POSSIBLE APPLICATIONS OF INDUSTRY 4.0 BASED ON CUSTOMER RELATIONSHIP MANAGEMENT IN BAKERY

SCIENTIFIC REVIEW PAPER

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ABSTRACT: Production of bakery products went through a long and gradual transformation from individual, craft to modern industrial production. Today, the production of bakery products has been developed by mass high-automated industrial production. Although production plants that find their economic justification mostly on the expenditure side of reduction of production costs and production processes, the modern business requires a change of the income side, where development of relations with consumers has more important role. Production of bakery products had all the features of mass production until recently. Due to the importance of bakery products in the nutrition of people, particularly in developed parts of the world, demand for bakery products could be considered as non-elastic, since the price, quality and range of bakery products were basically irrelevant to the volume of demand for these products. However, at the end of the twentieth century the purchasing power of the population, as well as the level of information, knowledge and self-awareness, significantly influenced the consumption of bakery products. The modern consumer changes the structure of food in the nutrition and he is no longer satisfied with a mass-produced product, but requires a product that is "tailored" according to his needs. The manufacturing capabilities of modern, numerically controlled machines that make Industry 4.0, allow the production of "tailored" products according to the needs of individual consumers. Consequently, transformation and transition from mass to individualized bakery product production requires a scientific and systematic approach.

KEYWORDS: bakery, customer relationship marketing, industry 4.0, mass production.

INTRODUCTION

One of the challenges that human society has faced from its beginning to today is a problem of inertness, i.e. understanding and accepting changes which are an inevitable outcome of evolutionary social processes. The same problem is incurred in the process of preparing young people for their future life. When we talk about the education system, it is obvious that education processes are oriented toward the past, and learning principles and skills used in the past, or optionally those used in modern conditions. However, the future is very rarely or never taken into consideration, or answers to the question what they would be like in the future are not offered either. Inertness of majority of human society was not an important problem in the past, because social changes happened very slowly. Things significantly changed during the 20th century, especially at the end of it, when society started galloping development under the influence of applying new scientific discoveries. Those changes were so rapid, that some fields of science were conservative and hardly accepted an idea that society would obtain totally different form in the near future, and that current principles of activities would almost not be worth the effort. Often, science in its study research perceives the current social situation without taking into consideration social changes and what will happen to society, and without considering how those changes will reflect on scientific research. One of the reflections of awareness of the pace of changes and importance of their acceptance is the "Bologna process", which transforms education from partial to lifelong learning regardless to a fact of rapid obsolescence of acquired knowledge under dynamic developmental conditions, under which the modern world operates.

In science, inertness is generally a consequence of lack of interdisciplinary approach to research, which is necessary to accept new knowledge and understanding, especially those relating to social transformation. Technical sciences often ignore results of social and human science researches, focusing on scientific problems and considering them from the standpoint of today's developmental social scope, and not from the point of view of the major social changes, which are axiomatically held to be certain. A good example is that part of technological research sciences is oriented toward mass production proc-

esses, which were present during the 20th century, but which is to be ended. Often, the focus on investigating the process of mass production is justified by the thesis that in the future many products will remain products of mass production. However, it is a very questionable assumption, because changes in social behaviour influence social needs. It is evident that society enters the age of enormous awareness of individuals as well as of general rise in knowledge which strengthens self-awareness and complacency of each individual in that kind of society. That leads to rise of individual needs for a stronger identity, quality and safer life and increases the growth of individual needs. Banal examples of those changes are individualization and personalization of a large number of products and services. For instance, a modern tourist is increasingly oriented to individual travels than to mass travels. Mass and group fitness training sessions are more often replaced with individual training sessions with personal fitness coaches. An attitude toward clothing products and their substitution with those with brands has also evolved. Those social changes also produce the need to change the focus of technological research on the search for optimal production processes, which would ultimately result in lower production costs and more rational production. The focus would be on the low-level and individualized production of products with high added value, primarily in terms of services and knowledge, for the well-known consumer.

In accordance with the above stated, it is important to consider the question of possible changes in the sphere of production of bakery products. In order to give a relevant answer to this question, it is necessary to explore the future of bakery products and to answer the question whether bakery products are included in a group of products that are naturally products of mass production, or they are products that will be individualized products in the future, and then argue for taking a certain attitude. Results obtained from the research should be the starting point for further research related to the production processes in the bakery industry and cooperation of social sciences with technological science with the aim to optimally meet the needs of people in the new era.

RESEARCH METHODOLOGY

Modern human behaviour is largely determined by conditions in which the modern human exists. Unlike people in the last century, people today are much more informed, they possess a significantly higher level of knowledge, which results in a significantly higher level of self-awareness. The self-awareness of modern human is, among other things, reflected in his relation to both the environment and himself. Modern human is more environmentally friendly, more concerned about his health and appearance, but also about his social position. While the average reflected through the massive uniformity of society ruled during the mid of the last century, a modern man is an individual, "nobleman" of modern era who wants the best for himself. Therefore, a modern man is not satisfied with average uniform products, but seeks products tailored to his own needs and wishes. Modern industry can provide that, because modern manufacturing potential and capabilities have significantly changed owing to information and communication technology. It is this new industrial platform that can and should be studied by modern technological science to find solutions that satisfy individualized needs of modern consumers.

In accordance with the foregoing, it is possible to set the following hypothesis:

> It is possible to organize profitable individualized and personalized production of bakery products using a combination of Industry 4.0 concepts and consumer relationship management (CRM).

Research goals are:

1. Consider what Industry 4.0 is and prerequisites for using it in order to meet consumer needs for individualized and personalized products.
2. Consider what evolutionary processes are present in consumer's behaviour, and how these changes have influenced the evolution of marketing and development of the concept of consumer relationship management.
3. Consider what the potential repercussions of evolutionary processes in industrial production and marketing are for production of bakery products, and determine whether bakery products will be more suitable for mass production or individualized production for the well-known consumer in the future.
4. Create a conceptual model of industry 4.0 concept in the bakery industry.

To achieve the goals of research the following scientific methods were used: deduction method, historical method, abstraction method, classification method, generalization method, aggregation method, combination method, causal conclusion method, descriptive and graphical modelling method methods.

RESULTS OF RESEARCH

Until the beginning of the first industrial revolution at the end of the eighteenth century, the products

were produced in a so called craftsmanship way which meant manufacturing without division of labour and use of manual tools, which made it slow and inefficient. Thus, until the onset of the industrial revolution, production was largely individualized or low-volume mainly for the known consumer. Given the level and scope of needs of the man at the time, most modern products did not exist or were produced in households that were self-sustainable or were the products of a craftsman [1]. The situation was the same with bakery products. It was significantly changed in the second industrial revolution, which took place from the end of 19th century to the second half of 20th century; yet its features are present in many industries even today.

The second industrial revolution was marked by creation of large industrial production capacities, especially in today's developed western countries, which created conditions for mass industrial production [2]. The high division of labour and engagement of a large number of people was present in the production process.

The products were standardized and uniformed, and a business success was based on lowering fixed costs that drop with the increase of production volume. During the second industrial revolution, the focus of management was on production process optimization by increasing labour productivity and lowering production costs. Even today, a good part of the bakery industry has inherited the principles of behaviour that characterized the second industrial revolution. The characteristic of the third industrial revolution is high level automation following the use of electronics and robots in the production process [3]; while in the fourth industrial revolution the use of computerized production capacities, in particular the use of 3D production systems, enables personalized and individualized production of products tailored to the needs of modern human [4]. It can be concluded, therefore, that owing to the needs of modern consumers, who have become self-aware and seek products that are tailored to their needs, and owing to the potential that modern intelligent systems provide, the philosophy of production has made a full cycle, from production for own needs in households, individual and low volume production for well-known consumers, through mass, standardized and uniform production to modern low volume production, i.e. production tailored to the needs of small groups of consumers or even individualized consumers.

Figure 1 shows the evolutionary processes in industrial production.

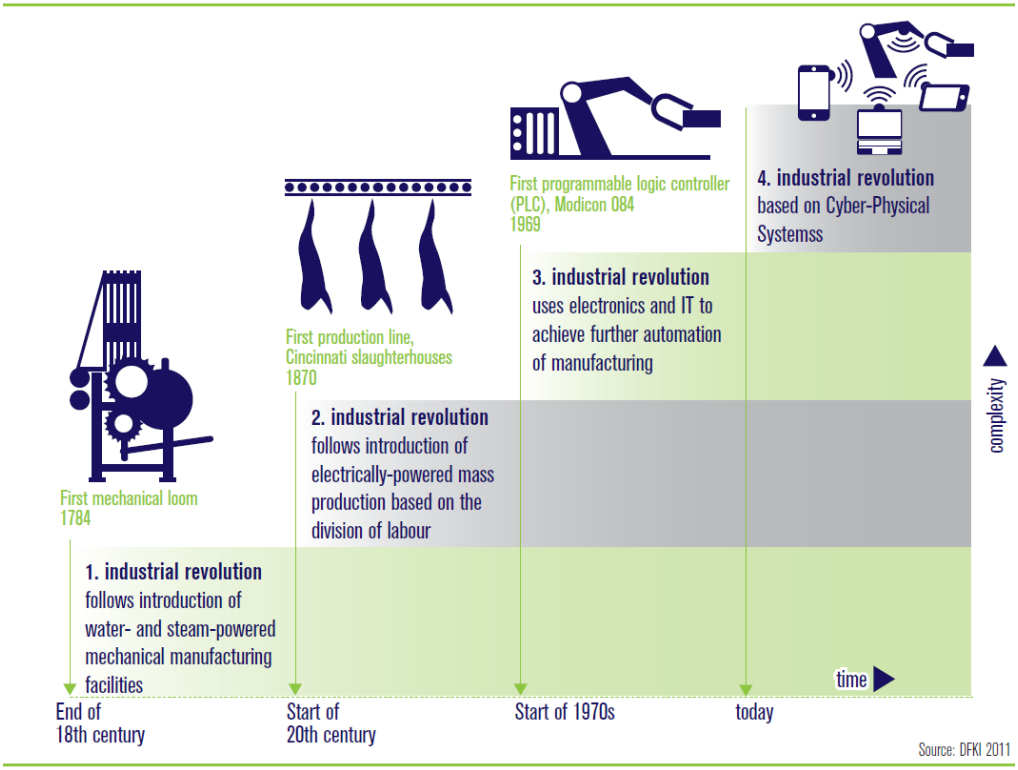

Figure 1. Evolution of industrial production [5]

The ratio of industrial production according to consumer needs is shown in Figure 2.

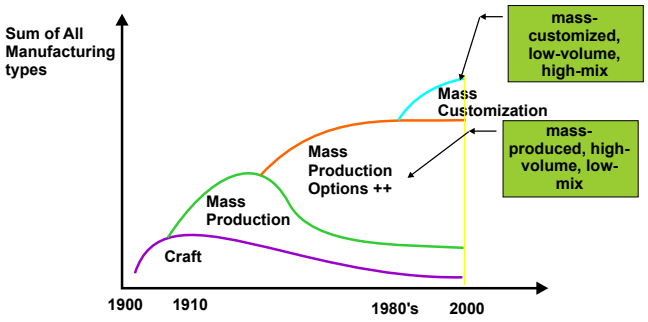

Figure 2. The ratio of industrial production to consumers [6]

In view of the evolutionary processes of pre-industrial age and industrial production, and the relation of production to the needs of consumers, the following can be differentiated:

- Domestic production for personal use
- Craft individual and low volume production
- Mass industrial production
- High volume industrial production with variations
- Low volume industrial production
- Individualized and personalized industrial production
- Domestic industrial production.

Figure 3 represents the circular process of industrial production from domestic, or craft individual production through mass production, again individualized and personalized production enabled by the production system within the Industry 4.0 concept.

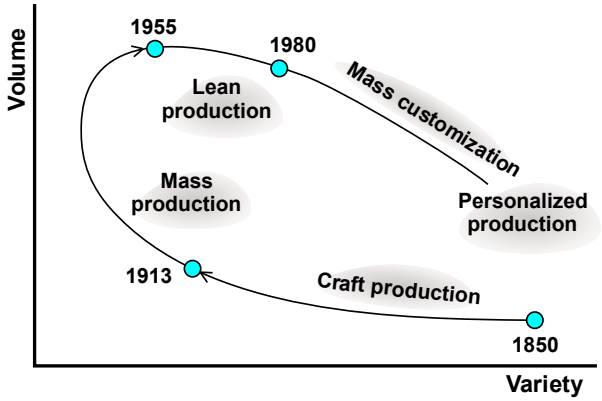

Figure 3. Circular process of industrial production [7]

Modern industrial production, which is defined by Industry 4.0 concept, is characterized by a high level of artificial intelligence, information and knowledge within the concept.

However, in order for Industry 4.0 to meet consumers' needs, it is necessary to establish a stronger link between industrial production and consumers. If production concepts have no information on consumers' needs, it is impossible to manufacture to satisfy those needs. Unlike mass production period when a manufacturer was not interested in customers' needs due to the shortage of commodities in the market and high demand for everything that was produced; or unlike the period when care for consumers' needs started and the needs were low and production of products that covered the modal consumer needs solved the problem of demand. Since today's consumer is self-aware and wishes a product tailored to his own needs, such production is possible if a strong information and communication relationship between consumers and manufacturers is established.

When it comes to information about the needs of consumers, and the communication process with the consumer, then the focus of discussion should be on marketing, or relationship marketing as the last developmental version of the marketing philosophy. Marketing began in the middle of the last century in response to the problems of industrial production during the second half of the first half of the last century, when massive industrial production resulted in the emergence of surplus goods on the market and the problem of selling these goods. The solution to this problem was initially required within the framework of the so-called selling concepts by finding better ways to persuade the customer to buy the product. However, this concept soon showed its limitations, because people quickly learned to protect themselves from unscrupulous merchants and pushing goods. As an alternative to the sales concept, in the middle of the last century, marketing emerged. It focuses primarily on consumer's needs and does not push the product and does not persuade the customer to buy the product, whether or not the customer needs the product. The primary idea is to investigate the needs of consumers, and based on those needs to produce goods. Logic implies that a consumer will buy a product if he needs it, or if a product meets his needs.

At its first stage, marketing was a mass concept that met average consumer's needs, which was in line with development of consumers' needs as well as with the power of industrial production. Therefore, information on consumers' needs were gathered by market research prior to the beginning of production of a product, which was the basis for defining the product range selling price, as well as the basis for the choice of advertising the product and its distribution. As the needs of the population grew and people differentiated according to their needs, marketing also evolved into segmented marketing, then into marketing niche, only to evolve into a fine segmenta-

tion of the market, in the nineties of the last century, which transformed marketing into micro marketing, or 1:1 marketing relationship. Figure 4 shows evolutionary processes in marketing.

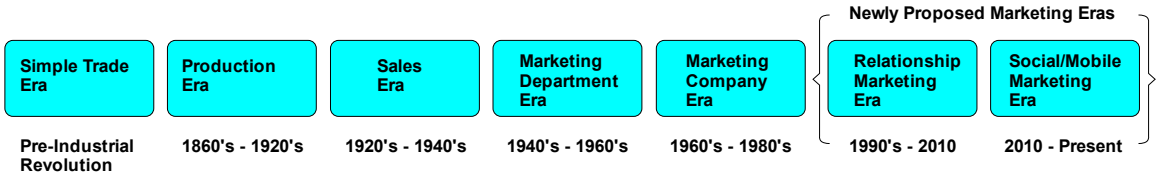

Figure 4. Evolutionary processes in marketing [8]

This last transformation of marketing should be related both to evolutionary processes in industrial production and to evolutionary processes in information and communication technology. Thereby, marketing relations are said to be an important component of digital marketing. Marketing relations is a consequence of evolution processes on the global market. In fact, in the era of global transparency and high competitiveness, it is very difficult to conquer new markets and find new free consumers. Recapturing a consumer from competition is an expensive and risky venture. Therefore, businesses try to keep their existing customers by building barriers around them, and take advantage of the repetitive and cross consumption in the best possible way. Accordingly, marketing from a former offensive business philosophy has transformed into a defensive business philosophy. In order to keep consumers and transform them into customers, it is necessary to optimally meet both their needs and their expectations. This can be done if you are well acquainted with consumers, or if you are familiar with their needs, but also if consumer dissatisfaction is quickly and efficiently eliminated. Therefore, it is necessary to continuously investigate consumer needs, i.e. consumer satisfaction with the products they consume. Permanent marketing research can be done only through permanent communication with the consumer in which a key role has a communication component of modern information and communication technology today. In order to realize in practice the theoretical framework set up by marketing relations, the application concept of consumer relationship management (CRM) has been built.

One of the key assumptions of the consumer relationship management concept is the systematic collection and recording of data on consumer characteristics and his behaviour in the database, for the acquisition of key knowledge of consumer needs and habits. Thus, any interaction with the consumer, whether in pre-sales, sales or post-sales activities, is recorded. The outcome of collecting data on the needs of the consumer and his behaviour results in a "genome" of consumers. Figure 5 represents the "genome" of a consumer.

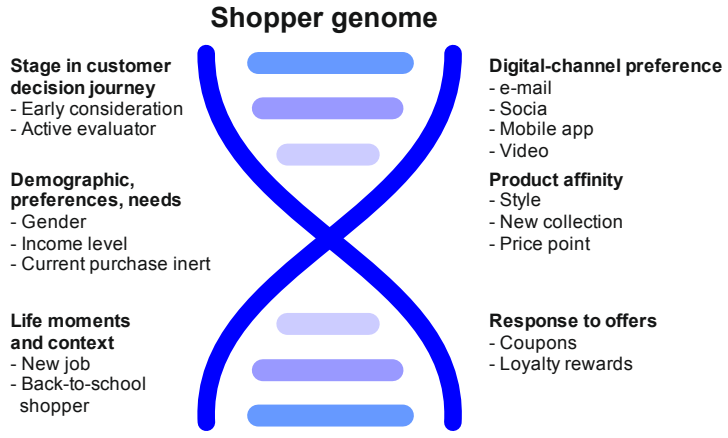

Figure 5. The customer or consumer genome [9]

When it comes to interaction between consumers and manufacturers in terms of designing and manufacturing products tailored to the needs and desires of an individual consumer, or a smaller group of consumers then, quality cooperation between Industry 4.0 concepts and consumer relationship management is necessary. The consumer relationship management concept should provide key information that is used to design and manufacture custom made products. Some important questions that arise are: for which

products and to what extent it is important to customize the product, and whether the bakery products will remain mass production products or not, or if they are expected to be produced for small groups of consumers or individual consumers; furthermore, if it makes sense to produce bakery products for small groups, or individual consumers, then why and how to do it. In order to give answers to the above questions it is necessary to try to mentally model the future based on the trends that are present in human behaviour, and human society.

In the first half of the 20th century, due to the relatively low needs of people that were the result of low knowledge and awareness, the struggle for survival was the fundamental motive of work and action of most people. Ignorance of long-term results of the certain forms of behaviour was certainly one of the main reasons why a contemporary man accepted work conditions and activities that had an impact on his health and longevity. As science evolved particularly medical, chemical, biochemical, technology sciences and others, and also by spreading information through education and mass media, people's awareness of the need for curative and preventive action to restore and maintain long-term health, and to prolong life raised. An increase in the self-awareness of a modern man, particularly in the second half of the 20th century, resulted in an individual struggle of people to improve the quality of their own lives. Therefore, nutritionist science plays an increasingly important role in correlating the quality of nutrition with the health and quality of life. "Nutrition science began with modern chemistry and its founder Antoine Lavoisier infection, in the late 18th century. The basis for the establishment of new science, nutrition, has brought about the knowledge of general chemistry (identification of elements and compounds), development of chemical analysis methods, biochemistry and physiology, and the scientific and quantitative testing of old and new theories and ideas. Development of nutrition science was largely dependent on the development of analytical chemistry and general physiology."[10] Furthermore, the following can be stated: "Research is continued today. While in the middle of the last century classical nutrition was primarily concerned with hunger, rationalization of food and prevention of deficiency diseases, research today tends to determine the meaning of certain food ingredients (fibres, cholesterol, vitamins, minerals, phyto-substance) and eating habits on health and disease." [10].

If we take into account that food belongs to the basic human needs, and that there is a link between food, health and human illness, than modern manufacturing concepts supported by customer relationship management enable the production of individualized products, but also that further growth in the understanding of nutrition and individualization of the needs of people for the exact forms of nutrition, then it is expected that bakery products will be produced according to the individual needs. In addition, the growth of the needs and desires of people for individualized organoleptic properties [11] of bakery goods (appearance, colour, smell and taste), then it becomes certain that in the near future the bakery industry will be transformed into an individualized and personalized production based on the Industry 4.0 concept. The structural and process model of action of the production system is shown in Figure 6.

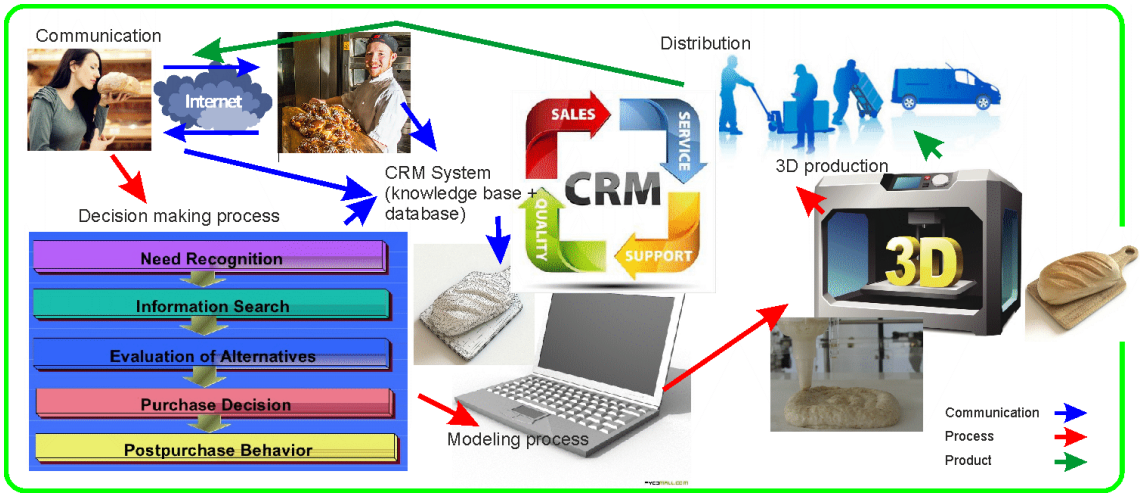

Figure 6. Structural and process model of bakery product production within the framework of Industry 4.0 [12] – [19]

CONCLUSION

Great part of modern production of bakery products is based on mass production or, to a lesser extent, on craft production. Mass production is a relic of the past that will probably become extinct due to the growth and changes in the needs of modern consumers. The modern consumer is no longer satisfied with the average product but wishes an individualized product that will meet his personal needs and preferences. However, bakery products as an individualized product of the future, besides having to satisfy the consumer with its organoleptic properties, it will have to respond nutritionally to consumer needs in terms of preserving his health and ensuring the quality of life. The reason for this lies in the fact that earlier demand for bakery products, as basic living food, was non-elastic, and that the price and quality of products did not affect a product demand. Therefore, mass production was a rational choice during that period. Today's survival of modern human does not depend on bakery products, so the demand for bakery products has become elastic, and bakery products have to adapt to new conditions, which implies transformation of bakery products from mass production to individualized production for the well-known consumer.

These expected changes also seek changes in the focus of science. At the time of mass production, the focus of technology but also economic sciences was on mass production in order to reduce fixed costs, as well as to optimize the product range and production processes. Nowadays, owing to the potentials of information and communication technology, the focus of bakery products production should be directed to optimally satisfy consumer needs to retain consumers. Thus, the new focus requires complete reorientation of technological, economic and information sciences which means leaving studies related to mass production and orienting to research which focuses on individualized and personalized production within Industry 4.0. A whole new series of problems arise, to which scientific answers should be found soon.

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