
14. Chen, M.: Towards smart city: M2M communications with software agent intelligence. *Multimed. Tools Appl.* **67**(1), 167–178 (2013)
15. Chan, H.C.Y.: Internet of things business models. *J. Serv. Sci. Manage.* **8**, 552–568 (2015)
16. Osterwalder, A., Pigneur, Y.: *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. Wiley, New York (2010)
17. Gassmann, O., Frankenberger, K., Csik, M.: *The Business Model Navigator 55 Models That Will Revolutionise Your Business*. Pearson, New York (2015)
18. Manyika, J., Chui M., Bisson P., Woetzel J., Dobbs R., Bughin J., Aharon D.: *The Internet of Things: Mapping the Value Beyond the Hype*, McKinsey Global Institute (2015). http://www.mckinsey.com/insights/business_technology/the_internet_of_things_the_value_of_digitizing_the_physical_world