



INDUSTRY 4.0 AND MCP: INTERRELATION AMONG CONSUMERS, PRODUCERS, AND NEW TECHNOLOGICAL CONCEPTS

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Abstract: *Industry 4.0 is changing the sphere of production and manufacturing processes. New technological concepts such as cloud computing, the Internet of Things, big data, and artificial intelligence are imbuing the manufacturing industry while making it smart. This implies a strong connection between the real (physical) and virtual world in cyber-physical smart factories. Smart production integrates new technological concepts to improve performance, quality, controllability, and transparency of manufacturing processes while addressing current challenges, such as increasingly customized requirements and reduced time to market. As one of the crucial elements of Industry 4.0, smart factories have a significant impact on the production system, respectively bridging the gap between mass customization and mass personalization. Mass personalization, as an advanced stage of mass customization, is bringing more value to both producers and customers, and it requires for demanding production processes to become smarter according to new technological concepts of Industry 4.0. In this way, the role and interrelations among consumers, producers, and new technological concepts are changing, following mass personalization trends and Industry 4.0 requirements facing new and different challenges that these interrelations bring. Based on the literature review and previous research results, this paper will give a foundation for a better understanding of the interrelation among consumers, producers, and new technological concepts in Industry 4.0, from the perspective of mass personalization.*

Key Words: *Industry 4.0, Smart manufacturing, Mass customization, Mass personalization*

1. INTRODUCTION

Industry 4.0 is changing the sphere of production and manufacturing processes followed by the exponential technological development and new solutions in production processes, which contribute to the efficiency and production flexibility [1]. New technological concepts such as cloud computing, the Internet of Things, big data, and artificial intelligence are imbuing the manufacturing process while making it smart. This implies a strong connection between the real (physical)

and virtual world in cyber-physical smart factories. Traditional manufacturing systems in Industry 4.0 are changing from centralized to decentralized intelligent control systems, and the key to these intelligent control systems, also known as smart factories, is the real-time data exchange between devices [2]. In these systems, components can negotiate not only with each other but also with the other factory components to request or offer different functions [3], while the production model is transferring from digital to intelligent [4]. Smart production integrates new technological concepts to improve performance, quality, controllability, and transparency of manufacturing processes. One of the advantages of this new system is the "responsiveness" because the information is delivered at the right time to the right recipient. That increases its ability to respond to different time changes, as well as the customer requirements, and the status of the internal production system [3]. As one of the crucial elements of Industry 4.0, smart factories have a significant impact on the production system, respectively bridging the gap between mass customization and mass personalization.

New technological concepts brought a new paradigm known as mass personalization, which has become a key success factor for industries and business sectors. Individualization of the products and flexible production is a major change in the new manufacturing paradigm in which consumers and producers are both included in business processes and value creation [1]. Individual needs and requirements of consumers are becoming companies' priority to gain a competitive advantage. In that way, the communication among consumers, producers, and suppliers becomes more efficient, followed by production flexibility and high efficiency. [5]. However, the new advantages come inevitably with different challenges, such as shortened innovation and product life cycle, demand for custom products at the cost of large scale production, competitive pressure of the global market, change of the business model, a new approach to the employment, systematization, and increased pressure for bromine adapting to the latest global market demands [3]. Based on the literature review and previous research results, this paper will give a foundation for a better understanding of the interrelation among consumers, producers, and new technological concepts in Industry 4.0, from the

perspective of mass personalization, also indicating the challenges that new manufacturing paradigm brings with it.

2. MASS PERSONALIZATION AS AN ADVANCE STAGE OF MASS CUSTOMIZATION

As one of the crucial elements of Industry 4.0, smart factories made a significant impact on the production systems, respectively bridging the gap between mass customization and the need for mass personalization. New technological concepts are radically changing production processes, business models, the way of providing services, and sources of competitiveness.

Historically observed, every industrial revolution brought a change into manufacturing and production systems that were referred to as the transition from mass production to mass customization, and nowadays to mass personalization [6].

The paradigm of mass customization emerged in the late 1980's as demand for product variety increased [7]. Mass customization assumes fixed product architecture and pre-defined configuration models [8]. Although mass customization has a lot of advantages, it also has certain limitations, such as the absence of user participation in the design phase, because consumers engage after products have been made. In addition, it is not capable of providing personalized service and goods but requires subsequent product development.

Mass personalization produces products tailored to the individual needs and preferences of consumers [9], at mass production costs exactly when they are needed, and it brings flexibility and possible adaptability and changeability of product design. Both mass personalization and mass customization, are highly oriented toward consumer and product. The added value that mass personalization brings to the consumer is a highly personalized touch based on their personal preferences and characteristics. Mass customization, as an older concept cannot keep up with individual demands, in that manner.

Industry 4.0, with the growing amount of ICTs, enabled a whole new form and value of personalization [10]. The production process is adapted to each product, and flexibility is focused on meeting the consumers' needs by creating a new phenomenon called customer-centricity in the manufacturing systems which forces factories and manufacturing systems to be highly flexible and agile to meet "customer-driven changes" more efficiently, faster, and frequently [11]. As it was mentioned before, adaptability, flexibility, and unpredictability of product design become essential for mass personalization.

2.1. Consumer role in mass personalization

Mass personalization is factually changing the role and involvement of customers and consumers in manufacturing processes. Application of new technologies in Industry 4.0. has given many more opportunities for consumers with thus overcoming time and space constraints, enabling them to choose the product and even participate in its creation quickly.

Expectations of the modern consumer have risen, and now it's it is more than just the best quality product at the lowest price. Personalization becomes a new imperative, which needs to be followed by the application of automated and knowledge-based design systems to satisfy the elementary idea of a new paradigm [5]. Consumer involvement becomes essential due to high efficiency and effectiveness and is shifting from buyer to "prosumer" (producer + consumer) [12].

3. INTERRELATION AMONG CONSUMERS, PRODUCERS, AND THE NEW TECHNOLOGICAL CONCEPTS IN INDUSTRY 4.0

If we observe the interrelation among consumers, producers, and technological concepts through the manufacturing processes in the past, we can point out that there was no involvement of consumers in mass production because designers were standardizing products.

In the mass customization, consumers are guided by producers with participation limited to some product features, and they have a more passive role in which their decision is based on the manufacturer's offer. Therefore, consumer participation is not so necessary in the supply chain.

However, in mass personalization, which addresses a market of one, the role of the consumer in the product design go towards joint development of highly personalized product characteristics. Consumers are the most influential factor, which means that the business model of a company is focused on solving their problems and satisfying their needs. That brings producers and companies to the point where they need to create different strategies, adopt new business tools, implement new models, and think innovatively to gain competitive advantage.

The interrelation between consumers and producers is based on the implementation of new strategies and business models, interdependence, cooperation, value sharing, etc. Production and demand represent the main opus of Industry 4.0 in which the supply of personalized products can bring benefits for both parties in the consumer-producer transaction [1]. Consumers and producers have a strong mutual influence in which consumers are treated distinctively by the company, and they can be provided with products with less lead time and high quality [10].

Nowadays, for companies to gain a competitive advantage, they need to give the consumers what they want and when they want it. As much as the new technologies bring better options and more value to the producers, they also create an opportunity for consumers because now they can participate in the design process, and receive the product or service by their preferences. Creating new values for consumers goes beyond fulfilling their requirements and becomes a purpose of mass customization and personalization. This implicates that producers need to communicate, connect, and collaborate not only with small groups of target consumers but also individually with every consumer [11]. In this way, a consumer is transforming from user-

passive consumer of information to the user-co-producer, the prosumer, whose participation becomes a driving force for the whole production process [13]. That affects the final product offering directly in personalization [10].

Consumers manufacture creative products and gain value by cooperating with producers through modern technological tools and approaches [10]. By supplying consumers with customized and personalized products, producers can achieve differentiation, so both consumers and producers can benefit from mass personalization. This all indicates that manufacturers need to understand individual consumer voices as well as to add new values for products and/or services. This way, consumers and producers are interconnected and share mutual benefits in this customer-centric type of production. This added-value strategy needs to be marked alongside the existing product portfolio, and companies have the liberty to add a specific kind of attribute to be customized by consumers, which is likely to influence consumers' adoption intention and satisfaction [14].

4. THREATS AND CHALLENGES

Industry 4.0 will enable novel forms of personalization. New technological concepts, manufacturing and producing systems will have a lot of advantages and positive influence on each other and the economy and society. Still, it is important to point out that there are some potential threats and challenges which may occur. From an economic perspective, countries and markets are different, and the rising question is how countries in transition and those economically less developed will be able to meet the needs and requirements of the modern technological age. Some authors even emphasize that there are going to be specific threats related to technological unemployment, as well as a change in the employment structure and required qualifications because manufacturing companies most often employ people with basic qualifications. This raises concerns about changes in the social structure caused by the exclusion of people with low qualifications when the concept of Industry 4.0 is introduced, which leads to the emergence of a series of problems of a social and economic nature resulting from technological unemployment. Also, some entrepreneurs will not be able to afford investments in new technologies that can cope with the automatized production remaining at the price level of mass production [1]. Companies will need to tailor their customization and personalization strategies accordingly. In the increasingly competitive market, companies are faced with a significant challenge to attract, retain, and maintain the loyalty of the consumers. On the other hand, there are also some concerns regarding consumers. There is a danger that they can be addicted to personalized production, which, as a result, has an increased stress level caused by the desire to have unique products. Consumers are embracing the new opportunities, but some may also be feeling less secure as they grapple with new products and ways of purchasing [15]. When it comes to companies and producers, high consumer demand who do not only have the desire for personalized functionalities but as well as for the most affordable products, influenced

almost all business sectors to overcome mass production, therefore defining the highest acceptable personalization with the lowest cost in the complex mass personalization paradigm [16].

Although the purpose is to meet the highest consumer satisfaction, a rising question is how to achieve the balance between the highest level of personalization and affordability.

5. CONCLUSION

Humanity is facing a fundamental paradigm shift that will undoubtedly have far-reaching consequences for our worldwide economic systems. That is why Industry 4.0 does not describe a purely technical innovation scenario, but rather a way in which intelligent technology can help to overcome the global challenges of the 21st century. The new manufacturing paradigm should adapt to new trends such as socialized resources utilization, social community-based resources self-organization, cyber-physical-social interconnection, social media-supported communication, and social business relationship management. Mass personalization brought a change in interrelation among consumers, producers, and new technological concepts in Industry 4.0. It changed consumer behavior. Consumers and producers are collaborating in creating new value. Manufacturing becomes faster, closer, and more responsive to consumer requirements while changing global markets [10]. As a result of improved transcontinental communication and lower transportation costs, traditional company boundaries and more extensive value chains are shifting. The attitude towards the market has been changed as well. Products are being sold before they are made, and therefore sales precede production. Instead of competing on the costs basis only, competition is also developed based on the innovation, the ability of manufacturing products tailored according to customers' needs, as well as on the products of better quality. This results in consumers playing a centric role in the production system. Thereupon it is a consumer-oriented and data-driven concept that depends on enterprise logistics service, such as personalized supply chain management, customer relationship management, etc. Nowadays focus must go on finding and implementing strategies and methods for managing product, process, and systems development that can follow up with the product variety, adaptability, and leanness, built upon the paradigms of mass customization and product personalization [17].

6. REFERENCES

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