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# MARKETING PRINCIPLES FOR INDUSTRY 4.0 — A CONCEPTUAL FRAMEWORK

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## ABSTRACT

The holistic approach to Industry 4.0 requires a broader look at the changes taking place in the area of marketing. Therefore, this article mainly aims to present an outline of changes in marketing for companies implementing the concept of Industry 4.0 in the context of Design Principles of Industry 4.0. The authors propose a conceptual framework for Marketing in Industry 4.0, deriving from the guidelines for designing strategies to implement Industry 4.0.

The paper allows a better understanding of the Industry 4.0 phenomenon in the context of changes in the area of marketing in general and in industrial markets in particular. The conceptual framework presented in the article suggests a need for a new approach to shaping marketing strategies and the marketing mix in the Fourth Industrial Revolution and helps in identifying the key areas for the marketing mix according to the Industry 4.0 concept.

## KEY WORDS

**Industry 4.0, digital marketing, digital transformation, Fourth Industrial Revolution**

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## INTRODUCTION

The current changes in production methods and the business environment of manufacturing companies, caused by the development of new digital technologies, tend to be described as the Fourth Industrial Revolution. Industry 4.0 and Smart Manufacturing are related expressions, often used interchangeably (Liao et al., 2017). The concept refers to a deep digital

transformation of value chains, business models, products, and services. The changes that are shaping this transformation are happening in two integral business areas, namely, production and business management, and involve a development of smart factories that communicate in real time via the Internet of Things in an ecosystem composed of machinery, a network of factories, and people (Kagermann et

al., 2013). Cloud technologies and the ability to perform an intelligent analysis of large data volumes also enable the integration of value chains, both vertical — occurring inside companies — and horizontal — involving other market participants (Jarocka and Wang, 2018; Saucedo-Martínez et al., 2017). This phenomenon has a direct impact on the changes in the management domain of a product lifecycle and on the relationships with stakeholders in the market. The digital solutions of Industry 4.0 change humans as consumers and affect their work processes and behaviour. Moreover, considering the extremely dynamic and even exponential development of technology and its impact on society, one can claim that changes also occur in the areas of marketing activities and marketing tools aiming to adapt them to the new reality of today's markets (Daviy et al., 2017; Sterev, 2017; Mazurek, 2019; Mazurek and Nosalska, 2018).

A review of the relevant source literature has shown a gap in research regarding the impact of Industry 4.0 on marketing. Therefore, the authors have prepared a literature analysis with regard to marketing theory to present a conceptual framework of marketing in Industry 4.0. This article uses qualitative methods and offers a wide literature review to propose five main marketing principles for the era of the Fourth Industrial Revolution and discuss their impact on the overall marketing mix.

## 1. LITERATURE REVIEW

### 1.1. INDUSTRY 4.0 — A DEFINITION

The Fourth Industrial Revolution determines the changes in the domain of manufacturing. It concerns a shift in the production practice — from mass to personalised production — which results in greater flexibility of production processes and provides means to satisfy the individual needs of different customers more effectively.

The term is also a direct reference to the changes that have taken place over the course of history under the influence of the spread of new manufacturing technologies, which have prompted radical changes in production, society, economy, culture, and business. The First Revolution started with mechanical production relying on the power of steam and water (the so-called Age of Steam), taking place in the late 18th century. The Second Revolution began in the early 20th century, driven by the development of electricity, which contributed to the growth of mass production. Then, during the 1970s, the development

of computers and the automation of production processes initiated the following — third — industrial revolution. Currently, new digital technologies, such as Virtual Reality, Augmented Reality, Big Data Analytics, Cyber-physical Infrastructure (CPS), Internet of Things, Additive Manufacturing, Cloud Computing, Smart Sensors, Artificial Intelligence, Mobile Technologies, and Autonomous Robots and Systems, are causing material changes in the business environment and our everyday lives (Mittal et al., 2017; Pfohl et al., 2015; Mazurek, 2019). These disruptive technologies are shaping the Fourth Industrial Revolution.

The importance of these phenomena has also been noticed at the level of governments of multiple countries (Kagermann et al., 2013; Li, 2018). Many government authorities have proceeded with the introduction of development schemes to increase the digitisation of production companies and to facilitate the achievement of higher industrialisation index rates. One of such schemes is the concept of Industry 4.0, which was first proposed in Germany in 2011. The term is used in Europe interchangeably with the Fourth Industrial Revolution, and it is this concept, around which the scientific discourse concerning digitisation revolves now. The concept has also been popularised under different names in different parts of the world. For instance, the names functioning in the US include the Industrial Internet of Things (IIoT) or Smart Manufacturing, or the Internet of Things, which describes a broader range of changes. The terms refer to similar phenomena encompassing the advancing digital revolution, and, thus, fit in the general digital transformation trend occurring today.

Many different definitions of Industry 4.0 are present in the source literature. Authors, e.g. Herrmann, Pentek, and Otto (2015), Wang et al. (2017), Sandengen et al. (2016) and Tupa et al. (2017), briefly define Industry 4.0 as a collective term describing changes in the technological scope and the organisation of value chains. This approach reveals two main aspects of the digital transformation in question — its technological aspect and its business aspect.

Many authors emphasise the importance of the holistic approach to Industry 4.0, treating the changes caused by digitisation very broadly. Strandhagen et al. (2017) define Industry 4.0 as an “umbrella term” referring to a number of concepts and affecting many disciplines in the industry. Generally, defining the scope of Industry 4.0 requires listing its specific aspects. For example, Saucedo-Martínez et al. (2017) sequentially refer to the meaning of Industry 4.0,

i.e. (1) the integration of complex machines and devices with sensor and software networks used to predict, control and improve business activities that have a social impact, (2) a new level of organisation and value chain management throughout the entire product lifecycle, (3) a common term for technology and value chain organisation concept, (4) a holistic system including IT solutions, people, machines, and tools, enabling the flow of goods, services and data in a controlled manner in the value chain, using autonomous processes and the possibility of high data flow capacity and information necessary to make decisions.

Therefore, based on a review of different definitions, Industry 4.0 can be defined as a concept of organisational and technological changes that involve the integration of value chains and new business models, smart products, and services. These changes are driven by individual needs of customers, the development of digital technologies, data integration, and common access to the Internet (Saucedo-Martínez et al., 2017).

The concept is actually materialised through a network of digital factories, the operation of which is based on cyber-physical systems that create virtual copies of physical applications that can make autonomous decisions. Such cyber-physical systems work with and exchange data among themselves, people, and other smart factories, thereby creating one element of a larger ecosystem of the Internet of Things. The smart products they manufacture can also react to changes happening in their surroundings in real-time and make autonomous decisions on their operation (Wang et al., 2016; Mittal et al., 2017).

### 1.2. ROLE OF CUSTOMERS IN A DIGITAL ECOSYSTEM

The original impulse to introduce new solutions based on digital technologies was to change the method of manufacturing goods by turning from mass production to mass personalisation. It was caused by a strong trend that involved customer demands for custom products. The application of the latest technological solutions and the creation of flexible production lines result in the costs of personalised low-volume production remaining still similar to the costs of mass production. Customer needs are the factor that triggers the changes described above. Therefore, if the customer and the product have a significant impact on the transformation processes, one can claim that marketing plays a considerable

role in business operations pursued in their respective markets during the time of the industrial revolution (Bettiol et al., 2017).

The activities pursued by companies aiming to implement the Industry 4.0 concept are targeted at individual customer requirements, calling for customer-oriented organisations (von Leipzig et al., 2017). The customer is treated as the company's partner who co-creates the product. The process of integrating data in the value chain enables a fuller interaction between the customer and the company at virtually every stage of value creation. By applying technologies — such as virtual reality, 3D print, or smart design tools, which are also supported by extensive communication with the customer — the customer can participate in creating the product at an early stage of research and development (R&D). The ability to use fast prototyping that involves 3D printing, combined with the easy operation of product configuration software allows companies to work closely with customers and, consequently, satisfy each customer's expectations to receive a customised product. An example of such a process is what companies who manufacture running shoes offer to their customers, making it possible for them to order footwear that perfectly fits each customer's foot (for example, NIKEiD, Adidas Futurecraft). Such cooperation with the customer may be even more extensive in the B2B area. An example of such a practice in the B2B market is the 3DEXperience platform of Dassault Systèmes. It is a virtual space that lets a number of people communicate and create innovative products (Dassault Systèmes, 2018). Co-creation reinforces the value proposal even further by offering customers the option to personalise their own products and services.

According to a forecast by PwC (Reinhard et al., 2016), changes caused by the implementation of digital solutions show a large potential for changes in data analytics to improve customer relations and analyse each customer's behaviour (so-called customer intelligence). This facilitates access to products, sales, and marketing channels. These changes will include, among others, management of the order placement process and further development of customised products. Such progression of data integration along the entire value chain enables the transmission of data all the way from the production stage to centralised production planning systems and even further — into integrated customer service systems. Data coming from every stage of the product lifecycle will thus become a new information resource for marketing and will be useful for the value creation process.

One of the factors for gaining competitive advantage in the industry of the future is the ability to function effectively in business network ecosystems (Teece and Linden, 2017). Therefore, the multitude of stakeholders who co-create value and cooperate with a company at various stages of value creation will be able to create new possibilities but also spawn new obligations in terms of marketing.

The fundamental element of the development of digital transformation is the existence of a digital ecosystem wherein spontaneous interactions between objects, people, and business units occur enabled by data exchange processes (Saarikko et al., 2017). Therefore, cooperation and deeper integration between smaller market players give all the ability to succeed in global markets. According to Cisco (Bradley et al., 2015), as many as 40% of companies will face the risk of insolvency in the next few years if they do not meet the challenges posed by the new reality of cooperation taking place now in the digital world. Referring to the Darwinian theory of the biological ecosystem, also in the digital network, adaptation to the changing business environment becomes a condition for the survival in the market of today and of the future (Kreutzer and Land, 2013; Moore, 1993).

A viable solution for enabling integration and activity in a network is the digitisation of companies and effective process management in the entire value chain. This means that enabling the growth of a digital ecosystem is provided naturally by new technologies and the ubiquitous Internet, which is also a natural progression of the trend of the Internet of Things. According to McKinsey's forecasts, the number of devices interconnected within this network by 2025 will exceed 50 billion objects, that is 2.7% of all products manufactured, reaching the potential for the world economy that amounts to between USD 4 and 11 trillion (McKinsey Global Institute, 2015).

### 1.3. STRATEGIC BUSINESS CHANGES CAUSED BY DIGITAL TRANSFORMATION

The market of today is becoming more and more unpredictable, forcing companies to adopt a more flexible outlook on their own strategies. The phenomena that companies face, such as the blurring of the boundaries between industries, the shortening of supply chains, or the occurrence of co-competition, affect the ongoing process of strategic decision-making and involve changes in marketing activities with respect to value distribution. When analysing the market and designing a strategy, marketing teams must fully consider all of these factors.

The rapidly progressing digital transformation and the implementation of Industry 4.0 solutions also create opportunities to redefine the previous nature of business operations and create new business models or introduce innovations to the existing ones. Innovations in products, processes or services alone are not sufficient any longer to stay fully competitive (Gassmann et al., 2017). A study (Planing and Pfoertsch, 2016) conducted among leading production companies has proven that their strategic decision fields belong to two main dimensions — digitisation of products or services and digitisation of business models. The authors of this study suggested that to be fully successful, companies had to follow these two strategic directions simultaneously. However, at present, companies most frequently follow the pathway towards digitisation of their products. This choice may be caused by a focus on the technological dimension of the phenomenon, translating into opting for the simplest solution, which is equipping products with data sensors. This choice enables companies to collect information from the product use phase and use that information further to offer complementary value and to profile the product based on the customer's behaviour history.

In Industry 4.0, a digital product should be considered not only as the physical result of the manufacturing process but also as an intelligent source of data collected from the process of its use. The product also gains a new virtual dimension, thereby creating a digital equivalent of a physical product called a digital twin. In a not too distant future, the purchasing process for technology components may change completely. It will be necessary for the customer to create a digital twin of any product to be able to simulate the entire process and test the product first in the virtual phase before the actual acquisition of the physical equivalent. Such an activity makes it possible to reduce customer costs and enable the customer to make the right investment decision (Uhlemann et al., 2017).

As MIT's Capgemini studies show (Westerman et al., 2012), to reach the highest digital maturity, which directly affects the financial results gained, it is necessary for companies to develop strategic and technological investments simultaneously for successful organisational changes within their structures. The entire digitisation process should, therefore, be treated as a project that involves extensive changes both in the company and in its positioning in the digital business ecosystem.

## 2. CONCEPTUALISATION

Aiming to structure marketing changes caused by the impact of new digital technologies and the frequently growing number of new business models, the authors of this paper propose a conceptual framework for marketing in Industry 4.0. The development and structuring of the concept involved the use of the qualitative method proposed by Jabareen (2009), which defines a conceptual framework as “a network or a plane of linked concept”. This method of analysis offers a procedure of theorisation for building conceptual frameworks based on the grounded theory method. The analysis is supported by a broad literature review performed in the area of research on the development of the Industry 4.0 concept in the context of changes taking place in the domain of marketing.

The authors have put together two concepts — the Design Principles of Industry 4.0 (Hermann et al., 2016) and the popular Marketing 4.0 concept offered by Kotler, Kartajaya, and Setiawan (2016). The method makes it possible to combine two multidisciplinary areas of knowledge — technology and business — allowing a better understanding of the Industry 4.0 phenomenon related to changes in the area of marketing in general and in industrial markets in particular.

When analysing the source literature and the principles of the concept of Industry 4.0, one may notice that the main elements of a marketing mix remain under the considerable influence of the Fourth Industrial Revolution. This also necessitates changes in the planning of marketing tools, which has been defined by Kotler, Kartajaya, and Setiawan (2016) in the Marketing 4.0 concept. This stage of the marketing mix evolution not only focuses on the digital dimension of the relationship but also combines online and offline interactions between the customer and the company, using digital technologies to strengthen the actual customer engagement.

The traditional marketing mix has undergone multiple evolution stages, transforming from 4Ps to 4Cs (co-creation, currency, communal activation, and conversation; Kotler et al., 2016). However, in the case of companies that implement Industry 4.0 solutions, effective marketing strategies that yield positive results require an innovative outlook on the marketing mix as well as a profound understanding of the holistic meaning of the Industry 4.0 definition. This approach is all the more suitable if we relate it to the

main phenomena that mark the Fourth Industrial Revolution, meaning the processes of integration of data in value chains. Data generated at various stages of value creation become available to each one of the chain elements, bringing about new opportunities to use diverse data in the value creation process. Also, new business models that form one of the main pillars of Industry 4.0 make it necessary to look at the marketing mix from a new perspective.

Aiming to derive the basic principles for marketing that should form the basis for the creation of effective marketing strategies, it is reasonable to take a closer look at the four principles of Industry 4.0 as defined by Hermann, Pentek, and Otto (Hermann et al., 2015, 2016), which facilitate the transformation of companies and the actual achievement of digital maturity according to the concept of Industry 4.0. The principles support companies in identifying and implementing Industry 4.0 scenarios and lie at the core of the functioning of companies according to Industry 4.0. These principles are (1) Interconnection, (2) Information Transparency, (3) Decentralised Decision, and (4) Technical Support — Virtual and Physical Assistance. They also have their own implications for both organisation management and marketing.

The authors of this paper offer an interpretation of these four principles in the context of the need to use them in the process of building a marketing strategy and planning a marketing mix. Based on the Design Principles and literature review, a conceptual framework for marketing in Industry 4.0 has been presented.

### 2.1. DESIGN PRINCIPLES OF INDUSTRY 4.0 IN THE CONTEXT OF MARKETING

#### INTERCONNECTION

As already mentioned, interconnections between the elements of a digital ecosystem are the essence of the Fourth Industrial Revolution. Machines, devices, products and people are connected to the Internet of Things, thereby creating the highest degree of network development — the Internet of Everything. This way, all of the interconnected objects can share information, which becomes the basis of cooperation aimed at achieving common goals. We can distinguish three types of cooperation within the IoE: human–human, human–machine, and machine–machine. It is important to maintain the interoperability of the ecosystem and the modular nature of these solutions, aimed at making it easier for companies to adapt

themselves smoothly to the dynamic changes in the market and to better meet individual requirements of their customers. Modularity is extremely important in product design as it facilitates configuring an individual version of a product according to specific customer requirements. It is also a basic property that makes it possible to build a product configuration tool which is then used by customers as part of offer customisation.

### INFORMATION TRANSPARENCY

Aiming to effectively integrate the growing number of interconnected objects and people and create virtual copies of a physical company, transparency and – in some measure – standardisation of information flow and processes is required. It is an indispensable element of effective data exchange between the stakeholders of a business ecosystem, and an essential feature of the integration of value chains and supply chains. To draw reasonable conclusions and make good decisions, data coming from sensors must be connected with other contextual information about a process, about the condition of the devices, and about the products, and then be analysed and interpreted accordingly.

To benefit from full transparency of the decisions being made, the results of data analyses must be made available to all participants of a given value chain in real-time. The cooperation based on transparent data is clearly illustrated by the functioning of the business platform model, wherein data exchange standards and the ability to share those standards are imposed by the creator of the system, while the decisions concerning the use are assigned to participants of a given platform. These new sources of information coming from business partners and various stages of product life are a major challenge to marketing and an area for new opportunities to take better advantage of marketing in the efforts to shape a full marketing mix.

### DECENTRALISED DECISIONS

Decentralised decisions are based on the interconnection of objects and people as well as on the transparency of information placed along the entire value chain. This kind of network makes it possible to use local and global information for more effective business decision-making. This way, participants of the ecosystem are given a chance to make autonomous decisions based on generally available data.

Naturally, trust is another aspect mentioned in the open and sharing economy theory, which is

important here as well. Strengthening the sense of trust between partners is one of the challenges posed for the Fourth Industrial Revolution. To overcome this challenge and build strong relationships based on mutual trust, it is important to implement solutions in the field of cybersecurity and change the organisational culture of enterprises. The issue of decentralised decisions and trust also concerns the ability of companies to design smart products that are able to make autonomous decisions and react to the stimuli in their environment in real-time. One of the most advanced examples of a smart product is Tesla, an autonomous car. It paves the way for similar solutions not only in technology development but also in terms of legal regulations.

### TECHNICAL SUPPORT — VIRTUAL AND PHYSICAL ASSISTANCE

Owing to the growing complexity of production and business processes in the reality of the Fourth Industrial Revolution, people are supported by virtual and physical assistants based on new technologies (e.g. tablets with smart software, smartphones, robots, virtual assistants, and robo-advisors). Such systems visualise and aggregate information transparently to facilitate informed decisions. The application of virtual reality is one example that uses technologies to help customers make decisions. There are already many solutions based on this technology, and they make it easier, for instance, to choose a flat and its furnishing or configure the interiors of a car. Virtual and augmented reality solutions reinforce the cognitive stimuli that motivate the customer to select the most suitable offer (Scholz and Smith, 2016). Another example of innovative application of technology may be the design of a virtual reality-based training simulator by Siemens. This solution makes allows accelerating the training of employees in difficult conditions or in distant targeted workplaces (Schröder, 2018), e.g. on drilling platforms.

To sum up, the Design Principles of Industry 4.0 (Hermann et al., 2016) provide a set of main directions and suggestions for implementing marketing strategies and creating a marketing mix. These include:

- ensuring connectivity with the customer and the product (connectivity) and using the possibility of collecting and analysing data throughout the product lifecycle to recognise the needs and customer behaviour in greater detail, even in real-time (cognition), which gives an opportunity to

- co-create value with the customer at every stage of product creation (co-creation), personalised customer communication (conversation), and cooperation in the supply chain (cooperation);
- the ability to use data from the entire product lifecycle to implement product servitisation and new business models;
  - the development of product autonomisation;
  - the digitisation and data integration in the value chain (vertical and horizontal), enabling transparent exchange and sharing of data between business partners, customers and company employees;
  - taking advantage of product simulation and virtualisation capabilities (creating digital twins of physical products);
  - the creation of a product offer based on the principles of standardisation and modularity;
  - making use of digital customer assistants.

## 2.2. PRINCIPLES FOR MARKETING IN INDUSTRY 4.0

Speaking of a digital business ecosystem, we talk about the connectivity of and among stakeholders, which enables cooperation, communication, as well as the co-creation of personalised value that is created on the basis of data available in real-time and coming from the cognitive processes that analyse customer behaviour. Both customers and other market participants, e.g. business partners or suppliers who participate in a vast digital business ecosystem, should be treated as stakeholders of the ecosystem. Therefore, based on an in-depth literature review of the idea of Industry 4.0, the authors propose a set of the main principles of marketing for the Fourth Industrial Revolution. These principles are:

- Cooperation,
- Conversation,

- Co-creation,
- Cognition,
- Connectivity.

These five principles can be combined by a context of using the approach to the marketing mix and thus offer an innovative concept. In the new proposition of the marketing mix, the creation of a product is based on co-creation, and its promotion involves mutual communication with product stakeholders in the market, while the distribution is based on the cooperation in a full business ecosystem, and its price is determined dynamically based on the data gathered from the cognitive processes that analyse customer behaviour in real-time. All four elements then merge, utilising the basic principle of connectivity (see Fig. 1). The implementation of these principles is possible with the use of new digital technologies and by building strategies according to the Industry 4.0 concept.

### CO-CREATION

We are currently talking about products being co-created by customers through their active involvement in the value creation process, e.g. by selecting customised parameters of a product being ordered via an online configuration tool, or about the impact of customer voices and opinions shared on social media, and about the impact on brands and products. The cooperation with a customer taking advantage of mobility and Internet access reinforces the innovative nature of products and enables companies to perform a quick validation and tests of their new projects. We can then already speak of the customer as a co-designer, a co-marketer, a co-branding, and a co-producer. Then, undoubtedly, we can conclude that the customer's knowledge and knowledge about the customer become the company's greatest asset.

The Fourth Industrial Revolution and the new technologies that come with it position the customer

### 5C for Fourth Industrial Revolution

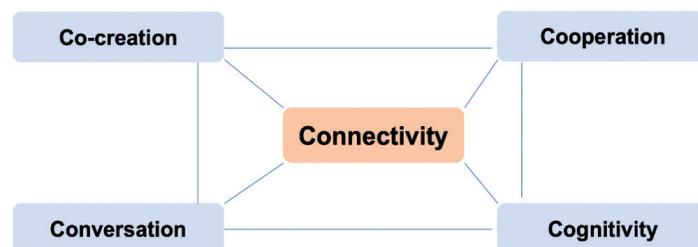


Fig. 1. Marketing Principles for Industry 4.0

in yet another role, releasing the customer from full and active engagement in the product co-creation process. In a digital ecosystem, the customer co-creates value unknowingly, by making the data on the manner of using a given product available and thus enabling the company to adjust their offer even more precisely to fit the customer's needs. By analysing historical data, artificial intelligence algorithms can learn and become able to discover the hidden needs of customers rather than just react to the circumstances.

Thanks to data-collecting sensors and artificial intelligence algorithms, we are already dealing with smart products. Such products allow for the analysis and interpretation of data, the prediction of failures, and autonomous decision-making. The advancing technology of AI-based voice assistants opens an entirely new chapter in the domain of product development, thereby starting the process of an actual product humanisation. Therefore, the most important task is to develop the Smart Product vision, and from a technical point of view, to ensure the access to data provided by the customer and the connection of products to the Internet. Then, under such circumstances, the customer participates in "unconscious co-creation" of value. However, the psychological aspect of opening customers to new technologies and ensuring the security of the data they generate is equally important. Looking at a product as a source of access to very reliable user data, companies should start creating new business models. The "as a service" model is currently one of the most popular solutions, which gives companies a new way to obtain income not only from the sale of products but also from, e.g., renting products to be used by customers. Tires-as-a-service implemented by Michelin is one example of this model (Frontere, 2013). "Engine-as-a-service" called TotalCare, offered by Rolls-Royce, is another example (Rolls-Royce, 2014). In this model, the company offers jet engines as part of a "power by the hour" payment, thus enabling payments to airlines for the use of their engines depending on several variables, including the duration of the flight. Therefore, the use of new business models today considerably diversifies portfolios of companies and offers still newer opportunities to build a competitive advantage in this new industrial revolution.

## CONVERSATION

Considering the increasing focus of companies on their customers, which is aimed at personalising the products and services they offer, companies are

gradually adopting new strategies of brand promotion using the dialogue with their customers to benefit from long-term engagement and interaction. Using generally accessible mobile technology, the modern customer of today is a digital native who has an enormous power to influence brands through their ongoing activity pursued in social media or blogs and by sharing their thoughts and opinions online. Nowadays, it is possible to engage in direct conversations with customers on the Internet in real-time. The application of intelligent algorithm solutions and modern big data technologies leads to the development of new communication tools, such as chatbots, virtual assistants, and even marketing automation solutions. A message based on the strategy of attraction and the use of content marketing and digital content distribution channels can all encourage customers to enter into a dialogue with a company through the provision of useful content that matches their unique current needs as they are appropriately profiled.

Most of all, the Fourth Industrial Revolution offers many new ways of collecting customer data in real-time, which reinforce the need to apply real-time marketing. The voice assistant solutions mentioned here earlier, such as Siri or Google Assistant, can "talk" with the customer on the level of human bonding and, thereby, completely revolutionise the assumptions made for brand promotion strategies.

## COOPERATION

In a digital ecosystem, partnership and cooperation become the basis for the operation of companies that do not consider their participation in the market only in terms of competition with other brands any longer, but instead take the opportunity to work with them and take advantage of their best competencies (Subramaniam et al., 2019). One of the most popular examples of cooperation between two large competitive brands is the current ongoing partnership between Apple and Samsung in the area of supplying components for Apple products.

Cooperation can also be seen manifested in the formation of smart supply chains, wherein technology makes it possible for all chain participants to use a transparent data system to increase supply effectiveness and reduce the time to market. For example, by gaining access to data sources generated by partners and using big data technology, companies may indeed transform business models and outline new opportunities for cooperation in the value chain. This strategy enables them to arrive at an additional, unique

information asset, which could never be accessed without initiating this kind of cooperation. On the other hand, companies more and more frequently reduce their supply chains and distribution networks by turning to new business models and e-commerce solutions. This change is illustrated by the project announced in late 2017 for the construction of a joint sale platform for Unilever, Mars, and Reckitt Benckiser, which – according to the announcements – would offer products cheaper by about 30% compared to the prices normally offered in the traditional sales channels (The Telegraph, 2017).

When creating a product distribution plan, one should also bear in mind that a company is a part of a larger ecosystem, where strong cooperative ties with other market participants are what matters. It is important to remember to work towards making the most of these ties.

### COGNITIVITY

The Internet makes it easier for customers to control prices through auctions and negotiations with multiple suppliers of the desired product. It also allows companies to adjust their prices dynamically to the current demand — or the preferred customer profile — in real-time. This concept is clearly illustrated by the diversification of the fare rates in Uber, which vary depending on the time of day and the volume of orders at a particular time and in a particular place. The ability to profile customers based on an analysis of the history of their activity on the Internet — or even the operating system they use — enables airlines to diversify rates depending on their customers' outlined profiles. Amazon is a master in the domain of use of customer data and market trends as it searches its databases and reacts to the current demand for a particular product range, profiling any special offers for each customer and any complementary products, thereby determining these prices dynamically.

Considering the growing volume of data generated in sales and coming directly from smart products, we will gain more and more opportunities in the future to utilise variables found in the price selection algorithms. Therefore, the answer to the traditional question being “how much does it cost?” is far from simple.

### CONNECTIVITY — THE HOLY GRAIL FOR 5CS

Looking at the above four principles and the examples given, we may conclude that they would not

have become practicable if it had not been for the Internet. It is the Internet that forms the basis of the digital ecosystem seen today and gives us the exact ability to exchange data gathered from sensors. All digital technologies indeed achieve their real value only when such connectivity is employed. This feature not only unites the concept of the marketing mix presented here but also defines the key role that connectivity plays in this list and, indeed, predestines this role and its outcomes for becoming one of the major marketing principles of the Fourth Industrial Revolution.

## 3. DISCUSSION OF THE RESULTS

The scientific discourse on Industry 4.0 focuses currently mainly on the technological aspects of the occurring changes. The holistic meaning of Industry 4.0 suggests a need for a multidisciplinary approach to identifying the changes emerging in various areas of business operations. Using this approach as a direction to follow in the understanding and developing the concept (in both practical and scientific fields), the authors have proposed the main marketing principles for Industry 4.0.

The authors also emphasise that technologies are only “enablers”. They make it possible to develop relationships in business ecosystems, facilitating communication between market participants. It is not enough to implement a single technology in a company without considering all the processes in the related value chain and the stakeholders who create it. A competitive advantage based only on the implementation of new technologies is by its very nature only short-term (Carr, 2003). Only a strategic organisational change, effective process management, a redefinition of production paradigms, a change in business models, an openness to cooperate, and a willingness to participate in a digital ecosystem provide unique opportunities to entities seeking a long-term advantage.

The role of technology and IT systems is crucial – but it is not the only factor that counts. Without applying a new strategy, it is not possible to take full advantage of the introduced organisational changes. For this reason, an effective strategy produces the synergetic effect formed between the use of new technologies and innovative business solutions. Several examples of these impact areas related to various technologies on business operations and marketing are described in Table 1. As the examples suggest,

Tab. 1. Examples of technologies supporting Marketing Principles in Industry 4.0

MARKETING PRINCIPLES (5Cs)	SUPPORTING TECHNOLOGY	CHANGES BROUGHT BY THE SUPPORTING TECHNOLOGIES
Connectivity Cooperation Communication Co-creation	IoT and 5G	The technologies make it possible to obtain data on the use of products directly from the customer in real-time Such technologies connect multiple devices and products into a network of independent objects, which are additionally supported by artificial intelligence algorithms that can make autonomous decisions
Connectivity Cooperation Communication Co-creation	Cloud Computing	It enables the formation of a network for the exchange of transparent data available to every network participant. It facilitates the building of a digital ecosystem and the creation of new business models (e.g. a business platform model or Product as a Service)
Cognitivity	Big Data	An analysis of large data volumes makes it possible to identify regularities and market trends, thereby offering cognitive conclusions on the use of products and customer behaviour previously unavailable to marketing planning. This focus enables more dynamic pricing
Cognitivity	AI	It facilitates the identification of customer behaviours and the prediction of their preferences and needs and makes it possible to offer a more personalised complementary value to customers
Co-creation	3D Printing	It enables customers to take part in fast prototyping and testing of products already at the research and development stage and extends the spectrum of product personalisation, offering the highest possible level of customisation
Co-creation Cooperation	VR/AR	It enables better visualisation of a company's offer through the use of each customer's personal sense of space. This facilitates designing products in a three-dimensional virtual space
Co-creation Cooperation	Simulation	It makes it possible to create a digital twin that gives an opportunity to test the functionality of a given product before buying it

these are also enablers within the meaning of the theory of five marketing principles of the Fourth Industrial Revolution as presented below.

## CONCLUSIONS

All five marketing principles not only intertwine through the existing component of connectivity. They also form a holistic concept of creating innovative and effective marketing tools in the times of the Fourth Industrial Revolution. If contemporary companies prove their ability to adopt these rules as guidelines to plan their revolutionary marketing strategies, this move will offer them a unique and new perspective for standing out and building greater long-term competitive advantages that should lead to even greater business success in the modern digital business ecosystem.

The presented conceptual framework highlights the area and direction of further research in the field of marketing in the context of the development of Industry 4.0, which can enrich the existing scientific literature with new perspectives for a better understanding of the emerging changes brought by digital transformation.

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