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Digitalization assessment features in the carpet industry of Kazakhstan

Abstract:

Object: Analysis of the digitalization assessment methods which can be used to evaluate the carpet industry of Kazakhstan. In turn such analysis requires to consider the modern trends in digitalization and global digitalization.

Methods: Authors examine the social and economic aspects of the digital transformation of the carpet industry in Kazakhstan, associated primarily with the preparation, development and effective use of innovative human capital as a key factor to improve financial strength of an enterprise.

Findings: Carpet industry has unique characteristics compared to other industries, mainly due to the quick changes in trends in the taste of the consumers and fast return of the investments. Digitalization of the carpet industry needs to be complex and cover all aspects in business cycle.

Conclusions: Nowadays, digital transformation is becoming a crucial tool for improving the quality and financial return of the carpet production. Current methods of evaluating the digitalization became ineffective, as it covers only technical aspects. Thus, digitalization needs to cover all aspects in the business cycle. In turn, such a complex method, allows to improve financial performance and labor productivity of a carpet producing enterprise.

Keywords: digitalization, digital transformation, carpet industry, customization, industry 4.0, production robotization, digital platform, labor productivity, economic efficiency.

Introduction

Carpet industry has some unique differences than other industries on fashion, consumer demands assortment issues. Modern carpet manufacturing aims to reduce production time. Hence in a modern world quickness in technologies means almost everything. Another characteristic feature of carpet production is the widespread use of the customization. Customization is the process of organizing production by combining advantages of mechanized and automated carpet production with the flexibility and mobility of the old production methods. Customization involves individualizing products based on specific customer orders through the implementation of constructive changes (Gosudarstvennye standarty, 2001).

Currently, digitalization is a strategic priority of economic development in many countries. According to forecast of leading world experts, a quarter of the global economy will become digital by 2022.Implementation of technologies for digitalization of the economy, which will allow effective interaction between the state, business and society is becoming an increasingly large-scale and dynamic direction (Istomina, 2018).

Hypothesis

Digitalization is based on the massive introduction of information systems and technologies in order to increase the efficiency of all types of activities, improve working conditions and the quality of life of the population. Informatization covers information processes of various types in the social, economic, scientific and technical field. When introduced into the enterprise, digital technologies provide a number of advantages, among which it is possible to increase the flexibility of production by proactively changing the characteristics of the production process and ensuring information integration of stages of the life cycle of the manufactured products. Digital transformation provides a qualitative improvement in the business pro-

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cesses of the enterprise by introducing innovations and adapting business models to the conditions of the modern digital economy.

Literature Review

The role of digitalization has increased extremely during the last years and now is considered to be among strategic goals of every enterprise in almost all spheres of domestic manufacturing sector.

Zhou J. has investigated the digitalization in manufacturing sector of China and has found some interesting findings. Author highlights the importance of promotion of engineering and commercialization in China`s manufacturing sector. Moreover, author identifies the main goal of implementing innovation by means of digitalization of the production process, which is to raise productivity of an enterprise (Zhou J., 2013).

In addition, during the implementation of the digitalization and intelligentalization in the manufacturing process, one should identify the importance of the innovation spurring development. Each country needs to identify its global position in its sector, in order to better understand its further development. As a result, enterprises need to highly cooperate with other enterprises in the industry, as well as with research institutions.

According to the research of Kotarba, another measurement of evaluation of digitalization KPI is the advanced data collection and processing of actions. In this regard, digitalization needs to be strongly linked with the management of data and thorough analysis of all parameters (Kotarba, 2017).

According to other researchers, shares in the market of some traditional textile enterprises are likely of acquisition by players from other industries. Globalization in the clothing sector is pushing up this process. Furthermore, some production mechanisms as 3D printing make it easy to customers to print textile goods at home or in various printing locations. Thus, brand of the goods in textile sector will lose its importance and customer preferences in the upcoming years. Trend is moving in opposite direction towards recognition of brands in the market and meeting the individual needs of customers (Ali et all, 2019).

Obviously, importance of measurement of digitalization will expand in the future. Meaning that enterprises will try to access the outcomes of digitalization. Since economic efficiency is the main goal of every enterprise, timing and payback is important.

Although there are few authors in Kazakhstan which have investigated the domestic carpet industry, there are no similar researches conducted on the digitalization of the carpet industry. Hence it is a new field which requires a deep analysis. In turn, previous authors who analyzed the domestic carpet sector highlights the importance of the competitiveness in this field. Obviously, competitiveness is highly correlated with the digitalization of the carpet industry. Thus, findings of those authors were also taken into consideration. In turn, Kazakhstani researchers have found out that in order to increase the level of competitiveness, it is necessary to approach this problem comprehensively, first of all developing a methodology for the development of the carpet industry both at the state level and at the level of individual enterprises. Therefore, it is necessary to solve the existing problems in the carpet industry (Durru et al, 2019).

Obviously, it is necessary to develop a strategy capable of forming a single mechanism of sustainable digitalization for the long term, based on agreed interrelated actions of the state, regions and enterprises, taking into account market relationships. Improvement of the organizational and economic mechanism, the solution of social problems, especially the improvement of the welfare of the population, the search for ways out of the crisis, inevitably entail an increase in the digitalization of carpet products of the Republic of Kazakhstan both in the domestic and foreign markets.

Methods

Assessment of the digitalization in the domestic carpet industry requires set of methods which enables to deeply analyze this sector. For this reason, this research provides complex methods of digitalization assessment of carpet industry of Kazakhstan. In turn complex methods mainly include: method eco-system management and analysis of comparative indicators during the assessment of economic efficiency of digitalization.

In turn, analysis of comparative indicators of economic efficiency includes several transformations depending on the desired outcome. There is an option to identify changes in the cost of product as a result of digitalization, which in turn can be transformed to calculate specific costs features. Authors have provided several formulas which allow to calculate economic efficiency in various cases including: in case if digitalization may result in rise in price of a good or if it affects other sectors of economy, which may require an analysis even at macroeconomic level.

Results

Advantages of digitalization in the carpet industry are following:

– digitalization of the industry allows to significantly save production costs (production data is stored digitally and does not require additional costs);

– decrease the number of workforces by means of digitalization;

– ability to initiate the amendments at any stage of the CAD file;

– quick adaptation to new market conditions, depending on demand the batch size can be easily changed at any moment;

– customization of the production line,by applying three-dimensional technologies, collections that are slightly different from each other can be printed. In turn, it creates personalized production lines of goods;

– absence of the usual restrictions.

According to the Table 2 below, production digitalization features is described, which also can be applied to the carpet industry.

The revival of the domestic carpet industry has an economic, social impact to Kazakhstan. Carpet production improves employment in the country, as it creates new workplaces. It also encourages the development of other light industry sectors (production of cotton and wool), which helps to restore regions affected by social stress.

Discussions

Digitalization of the economy across the countries varies depending on the level of their development and to the economic policies. This is mainly related with the economic development of countries. Developed countries are far behind those developing countries. Some developing countries currently can be on such stage of digitalization, which some western countries have passed in the previous century. However, overall global industrial digitalization in economic development can be divided into certain stages, specific features (Table 1).

Table 1. Evolution of Global Production Digitalization

<table>
<tr><td>1990-2000</td><td colspan="2">2005</td><td>2010</td><td>2015</td><td>2020</td><td>2030</td></tr>
<tr><td colspan="3">Foundation</td><td>Development</td><td>Advance</td><td>Turnover</td><td>Systematic digital transformation</td></tr>
<tr><td>Development of e-business</td><td colspan="2">Development of e-market</td><td>Growth of new digital products and e- services</td><td>Massive digitalization in traditional business</td><td>Transformation of business processes and business models</td><td>Systematical transformation</td></tr>
<tr><td>“Web 1.0”</td><td colspan="3">“Web 2.0”</td><td colspan="2">“Web 3.0”</td><td>“Web 4.0”</td></tr>
<tr><td colspan="4">since 1960s-Industry 3.0 (Third Industrial Revolution)</td><td colspan="3">since 2011-Industry 4.0 (Fourth Industrial Revolution)</td></tr>
<tr><td colspan="4">Emergence of the digital economy concept</td><td colspan="3">Broad understanding of the concept of digital economy</td></tr>
<tr><td colspan="7">Note - compiled by the authors</td></tr>
</table>

According to Table 1, starting from 2017, which is believed to be in the stage of digital economy maturity, the concept of “Industry 4.0” has been deeply embedded in the development of the national economies worldwide. According to preliminary forecasts, direct impact of digitalization on economy of Kazakhstan will amount to 1.7-2.2 trillion tenges by 2025. Therefore, total volume of investments, including private investments, will provide a significant return on investment till 2025, by 4.8-6.4 times larger than the initial amount.

Domestic carpet industry in Kazakhstan was also influenced by the digitalization boom. Overall, the domestic carpet market of Kazakhstan can be classified as an oligopoly market based on its parameters. This is due to the fact that carpet industry in Kazakhstan consists of several leading enterprises.

In these conditions, the most challenging aim for all carpet industry enterprises is to ensure the intensification of production and cost reduction of customized industrial products. Therefore, main solution is to switch to the Digital Factory model.

According to the concept of fourth industrial revolution “Industry 4.0”, digitalization is becoming a crucial factor in the development of the carpet industry. This can be observed by the fact that the quality of carpets increasing, new ways to win in tough competition are emerging.

The fourth industrial revolution “Industry 4.0” also plays a crucial role in the digitalization of the national economy. Nowadays, the concept of fourth Industrial Revolution, known as “Industry 4.0” is the most important global economic trend in the world. For this reason, President of Kazakhstan, Mr. K. Tokayev focused special attention to the development of digitalization in Kazakhstan. “Industry 4.0” aims to use advanced info communication technologies for a significant transformation of industrial sectors. These technologies include predictive tracking and real-time decision-making. Autonomous robot systems and internet access of industrial objects use complex technologies in order to analyze large data sets. Based on these technologies, main attributes of the new generation industry will be rapid adaptability, flexibility of production, and a focus on the production of personalized (customized) products. Ultimately, all these factors create new opportunities to increase the efficiency and profitability of production as a whole.

In 2017, the concept of “Industry 4.0” was firmly embedded in the daily life of Kazakhstani officials, economists and entrepreneurs. Former president of Kazakhstan, Mr. Nursultan Nazarbayev has also prioritized technological modernization of the economy, focusing on digitalization and the creation of new industries. As a result, Ministry of investment and development of the Republic of Kazakhstan immediately initiated the implementation of Industry 4.0 concept in Kazakhstan.

According to the current President of Kazakhstan, K. Zh.Tokayev: “… one of the main factors of competitiveness in modern times is digitalization of the national economy. Therefore, implementation of modern digital technologies is a strategic goal for the Government of Kazakhstan. Meanwhile, in order to achieve this goal, another important step is to develop and strengthen the domestic IT sector. Kazakhstan needs young, educated and motivated specialists in IT sector. National digitalization project needs to have a goal to train at least 100 thousand highly qualified IT specialists. In turn, export of goods and services with digital technologies should reach at least 500 million USD by 2025” (Akorda, 2021).

Currently, digitalization in Kazakhstan is moving slowly than expected. Government of Kazakhstan tries to develop digitalization by boosting the governmental programs, which are mostly aimed at industrial digitalization. However, such efforts result in ineffective outcomes and digitalization level of the economy is still low. This in turn, affects the labor productivity in the economy, which still has a weak performance.

This study is aimed to conduct a deep analysis of the digitalization phenomena and discusses main features of digitalization of the domestic carpet industry of Kazakhstan. In this regard, authors use several methods and conducts analysis of the evaluation methods of digitalization, which is aimed to improve financial stability and labor productivity of an enterprise. Thus, any action linked with digitalization needs to have a positive economic impact on an enterprise or the industry as a whole.

The carpet industry has a certain feature regarding the economic forecasting and economic and mathematical modeling, which should be taken into account while developing a system of models of relationships between indicators of industrial development. This feature requires that the described general principles of modeling to be supplemented in such a way that corresponding features are taken into account as much as possible (Marketing.rbc., 2021).

Table 2. Features of enterprise-level digitalization in the carpet sector

<table>
<tr><td>Firm</td><td>ERP,
PLM</td><td>NX Digital processing</td><td>Teamcenter
Interaction platform</td><td>Tecnomatix
Digital production</td><td>SIMATIC IT
Manufacturing</td></tr>
<tr><td>Production</td><td>MES/
MOM</td><td rowspan="4">SIMATIC NET</td><td>SIMATIC IT
Planning</td><td>SIMATIC IT
Production control</td><td>SIMATIC IT
Analytics</td></tr>
<tr><td>Employee</td><td>PCS 7,
SCADA</td><td colspan="3">SIMATIC Win CC
SCADA systems</td></tr>
<tr><td>Equipment</td><td></td><td>SIMATIC
observers</td><td>SIMATIC
Operator panel</td><td>SINUMERIC
Emergency management systems</td></tr>
<tr><td>Operation</td><td></td><td>SIRIUS
indicators</td><td>SIMATIC IDENT
Industrial Identification</td><td>SIMATIC
In/Out systems</td></tr>
<tr><td colspan="6">Note - conducted by the authors on the basis of research data</td></tr>
</table>

One of the features of the carpet industry is the rapid return on investment. Technological features of the industry allow us to quickly change the product range at its lowest cost, ensuring high mobility of production.

Robotics and Big Data Systems in this sector will become the basis for innovative modernization of industrial enterprises. Accordingly, both terms allow to improve business environment in the country to a new level.

Table 2 describes the production digitalization processes of enterprises in the carpet sector. Application of digital technologies allows a carpet manufacturing company to ensure availability of data at all stages of the product life cycle, from development to maintenance. This allows the enterprise to improve quality of production decisions, assure “quick transformation” in terms of market entry. Also, digitalization increases flexibility, safety and operational efficiency and allows to create new business opportunities.

Nowadays, importance of internet on selling products and services increases the need for such a digital “transition period”. The German government's “Industry 4.0” initiative has also emerged as a response to the need for horizontal and vertical integration across all sectors, by ensuring efficient use of information and data and turning development into a continuous process across the entire value chain. It is necessary to clearly understand that every progressive industrial enterprise should actively use digital technologies (Alekseev, 2019).

Digitalization usually refers to the storage of data or information in the form of digital signals. They are represented as 1 or 0 logical signals (yes, no). In this sense, the term is mainly used in areas such as data storage. It describes the process of digitalizing other forms of representation. In the business context, “analytics” can be considered as further digitalization of information. Thus digitalization allows to make more effective management decisions.

Based on the idea that every carpet manufacturer conducts its economic activities for the purpose of generating income, it is obvious that investment will benefit both in monetary terms and in strategic terms by complex implementation of digitalization. Obviously, an investor makes the decision by accessing the economic impact on annual production or other economic parameters.

Therefore, the basic principle of decision making in implementation of digital ideas is the payback period of such an investment. Accordingly, calculation of the annual impact from implementation of digital technologies can be calculated as sum of investment effects, in terms of macroeconomics which can be observed by the growth of national income and gross domestic product.

Calculation of economic efficiency is based on bringing costs to existing digital assets (Brousseau, 2007). Such costs are calculated using the formula:

$$RC = CPU + IDA \times PTS \quad (1)$$

where: RC – reduced costs;

CPU – cost per unit of product (services);

IDA – investing in a digital asset;

PTS – standard coefficient of efficiency of capital investments.

The recommended value for PTS is set by a measure of at least 0.15 units (for conditions in Kazakhstan), which is justified to some extent, by the fact that investments in digitalization needs to bring to the domestic industry additional benefits in the medium term.This is due to the fact that efficiency needs to be higher than the inflation rate in the country.

In turn, within the framework of the state programs aimed at development of domestic carpet industry, government needs to identify itself the minimum value of the efficiency factor.

Determination of the economic efficiency of digitalization, requires to ensure comparability of indicators. This is the second methodological principle of describing trends in the digital economy. Comparability of indicators needs to be based on the volume, quality, time spent on production, as well as environmental factors.

Implementation of digitalization brings transparency to the industry. An entrepreneur needs to pay attention on the total cost of such implementation in the carpet production. Total cost of digitalization of carpet production refers to the cost of purchasing, maintaining and disposing of such digital asset.

Economic impact of digitalization can have various types: digitalization of technological processes in carpet production, organizational methods of carpet production, digitalization of technologies. In turn, quality characteristics are productivity, durability, operating costs etc.

Economic effect (EE) of digitalization of technological processes, organizational methods of carpet production is calculated using the formula:

$$EE = (PUC - MUC) * Qi + \Delta Mon \times Qi, \quad (2)$$

where: Qi – volume of production using new digital technologies and methods of production organization;

PUC – reduction of per unit costs by digitalization;

MUC – reduced main unit cost.

According to the second formula, as well as by industry or other economic entities, it is possible to determine the change in the value of products (works, services) using digital technologies, digital assets by similar approach. This formula can also be used to consider changes and individual cost elements.

Digital technologies introduced into the industry affect several areas of consumption and production simultaneously, so calculation of the annual economic effect is calculated using the formula:

$$T_e = \sum^{n}_{i=1} E_i * Q_i, \quad (3)$$

where: E_i – annual economic result obtained from the production and use of new digital technologies used in the i-th sphere of consumption;

n – the number of consumption spheres;

Q_i – part of the production of new digital technologies used in the i-th sphere of consumption.

If new digital technologies lead to an increase in prices for goods (works, services), but at the same time increase the quality of the final product produced, then the calculation of annual economic efficiency is carried out according to the formula below:

$$T_e = (P_c - P_n * I) * Q_1, \quad (4)$$

where: P_C – the profit from the sale of new high-quality products using digital technologies. It is calculated as the difference between the profit from the sale of high-quality products and products produced without using digital technologies.

If the subject of carpet production needs to determine the social impact of the introduction of digital technologies in the form of a reduction in the number of personnel, then it is necessary to consider changes in the labor intensity of the unit of production.

As for labor resources, in the context of digitalization of the economy, the issue of labor productivity remains an important issue. Since many works in Kazakhstan and abroad are specifically devoted to the social nature of digitalization, then one can doubt the future of labor resources, as well as the future of digitalization. However, due to the fact that entrepreneurs aim to increase profit, then the implementation of digital technologies is expected to bring a positive impact.

The proposed methodology for evaluating investments in digitalization allows us to determine the economic effect. At the same time, business entities note that any investment in a digital asset is not only a direct financial loss and profit (their comparison indicates the profitability of digitalization), but also that digital injections create a synergetic effect (Biankina, 2017).

Financial expenditures of the industry into digital technologies allow us to implement several business processes that contribute to the growth of the company's competitiveness. Firstly, competitiveness of internal business processes expected to rise. Complex implementation of digital technologies allows us to ensure the connection of all organizational elements, reduce management costs and improve the quality of production and sales. For example, GPS system initially allowed transport companies to improve the quality of delivery in terms of control, delivery and speed. However, gradually companies have discovered new ways to use this on-board technology and data by directing transport. These innovations have made it possible to reduce fuel consumption, carbon dioxide emissions and increase the number of provided services.

Secondly, digital investment provides a “competitive effect”. The essence of changes in this direction is that the innovations used in more progressive companies are later copied by other companies that are behind the leaders.

Digital technologies are abundantly integrated into a wide range of economies and business activities and provide opportunities for rapid deployment (through modernization of systems or infrastructure) (Kosareva, 2019).

Electronic digital platforms allow to maximize digital investment and business entities to fill the supply chain with consumers and suppliers, digitalize the business and business models of their environment, as well as transform logistics and transport networks (Nasrat et all, 2017).

Based on the aforementioned methods of assessing digitalization in carpet production, it can be seen that the main factor for business entities is the financial result. An entrepreneur is not interested in indicators that characterize the degree of readiness for digitalization or the level of coverage of his industrial production network. Digitalization of the economy will not lead to a change in the initial foundations of business. Based on this, the main criterion for the effectiveness of digitalization of the industry for an economic entity remains profitability and economic efficiency (Petrovic et all, 2019).

In addition to indicators, criteria for evaluating the effectiveness of the digitalization of a particular carpet-producing enterprise, it is necessary to identify the main indicators to assess the level of digitalization in the industry.

According to the readiness of the carpet industry and their current share in this direction (investments, developments), it is also necessary to take into account the side effects of investments in digital assets, as they are often much larger than the investments. Disadvantages of international indices for the development of the digital economy can be attributed to the fact that they do not take into account the specifics of each item, there is only one type of adjustment of the indicators of countries to the calculated requirements of international indices (Tsifrovoi Kazahstan, 2021).

Currently, there is a difficult situation in which sales market is decreasing, in turn pressure on imported products is increasing. As a result, enterprises depend both on the prices of competitors and on the prices of imported similar products. Introduction of digital and computer technologies has simplified carpet design and manufacturing processes. In turn, for management purposes nowadays physical parameters of the equipment can be controlled remotely via a smartphone or tablet. As a result, part of the daily work can be carried out through automated systems. Digital technologies work faster and are more reliable than human work, which is also significant as personnel shortages problem is common in Kazakhstani light industry sector. Concept of "fast fashion" is becoming more relevant in the carpet industry, which aims to renew the assortment several times during the year. In this regard, "fast fashion" forces manufacturers to look for new printing methods, and digital printing becomes the best option. Its effectiveness is explained by its wide possibilities, which means that any type of printing can be applied to almost any material (Geczy et all, 2018).

Table 3. Carpet production digitalization features at economic sector level

<table>
<tr><td colspan="8">Strategic management. Ecosystem method in management.
Identification of the transformation zone and justification of the need for digitalization.
Coordination of strategic documents for the stages of Digital Economy Development.
Reconstruction. Diversification. Formation of an innovative space.</td></tr>
<tr><td colspan="8">Service departments</td></tr>
<tr><td rowspan="2">Production</td><td rowspan="2">R&D</td><td rowspan="2">Personnel</td><td rowspan="2">Marketing</td><td rowspan="2">Finance</td><td colspan="2">Information technologies</td></tr>
<tr><td>Digital Platforms</td><td>Cyber security</td></tr>
<tr><td colspan="5">Electronic Document Management</td><td colspan="2" rowspan="11"></td></tr>
<tr><td>Robots
IIoT</td><td>Agile
IIoT</td><td>Agile
IoT, IIoT</td><td>CRM
Targeting</td><td>Electronic trans-actions</td><td rowspan="10">Solutions for the development and start of digital platforms.</td><td rowspan="10">Solutions for Information Systems. Virtualization and online capabilities: SaaS, IaaS, Paas, AIaaS.</td></tr>
<tr><td>VR
AR
Mixed R</td><td>VR
AR
Mixed R</td><td rowspan="3">Crowd sourcing, Freelance, virtu-al employment</td><td>Multiplicity</td><td>Block-chain technologies</td></tr>
<tr><td>Drones</td><td rowspan="2">Multi-D Printers</td><td>E-commerce</td><td>Crowd funding</td></tr>
<tr><td>Crowd-sourcing</td><td>E-learning</td><td rowspan="3">Audit of the quality of elec-tronic services (e-SQMSU)</td><td rowspan="2">Virtual curren-cies, ICOs</td></tr>
<tr><td>Multi-D Printers</td><td>Digital mod-els, Digital copies</td><td rowspan="3">Gadgets, bracelets, chips</td></tr>
<tr><td>SRM, MES, PLM, BIM</td><td rowspan="2"></td><td>Online technol-ogies</td></tr>
<tr><td>Robots</td><td>Mobile applica-tions (Apps)</td><td>QR codes.
NFC
FinTech</td></tr>
<tr><td colspan="6">Artificial intelligence, neural networks</td><td rowspan="5">Basicknowledge of cybersecurity: technological solutions; economics</td></tr>
<tr><td colspan="6">BIG DATA and Machine Learning</td></tr>
<tr><td colspan="6">Basic concepts of Biotechnology, neurotechnology, etc.</td></tr>
<tr><td colspan="6">"Industry 4.0." ability to solve applied problems using technology</td></tr>
<tr><td colspan="6">Basic knowledge of BIG DATA, Machine Learning, Artificial Intelligence</td></tr>
<tr><td colspan="8">Competence in quality management of integrated electronic services</td></tr>
<tr><td colspan="8">Basic competencies in IT architecture and programming</td></tr>
<tr><td colspan="8">Supporting digital literacy and expanding mixed competencies,
Life long Learning</td></tr>
<tr><td colspan="8">Note - conducted by the authors</td></tr>
</table>

Despite the urgent need for modernization, the introduction of digital technologies is observed only in a small number of Kazakhstani companies. Most players are not ready for today's technological realities. However, there are other prospects, enterprises are introducing new technologies at all stages of the life cycle, becoming more competitive and increasing exports. The state also plays a role in this, providing support at various levels, from financing programs with low interest rates to organizing special clusters (Baimukhamedov, 2019).

Conclusions

Finally, it can be observed that current methods aimed to access the digitalization have some weaknesses. Historically, digitalization assessment mainly was aimed on the technical aspects and financial parameters were not deeply analyzed. Current situation in the global world of digitalization has stepped forward and most cycles of digitalization are now far behind. Thus, focus needs to be changed to the financial aspect. Modern enterprises need quick return on investment. Digitalization processes in turn, needs to be financially effective, with no harm to the quality of product.

Digitalization has some crucial effect to the labor productivity. Massive digitalization of the production process requires less labor force. However, enterprises need to understand that this does not mean only to fire the employees. In order to decrease the labor force as a result of digitalization, enterprise needs to focus on the education of the remaining staff. Thus, employees required to be well-educated on all digitalization cycle, so that technical aspect will not suffer much. This in turn, allows to achieve high quality transformation based on the digitalization of production process. As a result, labor productivity improvement is achieved at its best to the enterprise.

This research has offered some assessment techniques of digitalization with the focus on the carpet industry of Kazakhstan. Although, this sector is relatively new sector for the domestic economy, offered techniques can be used for the enterprises in the market to make some quality decisions to improve the production process by means of digitalization. Enterprises can have some positive impact on their financial performance by using aforementioned techniques before implementation of new digitalization solutions.

Therefore, such factors as determination of development level of digital economy, required infrastructure and education of the population are also important. Digital economy is a complex phenomenon which covers processes of transformation of social and economic institutions of society at the micro and macro levels. Thus, evaluation of the digital economy needs to be undertaken on the basis of a number of indicators that allow us to analyze the digital economy at different levels.

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Д.Е. Қанашаев, А.Е. Есболова, Р.К. Андарова, Г.А. Жадигерова, Мустафа Нурсой

Кілем өндірісіндегі цифрландыруды бағалау ерекшеліктері

Аңдатпа

Мақсаты: Қазақстанның кілем өнеркәсібін бағалау үшін пайдаланылуы мүмкін цифрландыруды бағалау әдістерін талдау. Өз кезегінде мұндай талдау цифрландыру мен жаһандық цифрландырудың заманауи тенденцияларын қарастыруды талап етеді.

Әдістері: Авторлар Қазақстандағы кілем өнеркәсібінің цифрлық трансформациясының әлеуметтік-экономикалық аспектілерін зерттеген, бұл бірінші кезекте кәсіпорынның қаржылық тұрақтылығын арттыруды мақсат етеді. Қосымша цифрландыру барысында негізгі факторы ретінде инновациялық адами капиталды дайындау, дамыту және тиімді пайдалануды ұсынады.

Нәтижелер: Кілем өнеркәсібі басқа салалармен салыстырғанда ерекшеліктері бар, бұл негізінен тұтынушылардың талғамындағы тенденциялардың жылдам өзгеруіне және инвестициялардың жылдам қайтарылуына байланысты. Кілем өнеркәсібін цифрландыру күрделі болуы және бизнес циклінің барлық аспектілерін қамтуы қажет.

Қорытынды: Қазіргі уақытта цифрлық трансформация кілем өндірісінің сапасы мен қаржылық қайтарымдылығын арттырудың шешуші құралына айналуда. Цифрландыруды бағалаудың ескі әдістері тиімсіз болып келген, өйткені ол тек техникалық аспектілерді қамтыды. Алайда, цифрландыру бизнес циклінің барлық аспектілерін қамтуы керек. Өз кезегінде мұндай кешенді әдістерді қолдану, кілем өндіруші кәсіпорынның қаржылық көрсеткіштері мен еңбек өнімділігін арттыруға мүмкіндік береді.

***Кілт сөздер*:** цифрландыру, цифрлық трансформация, кілем өнеркәсібі, кастомизация, индустрия 4.0, өндірісті роботтандыру, цифрлық платформа, еңбек өнімділігі, экономикалық тиімділік.

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Особенности оценки цифровизации в ковровом производстве

Аннотация:

Цель: Анализ методов оценки цифровизации, которые потенциально могут быть полезны для оценки ковровой отрасли Республики Казахстан. В свою очередь, анализ цифровизации требует учета современных тенденций в секторе и глобальной цифровизации.

Методы: Авторы рассмотрели социально-экономические аспекты цифровой трансформации ковровой отрасли Казахстана, связанные с подготовкой, развитием и эффективным использованием инновационного человеческого капитала как ключевого фактора повышения финансовой устойчивости предприятия.

Результаты: Ковровая промышленность имеет уникальные характеристики по сравнению с другими отраслями, в основном из-за быстрой смены тенденций во вкусах потребителей и быстрой окупаемости вложенной инвестиции. Цифровизация ковровой промышленности требует комплексного подхода и охвата всех аспектов бизнес-цикла организации.

Выводы: В настоящее время цифровая трансформация становится важнейшим инструментом повышения качества и финансовой отдачи коврового производства. Общепринятые методы оценки цифровизации стали неэффективными, так как охватывают только технические аспекты. Таким образом, внедрение цифровизации на производстве должна охватывать все аспекты бизнес-цикла и должна учитывать технические и финансовые аспекты. В свою очередь, такой комплексный подход позволяет улучшить финансовые показатели и производительность труда коврового предприятия.

Ключевые слова: цифровизация, цифровая трансформация, ковровая промышленность, кастомизация, Индустрия 4.0, роботизация производства, цифровая платформа, производительность труда, экономическая эффективность.

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