



THE INFLUENCE OF TECHNOLOGICAL DEVELOPMENT ON MANAGEMENT INNOVATIONS - AN EXAMPLE OF THE TEXTILE INDUSTRY

Review paper
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ABSTRACT: This paper studies the impact of technological development on management innovations, with special attention being paid to management innovations in the textile industry. The work is based on the fact that in modern conditions, technological development is the basis and main driver of economic and social development in general, as well as that this process implies changes in all spheres of activity, including in the sphere of business management. The study of the subject matter begins with a brief overview of the development and changes of management from its origins to the present day, pointing to the fact that in the era of the new technological revolution, the application of nanotechnologies, biotechnology, industrial ecology, etc. it is necessary to apply new, sometimes completely different, business management methods that are in accordance with the new economic conditions. The main characteristics of innovative management methods in modern companies are new approaches to management, i.e. to conducting business activities, changes in the organizational structure of the company, encouragement of creativity and innovation of employees, simultaneous development of strategic adaptability and operational efficiency and the like. In the final part of the paper, management innovations that must be implemented in the textile industry sector are pointed out, and which concern, first of all, adequate management of the environmental, economic and social aspects of the textile production process.

Keywords: technological development, business management, management innovations, textile industry, business efficiency, ecology, human resources.

UTICAJ TEHNOLOŠKOG RAZVOJA NA INOVACIJE MENADŽMENTA - PRIMER TEKSTILNE INDUSTRIJE



APSTRAKT: U ovom radu proučava se uticaj tehnološkog razvoja na inovacije menadžmenta, pri čemu se posebna pažnja posvećuje inovacijama menadžmenta u tekstilnoj industriji. U radu se polazi od činjenice da je u savremenim uslovima tehnološki razvoj osnova i glavni pokretač privrednog i društvenog razvoja uopšte, kao i da dati proces podrazumeva promene u svim sferama delatnosti, pa i u sferi poslovnog upravljanja. U proučavanju predmetne problematike polazi se od kratkog pregleda razvoja i promena menadžmenta od nastanka do danas, ukazujući na činjenicu da je u eri nove tehnološke revolucije, primene nano tehnologija, biotehnologija, industrijskih ekologija i sl. neophodno primeniti nove, nekada potpuno drugačije, metode poslovnog upravljanja koje su u skladu s novim uslovima privređivanja. Kao glavne karakteristike inovativnih metoda upravljanja u savremenim preduzećima ističu se novi načini upravljanja, tj. obavljanja posla, promene organizacione strukture preduzeća, podsticanje kreativnosti i inovativnosti zaposlenih, istovremeni razvoj strateške prilagodljivosti i operativne efikasnosti i slično. U završnom delu rada ukazuje se na inovacije menadžmenta koje je neophodno sprovesti u sektoru tekstilne industrije, a koje se tiču, pre svega, adekvatnog upravljanja ekološkim, ekonomskim i socijalnim aspektima procesa proizvodnje tekstilnih proizvoda.

Ključne reči: tehnološki razvoj, poslovno upravljanje, inovacije menadžmenta, tekstilna industrija, efikasnost poslovanja, ekologija, ljudski resursi.

1. INTRODUCTION

Technology is one of the most significant factors in the modern development of humanity. The level of technological development corresponds to the level of the overall socio-economic development of a country. The application of modern technological achievements changes all aspects of human life, leading to large and rapid changes in the ways people live and conduct business. As a result, modern business conditions are characterized by large and rapid changes, but also discontinuity, which further complicates business conditions. This, on the other hand, permanently relativizes the position of economic entities, introducing uncertainty into their operations, against which they are fighting in the process of their growth and development. Growth and development in developed countries today are predominantly based on scientific and research activity, creativity and innovation in all areas of business. Changed business require the application of adequate management methods that are aligned with changes in the business environment. In this sense, it is necessary to introduce new, innovative management methods that would enable more efficient operations. These methods should be based on innovation, flexibility and appropriate motivation of employees. Each economic sector must take care of this in accordance with the specific conditions of its business. The textile industry, which undoubtedly represents a significant economic sector, provides wide opportunities for the introduction of management innovations, since a green transition should be made in this sector in order to realize its long-term sustainable development.



2. IMPACT OF TECHNOLOGICAL DEVELOPMENT ON CHANGES IN BUSINESS CONDITIONS

Although technology and technological development are as old as human society, it can be said that only since the First Industrial Revolution has there been a significant qualitative change in the nature of their influence on the entire socio-economic development of humanity. Modern technological achievements today represent the most powerful means of competitiveness of highly developed countries and the basis of their monopoly position in many areas of international economic and political relations. The level of technological development is also one of the most important criteria for dividing countries into highly developed and underdeveloped, because the new scientific and technological revolution, which was created by the long-term work of a large number of scientists and experts in all fields of activity, is today a necessary condition for faster development of all national economies. As a result, developed countries are investing increasing amounts of resources in scientific and research work, while the slower development of underdeveloped countries is largely determined by the underdevelopment of their scientific and research work and the low level of technological development.

The impact of technological development is very broad and manifests itself in changes in the way of production and technological procedures, the appearance of new products, materials, changes in the sphere of marketing and distribution of products, as well as in changes in the expectations and demands of consumers [1]. On the other hand, technological changes to a considerable extent cause an increase in the dynamism of the environment, which causes changes in business conditions, their greater uncertainty and unpredictability. As a result, business conditions become discontinuous, and the desire for globalization of the market and the world economy manifests itself, and as a result, the pressure on companies for constant diversification and rapid changes in production programs increases. It can be said that the new technological revolution and the information revolution, as an integral part of it, also led to the economic revolution. In such conditions, new ways of market economy, new methods of creating and using resources, as well as new value systems were created [2].

Technological development, however, represents not only the basis but also a prerequisite for the socio-economic development of every country and its economic subjects, as it:

- significantly contributes to the increase in the rate of economic growth,
- increases the productivity of economic entities,
- improves the country's position in the international division of labor and
- contributes to more complete satisfaction of the population's needs.

As a result, countries and economic entities that do not achieve adequate technological development permanently worsen their competitive position, which significantly slows down their development [2].

The development and application of the latest technological achievements implies continuous growth in the amount of knowledge of the economy and its entities, as a result of which modern economies are called knowledge economies and knowledge-based economies. The knowledge economy means an economy that bases its development on the

production, distribution and use of knowledge [3]. Knowledge-based economies use knowledge in all their economic sectors and activities, which has contributed to the change and expansion of their economic structure, so that knowledge-based economies become knowledge-driven economies. A high level of development of science, as well as an educated population, represent an adequate basis for faster technological development, so that between the sphere of knowledge, education, science, technology and economic development, a relationship of solid connection and interdependence is formed [4]. The development of the knowledge economy is conditioned, above all, by the development of information and communication technologies. As a result, global competition intensified due to the reduction of communication costs and the increase in communication speed. Changes also occurred on the demand side, since there was an increase in income, a change in consumer tastes and attitudes, etc. [5]. Practice shows that knowledge-based economies have wider opportunities for development and are more adaptable to changes in business conditions (Figure 1).

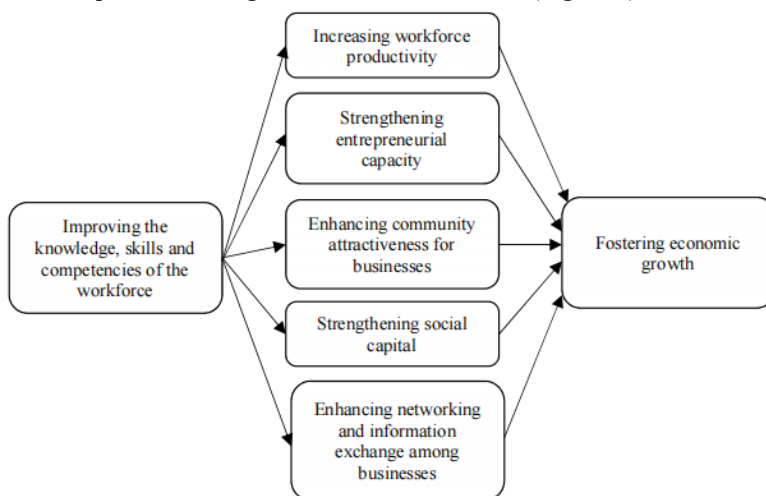


Figure 1: Contribution of human capital to economic growth Source: Adapted from [6]

Modern companies are forced to strive to improve their competitive position by strengthening their technological base and innovation potential. In the process of creating innovations, knowledge plays the most important role. However, in order for innovations to be successfully implemented on the market, appropriate efforts are necessary not only in the field of technology, but also in the field of engineering and marketing, which also imply the application of appropriate knowledge. In order to respond to the demands of changing business conditions, business entities should have appropriate human, financial and material resources, as well as develop cooperation with other business entities. On the other hand, business entities should build their own organizational structure that will enable them to establish an adequate connection between the technological and economic spheres of their business.



As it is not characteristic of technology to develop spontaneously, the process of technology development needs to be managed systematically, strategically planned and long-term oriented. In this sense, the technological strategy represents one of the most important elements of the economic development of every country, and it refers to the long-term exploitation, development and maintenance of the overall knowledge and abilities of the economy and its subjects [2].

Constant changes in the business environment affect the permanent relativization of the position of economic subjects who are forced to constantly adapt to given changes. Observing the technological development in the context of the overall development of the company, the technological development strategy is an integral part of its overall development strategy. Once defined, the technological strategy is not final, but is subject to constant revision in accordance with current changes.

3. THE CONNECTION BETWEEN TECHNOLOGICAL DEVELOPMENT AND MANAGEMENT INNOVATION

Management represents the process of managing business systems with the aim of optimizing their operations, increasing efficiency and profitability. Management can be defined as a process of planning, organizing, hiring, influencing and controlling, which is aimed at the efficient provision, deployment and use of resources in order to achieve a certain goal [2]. Management, in a broader sense, represents deciding on the goals of the organizational system, on the way and means necessary to achieve the given goals, as well as making decisions on the use of the results of the operation of a certain business system. In this sense, management can be viewed from three aspects, namely: management skill, management theory and management structure. Frederick Winslow Taylor is considered to be the founder of scientific management. He believed that management can be developed into a true science, which would be based on exact universal laws, rules and principles, the application and respect of which could improve business [7].

Modern management began to develop and gain importance since the First Industrial Revolution, and over time, its influence on business efficiency has only increased. Management as a scientific discipline went through different stages of development, starting from Frederick Winslow Taylor, the creator of scientific management, to modern theorists, who constituted their management theories in accordance with technical-technological changes and their application in the business process [2].

However, the management methods that are applied today are not always in accordance with changing conditions in the business environment. Until now, the focus of management activities has been directed mainly to improving efficiency, especially productivity, to improving planning, as well as to overcoming the resistance that employees have towards changes. Research shows that in modern conditions this is no longer enough for efficient business. New management methods must be aimed at expanding the awareness, skills and attitudes of employees. In order to achieve this, a multidimensional approach is necessary, which emphasizes the necessity of focusing on all areas, as well as the effort to achieve good results in all areas [4]. Changes should include [8]:

- company,
- organizational structure of the company,
- technology,
- company strategies,
- people (through influence on their behavior, emotions, rational thinking, spiritual development, as well as the process of planning changes in content and employees).

One may ask why innovations in the management process and in the application of management methods are necessary. The answer lies in the fact that the speed of changes in the business environment is increasing, that their unpredictability, mutual conditioning and connection are also increasingly pronounced, as well as their intangibility and the impossibility of seeing the consequences they can have on all aspects of socio-economic life. Innovations in management should be in accordance with the requirements of changing business conditions. Managers must be prepared to solve problems creatively and introduce innovations in management methods. It is also important to point out that managers' responses should be:

- fast,
- directed towards innovation and knowledge-based business development,
- aimed at ensuring a rapid response to environmental challenges.

One of the important characteristics of innovations in modern management is the ability to create adequate strategies for adapting to new changes, which would lead to more efficient execution of operational tasks. In this sense, it is necessary that managers try to include all employees in the process of solving business problems, in order to increase their motivation to perform work tasks, but also to transfer responsibility for the successful performance of given tasks [2]. Therefore, in the future, one of the main tasks of innovation management is to solve the problem of permanent motivation of employees to achieve innovation, greater efficiency and teamwork.

One way to overcome the identified challenges is to enhance innovation activities by applying a process model of knowledge management for innovation, which consists of three phases of the innovation process: *discovery*, *realization* and *nurture* (Figure 2).

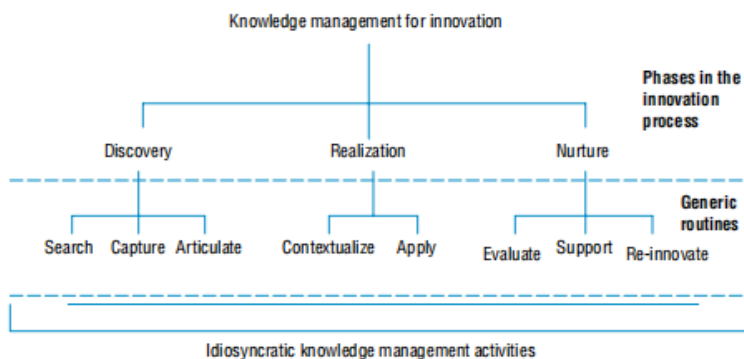


Figure 2: Process model of knowledge management for innovation, Source: [9, 10]



However, the reality is often different. Managers of large companies, due to the complexity of managing substantial assets and a large number of employees, are generally slow in changing their management methods. They are primarily focused on managing within the given circumstances, through cost reduction, process reengineering and incremental changes, while radical management changes are relatively rare in practice.

Research shows that in modern conditions, companies must react faster, be more efficient, flexible and ready to handle discontinuity in business. Precisely because of this, in order for the management methods to correspond to the given requirements, they must be significantly changed. New management methods should contribute to increasing the productivity of business systems that are organized in a new way. It is also important that management innovations contribute to expanding the scope of employees' responsibilities, so that they are more motivated to perform their tasks as efficiently as possible. The essence of management innovation is reflected in the fact that a greater number of employees are encouraged to permanently, when performing of everyday work tasks, provides its maximum. The basis of the comparative advantages of modern companies is represented by:

- passion for doing work,
- creative problem solving and
- the initiative of each individual.

The goal of introducing management innovations is to push the boundaries of existing achievements, both for companies and their employees. In this way, the entire economic recovery and development can be encouraged, because new business conditions imply new managerial and organizational competencies of managers. Companies should improve not only their efficiency, but also their strategic adaptability to changing business conditions. To that end, it is necessary to constantly strengthen innovation in all areas of business, as well as the motivation of employees to achieve optimal results.

4. SPECIFICITIES OF MANAGEMENT INNOVATIONS IN THE TEXTILE INDUSTRY

The textile industry is an economic sector that significantly contributes to the socio-economic development of a large number of national economies. However, due to the specific nature of the production of textile products, the textile industry has numerous harmful effects, such as:

- intensive exploitation of natural resources,
- generation of large amounts of textile waste,
- contribution to the greenhouse effect through the emission of harmful gases,
- water pollution by the release of toxic chemicals,
- pollution caused by microplastics and microfibers, etc.

All of the above indicates the need for radical changes in the operations of textile companies, in order to eliminate or minimize the adverse impacts of their activities. One of the acceptable solutions is certainly the green transition of this economic sector, especially the application of circular economy principles in production and business. The



application of the principles of circular economy in the business of textile companies can contribute to the solution of numerous problems, by reducing environmental damage, increasing the efficiency of resource use, increasing the profitability of business, as well as by improving the quality of life. The implementation of the principles of circularity in the textile industry would contribute to increasing the long-term sustainability of its business companies, since it would enable the production of high-quality products, while extending their lifespan and increasing their value.

Numerous studies point to the fact that the application of the circular economy in business can have numerous positive effects, the most important of which are economic, social and ecological. The most significant *economic effects* are reflected in lowering costs, increasing profits, increasing employment, as well as in the continuous growth and development of the national economy. The most important *social effects* that can be achieved in this way are, first of all, greater usefulness of products for consumers, production of better quality and healthier clothing, improvement of working conditions and earnings of employees, as well as an increase in living standards and more adequate care for the health of the population. The *ecological effects* achieved through the implementation of the circular economy refer to the reduction of environmental pollution, reduction of energy consumption, reduced use of harmful substances in production, etc.

The practical implementation of circularity in the operations of any business entity, however, implies significant changes in the approach and business philosophy, as well as the introduction of new business models. All of this requires the application of new management methods and presents significant challenges for the company's management. In this sense, management innovations in the future development of the textile industry can be very important. In order to determine the direction in which business management methods should be changed, it is necessary to start from the goals to be achieved in the future business and functioning of the textile industry.

The main goals to be achieved through the application of the circular economy in the textile industry can be summarized as follows:

- increasing product durability,
- increasing the possibility for product reuse and repair,
- reduction and elimination the use of dangerous chemicals in the production process and in textile products themselves,
- more efficient use of resources, primarily raw materials and energy.

These goals, along with the continuous increase in recycled content in products, the application of new technologies for production and recycling and the reduction of greenhouse gases, should contribute to the achievement of the main goal, which is the preservation and improvement of life on Earth. On the other hand, circular business should influence the constant reduction and ultimately the elimination of waste, which would also have a positive impact on the reduction of environmental pollution. However, the application of the principle of circularity in the business of textile companies implies the use of new materials, primarily non-toxic biological ones, instead of the ones used so far (synthetics, chemicals, microplastics and microfibers, dyes, etc.). On the other hand, in order to achieve the reduction and elimination of textile waste, it is necessary to apply



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completely new or modified existing technological procedures, which are sometimes unavailable or insufficiently developed. New materials and new technological procedures would facilitate the application of the sharing economy, extending the life cycle of textile products, increasing their reuse, and thus reducing waste. In order to realize all these processes, it is usually necessary to completely change the approach and methods of managing the business of textile companies. It is necessary to motivate management and employees to a different way of thinking and a different value system, to initiate and promote innovation when solving problems and to reward innovative solutions that contribute to the more efficient achievement of planned goals. In order to achieve this, it is necessary to start from management and new approaches to business management.

One of the most significant activities in the process of implementing the circular economy is waste recycling, which is one of the prerequisites for completing the cycle of sustainable production. Waste recycling involves the implementation of numerous management activities, from planning and organizing to motivating and controlling. It is necessary to manage the process of production and business so that managers and employees are informed, educated, encouraged and rewarded for the application of modern methods of organization, production, quality control, recycling, marketing, so that their application would contribute to a significant reduction in the production of new textiles from original materials, which would also mean a reduction in the amount of water used, the use of toxic chemicals and the consumption of various forms of energy. The production of textile products should be focused on the use of natural fibers, such as cotton and linen, and recycled fibers would form part of the resource pool of the textile or clothing industry. Whether it is post-industrial, pre-consumer or post-consumer textile waste, it is necessary to recycle it and leave it in the further processing cycle [11]. In this way, textile companies should be directed to recycling as a way to implement a circular economy and a way to achieve long-term sustainable development of this sector.

However, managing the recycling of textile waste is a very difficult and complex process. This is precisely the reason why the recycling of textile waste was not carried out to a greater extent before. The main reasons can be economic, then the characteristics and composition of the textile products themselves, the lack of textile material suitable for recycling, the lack of appropriate technologies, the lack of necessary knowledge, information, policies, standards, and inadequate management of the given process [12]. Therefore, the adaptation of management methods to the problems of recycling in the textile industry opens a new issue of introducing adequate innovations in that process. Managers should initiate, encourage and motivate employees to: create such a design of textile products that allows for easy disassembly, the possibility of recycling and the use of as few types of materials as possible, then the construction of an appropriate infrastructure for the efficient collection of textile waste, the application of new technologies for efficient sorting of waste, as well as undertaking adequate activities in order to increase the demand for recycled textiles [13]. The new business models created should enable the development of clothing rental services, then the development and application of a new design of textile products that would enable their reuse and recycling, influencing consumers to buy clothing that, thanks to higher quality, has a longer lifespan,



as well as developing consumer awareness of the benefits of sustainable textile products. The application of the principle of circularity in the textile sector would significantly affect the reduction of the generation of new waste. The responsibility for whether and to what extent modern business methods are represented lies mostly with the management.

In developed countries, the green transition measures of the textile industry have been applied for decades. These measures are based on the necessity of the transition itself, as well as on the necessity of applying new business models that would contribute to increasing the sustainability of this sector. Realization of the process of production of ecological clothing implies appropriate management of all its stages, starting from the creation of design for the environment, procurement of raw materials, production of clothing itself, proper distribution, and up to the consideration of their reverse logistics and waste [14]. According to Walter [15], three innovative trends are predicted to have a primary impact in the textile and clothing industry in the future. These are: digitization, sustainability, circularity and efficiency of resources, processes and the entire business, and new business and consumer models based on the sharing of production resources and final products, servitization, pay-per-use or subscription models.

In new production conditions, it is necessary to apply new management methods. The given management models must be comprehensive and aimed at increasing business efficiency by extending the life of products and closing the material loop in business.

In practice, the difficulties in applying the principle of circularity are influenced by a large number of factors, the most prominent of which are [16]:

- inadequate management methods,
- bad legislation,
- lack of digitization,
- lack of suitable workforce,
- lack of financial resources,
- irrational use of resources,
- market problems,
- difficult to change the way of thinking and value system,
- short-term visions, etc.

The biggest obstacles identified in the literature [17, 18] are:

- technological, financial and economic,
- organizational,
- supply chain,
- institutional,
- consumer-related,
- socio-ecological.

Managing the application of innovative and circular business models in the textile industry is a very complex and difficult process. This is supported by the fact that the lack of financial resources, appropriate technology, infrastructure, necessary knowledge and skills, as well as the absence of strategic planning and the like, can cause the process to be delayed or significantly slowed down. All factors affecting the absence and slowing down of the green transition process can be internal or external in nature.



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Internal limiting factors are the high costs of the sustainable business process itself, the lack of awareness of the necessity of creating sustainable innovations, etc., while external factors can be the lack of public support in the field of finance, the underdevelopment of public-private partnerships, the instability of the macroeconomic environment, and the like [19].

In the future development of the textile industry, the focus of management will be on the green and circular transition of this sector. This is particularly important because the application of sustainability principles in the future operations of the textile sector is necessary, but the implementation of such a process is usually a long and arduous. This process is much faster and more efficient in highly developed countries, while less developed countries, due to the lack of their own resources, especially financial, but also technological and infrastructural, face much more serious obstacles, which make the process of green transition much slower and less efficient.

The main focus of the European Commission's new strategy in the field of textile production is increasing the durability of textile products and the possibility of their repair and reusability, as well as increasing the possibility of their recycling, while combating against fast fashion. By applying innovative solutions, it would be possible for the textile industry to be more sustainable, climate neutral, and energy and resource efficient, while respecting human rights and environmental criteria, especially in the sphere of waste generation [20].

Papamichael et al. [16] created a new holistic business model that applies to all stages of the supply chain, and with the implementation of which it is possible to extend the life of the product, especially by using waste as raw material. One of the opportunities for management innovation in the textile industry can be directed towards undertaking appropriate management measures that would result in the improvement of existing products and processes, then towards the application of green operations in production and regeneration processes, reverse logistics, network design and waste management [14].

In order to realize this, it is necessary:

- conduct long-term strategic planning of the development of the textile sector,
- change in the design of the organization of textile entities in accordance with the planned changes,
- motivate employees to accept and implement the planned changes,
- ensure an adequate number and structure of employees who will implement those changes,
- provide adequate control over the implementation of the planned strategy.

All this represents a very complex and demanding task of company management. This complexity is reflected in numerous and complex tasks that need to be fulfilled, such as: application of eco-design of products, improvement of environmental protection, quantification of circularity, as well as transfer of knowledge to employees and customers in the fashion industry. Such innovative management should enable a much faster green transition of the textile industry.

Managing the business of textile companies is very challenging and complex. This is influenced by numerous difficulties faced by these business entities, such as, above all: low



business profitability, irrational and unsustainable use of raw materials, lack of adequate labor force, increased competition from third countries, etc. Since the application of the circular model implies appropriate resources, and above all adequate knowledge, experience and skills, as well as constant research and development work, which are not always available to the required extent, the problem of managing the acquisition, use and distribution of resources is thus more complex. In this sense, management activities should be directed towards:

- strengthening innovation in the field of new production processes and finding new technological solutions,
- development of new digital technologies,
- supporting innovative entrepreneurship and
- provision of adequate infrastructure and logistics for textile waste management.

The main problem faced by management in managing textile companies is how to overcome the problems of the current business, which concern, above all, the generation of waste, environmental pollution, oversized production and consumption, etc., and which make this sector unsustainable in the long term. On the other hand, falling costs, growing demand for textile products and growing consumption make these problems even more complicated, because they cause an excessive growth of clothing production, which is further stimulated by the growth of the world population and the expansion of the middle class, as well as the growth of living standards [11]. Since it is predicted that there will be an increase in the production of the textile industry in the coming years, which according to estimates would amount to about 4% per year until 2030 [21], measures are necessary to radically change something in this area. Consequently, the introduction of adequate management innovations represents one of the very important steps in the future sustainable development of the textile sector.

5. CONCLUSION

Technological development drives increasingly significant, rapid and uncertain changes in economic conditions. In such business conditions, survive only business entities that adequately react to given changes in time and at the appropriate speed. Changed conditions imply the application of changed management methods, as a result of which management innovations in business management are necessary. The textile industry represents one of the sectors in which there are great opportunities for applying management innovations, since it is an economic sector that must undergo a green transition, which implies a completely different business philosophy. As a result, the paper concludes that a change in management methods and business models is necessary in this sector. It is emphasized that managing the application of innovative and circular business models in the textile industry is a very complex and difficult process, due to the lack of financial resources, appropriate technology, infrastructure, necessary knowledge and skills, as well as due to the absence of strategic planning.

It can be concluded that in the future development of the textile industry, the focus of management will be on the green and circular transition of this sector. The application of



the principle of sustainability in the future business of the textile sector is necessary, but the implementation of the given process is usually a long and arduous process. This process is much faster and more efficient in highly developed countries, while in less developed countries, the green transition process is significantly slower and less efficient. The main task of the management when managing the business of textile companies is how to overcome the problems of the current business, which concern, above all, the generation of waste, environmental pollution, oversized production and consumption, etc., and which make this sector unsustainable in the long term. On the other hand, falling costs, growing demand for textile products and growing consumption make these problems even more complicated, as a result of which the introduction of adequate management innovations is one of the very important steps in the future sustainable development of the textile sector.

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