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DIGITAL TRANSFORMATION AND INCREASING MOLDOVA INDUSTRY SWOT ANALYSIS

Abstract. The digital transformation is now a reality in Moldova, as Moldova has begun to transfer social, legal, and civil service delivery online. Sped-up digitalization can be expected to create new business models and opportunities for digital jumping in traditional industries. The Coronavirus crisis has highlighted the need for support and investments in digital transformation and effective digital governance, especially to guarantee the continuity and delivery of core government functions. The digital transformation is changing not just business models but the methods of production and distribution and the industry's competitiveness. The country's competitiveness is directly proportional to the country's level of economic development. According to SWOT analysis, general strengths on which Moldovan industry digitalisation will rely can be distinguished. It rely on the fact that manufacturing sector output is increasing – the contribution of the manufacturing sector to national GDP is around 12%, however it is on the lower side compared to other EU countries. Despite that, recent years indicate the rise of the output of this industry segment and industry digitisation will further encourage this process. Secondly, public and private IRT infrastructure is well-developed – is consistently updated, provides world-class internet access, and allows faster digitization. Thirdly, the growing capacity of digitization solutions providers - supply a wide range of services by participating in local and global value chains. The interview with experts who work closely in digitalization or competitiveness was done, and the SWOT analysis was done. Based on the research made, the recommendations for Moldova were prepared and presented in this article.

Keywords: digitalization, manufacturing, industry**,** Moldova, competitiveness.
JEL Classifications: F63; O32: O33
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Introduction. Moldova is a small lower-middle income economy. It is one of the poorest countries in Europe. Moldova has made significant progress in promoting inclusive growth and reducing poverty and since the early 2000s. Global Competitiveness Index report covering 141 economies measures national competitiveness-defined as the set of institutions, policies, and factors determining the level of productivity. Moldova was also ranked 86th (The Global Competitiveness Index 4.0 rankings report, 2019). The majority of the entrepreneurs recognize that digital transformation is an excellent opportunity for development and competitiveness (Ślusarczyk, 2018). The strengthening of digitalization processes puts additional competitiveness pressures on manufacturing businesses. Although digital transformation is a new concept in manufacturing (Okano, 2021), to maintain competitiveness, steps towards the digitalization of industry have to be implemented.

Literature review and the problem statement. Digital transformation can be defined as changes in jobs and income creation strategies, applying a flexible management model standing against the competition, quickly meeting changing demands. It is a process of reinventing a business to digitalize operations and formulate extended supply chain relationships. Practical use of the internet in design, manufacturing, marketing, selling, presenting, and data-based management model (Schallmo, 2018).

The authors highlight the importance of digitization in the manufacturing sector and claim that companies need to implement the latest technology (Wang, 2016). The digital transformation process requires companies to transform every day and be concerned with items such as customers, business models, new technologies, agile methods, and innovations (Okano, 2021). Digital transformation is adopting disruptive technologies to increase productivity, value creation, and social well-being (Duarte, 2018). Ulas (2019) had identified several factors expediting digital transformation that include, among others, globalization, advancement of technology and innovation, electronic commerce, and social media. Experts highlight four areas where digitization technologies have the most significant impact: productivity, revenue growth, employment, and investment (Russmann, 2015). Digitization will make a significant impact on manufacturing companies, workforce, and companies supplying new manufacturing systems.

According to Leão de Miranda (2021), the term competitiveness has historically been used to relate companies and nations in terms of costs. Analyzing the concept of competitiveness, most experts agree that competitiveness is a highly complex and multi-faceting phenomenon, as is the competition itself, the evaluation of which requires taking into account the results achieved in various areas. The concept of competitiveness begins with trade theory (Smith, 1937). Porter (2012) identifies four stages of the competitiveness of the national economy, corresponding to four main drivers of its development: factors of production, investment, innovation, and wealth. At the same time, the first three stages are characterized by an increase in the competitiveness of the country's economy. Krugman's (1994) position on the country's competitiveness is based on Ricardo's classic theory (particularly the theory of comparative superiority). According to Krugman (1994), only companies trade and compete. International trade allows companies to develop a division of labor and enables the growth of the economies of all countries. Analyzing the concept of the country's competitiveness (Rakauskienė, 2013) distinguishes three approaches:

- The country's competitiveness is a successful foreign trade of the country;
- The country's competitiveness is the productivity of the country;
- The country's competitiveness is the ability to ensure the well-being of the country's population.

The model of systemic competitiveness of Esser (2007) is suitable for analyzing competitiveness. According to it, the country's competitiveness consists of four levels:

1) Meta-economic level: socio-cultural factors; value system; the country's political-economic clout; capacity to formulate strategies and policies.

2) Macroeconomic level: budgetary policy; monetary policy; fiscal policy; competition policy; trade policy. 3) Meza economic level: infrastructure policy; educational policy; industrial policy; environmental policy; regional policy; import and export policy.

4) Microeconomic level: management competence; company strategy.

The WEF's national competitiveness assessment is based on the Global Competitiveness Index (2019), which comprises several indicators measuring certain aspects of competitiveness, grouped into composite factors in terms of content, which form 12 groups of competitiveness factors (Table 1).

Table 1

The content of the Global Competitiveness Index

Groups of Factors	Factors
Institutions	Public institutions (property rights; ethics and corruption; abuse of influence; government efficiency; security); private institutions (corporate ethics, accountability)
Infrastructure	Transport infrastructure; electricity and telephony infrastructure
Macroeconomic environment	
Good health and primary education	Health; primary education
Higher education and training	Scope of education, quality of education, staff training
Product market efficiency	Competitiveness (internal competition; foreign competition); quality of demand conditions
Labour market efficiency	Flexibility; efficient use of talents
Growth of financial markets	Efficiency; reliance, loyalty
Ability to harness progressing technology	Technology uptake; the use of ITT
Market size	Local market size; foreign market size
Business literacy	
Innovation	

Global Competitiveness Index report (2019) covering 141 economies measures national competitiveness—defined as a set of policies, institutions, and factors that determine the level of productivity. Moldova was also ranked 86th.

The research objects of researchers studying competitiveness are different. Therefore, the analyzed and described factors of competitiveness are different. As a reason, there is no single and universally accepted methodology for assessing the country's competitiveness. Competitiveness is a set of factors, institutions, and policies that determine the level of productivity.

The Institute for Management Development (IMD, 2017), an independent academic institution with Swiss roots and global reach, started the World Digital Competitiveness measuring (2017). Based on IMD, World Digital Competitiveness (WDC, 2017) analyzes and ranks to which extent countries adopt and explore digital technologies leading to transformation in government practices, business models, and society.

IMD World Digital Competitiveness Ranking measures the capacity and readiness of 63 economies to adopt and explore digital technologies as a critical driver for economic transformation in business, government, and broader society. Based on institute research, the methodology of the WDC ranking defines digital competitiveness into three main factors: knowledge, technology, future-readiness. Moldova was not included in the digital latter ranking.

Business confidence in Moldova is low, while the macroeconomic framework remains vulnerable. Transparency, accountability, and corruption are crucial concerns and external budget support, which is based on an agreement with the International Monetary Fund, has a high level of

conditionality. To improve this situation, the Moldova government must carry out critical economic reforms and create a rule-based, effective and accountable environment for businesses.

However, the recent election of Parliament shows that country is split between pro-Russian and pro-European political powers. However, neither of these groups didn't gain the majority, which puts the country in a situation of political instability.

The influence of the industry sector on Moldova's GDP is around 15%. Industry sector in Moldova consist of mining and quarrying (B); manufacturing industry (C); decontamination activities (D). The distribution and influence of these segments on Moldova GDP can be seen in Table 3 (Statbank, 2020); production and distribution of electricity and heat, gas, hot water and air conditioning (D); distribution of water, sanitation, waste management.

Table 2

Contribution of economic activities in the GDP formation, %

Year	2014	2015	2016	2017	2018	2019
(B) Mining and quarrying	0.3%	0.3%	0.2%	0.2%	0.2%	0.3%
(C) Manufacturing	11.6%	12%	11.9%	11.6%	11.2%	10.6%
(D) Production and distribution of electricity and heat, gas, hot water and air conditioning	2.5%	2.5%	2.5%	2.4%	2.5%	2.3%
(E) Distribution of water, sanitation, waste management, decontamination activities	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%

According to the statistics department of Moldova, the industry sector was on the rise during the period of 2014-2015 and started to decrease from 2016 to 2019 (Statbank, 2020). Out of four segments, manufacturing is by far the most significant sector, and it saw the most significant increase over the period of 2014-2019. Sectors D and E showed an upward trend. However, it wasn't substantial compared to manufacturing. Last but not least, the Mining and quarrying sector remains the same.

The main factors which led to the growth of the industrial sector are: the expansion of the foreign investor's activities, especially in the automotive industry, the positive developments in the agricultural sector that stimulated the growth of the food industry, the increase of domestic and foreign demand for national industrial products, due to the opening of the foreign and the implementation of the international economic cooperation agreements.

Despite its growth and importance to the country's economic performance, the manufacturing sector has to improve. The structure of the manufacturing segment is dominated by resource-based businesses, which account for almost half of manufacturing companies (45.2%). Low-tech and medium-tech manufacturing companies account respectively 26.1% and 25.2%. The share of high-tech companies is extremely low and makes up only 3.5% of all manufacturing businesses (Competitive Industrial Performance Index, 2020). Finally, the manufacturing sector composition is mainly dominated by food and beverages production. This segment accounts for 40.4% of all manufacturing production. The other four most significant segments are wearing apparel, fur (10.9%); non-metallic mineral products (9.4%).

Data of 2016 shows a total of 51,600 SMEs in Moldova or 98.7% of total registered enterprises (Table 6). 20,300 or almost 40% of the total number of SMEs are active in the wholesale and retail trade. The second largest category represented by SMEs is the "other" with manufacturing and professional services, scientific and technical activities representing the third

largest category with an equal amount of 4,400 SMEs each (or 8.5% of the total number of SMEs). SMEs sector in 2016 employed 313,500 employees or 61.2% of the entire workforce. However, it should be noted that micro-enterprise is the most significant segment in SMEs structure and makes up 85.1% of it. Despite that, a number of employees in the SMEs segment are distributed relatively equally. Small and medium-size enterprises contribute a total of 31.4% of GDP in Moldova. In terms of income, SMEs have generated a total of nearly €2.5 billion in 2016. The main contributing sectors are wholesale and retail trade with approximately 49% and manufacturing industry with approximately 11%.

Table 3

Indicators related to the SME activity in 2016

Indicator	Number of units, thousand	Percentage of total in RM %	Number of people, thousand	Percentage of total in RM %
Total SMEs of which:	51.6	98.7	331.5	61.2
Medium-sized enterprises	1.3	2.5	101.5	19.8
Small enterprises	5.8	11.0	107.2	20.9
Micro enterprises	44.5	85.1	104.8	20.5

Research results. SWOT Analysis is a decision-making method, and it has been widely used in the management process. SWOT analysis has successfully been applied in identifying and solving problems (Mainali, 2011). SWOT analysis was applied to evaluate the current situation and future possibilities for the Moldova industry sector. This method is selected because it can incorporate the present conditions (through strengths and weaknesses) and the future conditions (through opportunities and threats).

The research adopts an expert interview approach to gather information. The main input for the SWOT analysis was knowledge and information collected through interviews with relevant experts. Experts interviews is a popular method of gathering information in various fields of political and social science. It can provide insight and valuable knowledge in the relevant field. It is also considered an efficient and concentrated method of gathering data, especially in the exploratory phase (Bogner et al. 2009).

Selecting the relevant experts is essential to gather usable information. The experts interviewed for this research compose of people who work closely in digitalization or competitiveness. Also, the triple helix approach was used to involve experts from Government, industry, and academia.

The interview was conducted through one-to-one interviews. The responses were collected from the respondents using a mixture of open-ended and scaled questions. To provide a quantitative assessment, the respondents were asked to rank their preferred option using the scale of 1 to 5 (1 - most unsuitable, 5 - most suitable).

In terms of its positive qualities (strengths and opportunities), the respondents emphasise on different aspects of Moldova industry sector. In order to understand the current situation and future possibilities for Moldova industry sector, SWOT analysis has to be performed (Table 5). Based on it, recommendations and measures will be drawn.

Table 8

SWOT analysis

Strengths	**Weaknesses**:
• Industry sector and manufacturing segment output is rising; • Well-developed, consistently updated public and private ICT infrastructure; • Moldova ranks 6th worldwide translating its innovation inputs into outputs • Digitisation solutions providers can supply a wide range of digitisation services (by increasingly participating in local and global value chains, related to ICT, robotics, automation, electronics, cyber security, digitisation solutions providers can offer services ranging from standard adaptable services to specialized services); • Moldova ranked 5th in regards to business friendly environment, according to fDi Manufacturing Locations of the Future 2018/19 ranking TOP 10 Manufacturing Countries of the Future 2018/19.	• Moldova innovation system consists of many institutions which whose competences overlap; • SMEs still lack appropriate education and entrepreneurial skills, understanding of HR remains low, digitalisation and modernisation of operations are still lagging; • Contribution of industry sector to Moldova's GDP is quite low (~15%); • Moldova export is mostly dominated by agricultural goods; • The manufacturing sector comprises only ~12% of country's GDP, which is low. Around 20% is considered to be optimal; • Issues in education and research system. Due to difficult social and economic situation since the country's independence, cuts were made for education and research which led to very low investments in these sectors over years; • Moldova R&I system presents several structural weaknesses such as low financing, ageing, migration and downsizing of the R&D personnel; • Country has 31 universities and 45 colleges, however only 4 universities and 6 colleges tech ICT. In 2016 just 823 students graduated with ICT related qualifications (out of 24,000 graduates); • Moldova competitiveness rating is low (According to World Economic Forum Global Competitiveness Index 4.0 2018 edition, Moldova is 88 out of 140 countries); • Moldova ranks poorly on the Corruption Perception Index. According to Transparency International's Corruption Perception Index 2014, Moldova ranks 103 on the list of a total 175 countries; • Differences between capital Chisinau and the rest of the country in regards to innovative activities; • Moldova manufacturing sector competition is interrupted. Moldovan manufacturing sector have an oligopolistic or monopolistic market structure. • Industry is dominated by micro and small companies that do not have an adequate demand or extent for the installation of digitisation technologies (since digitisation is more relevant for medium-sized and large companies); • Industry's technological readiness level is low (low- and medium-tech technological businesses dominate; industry is oriented towards the employment of used, second-hand manufacturing equipment and cheap labour; too little comprehension about what equipment is needed, how to optimally integrate and utilize it; few companies apply real-time analytics • There is a lack of systemic integration (the digital technological equipment companies have is acquired through separate initiatives and projects; there is a lack of systemic integration that would ensure a transparent transfer of data as well as horizontal and vertical integration within companies and in the exchange of data with other creators of the shared value chain; due to their price, such solutions, although available on the market, are often hardly financially obtainable for the local SMEs);

	• The majority of manufacturing companies produce/provide low added-value products/services • Issues with standardization and interoperability of systems (it is difficult to make different systems compatible and to integrate them together); • Too limited supply of qualified and specialized innovation support services. There are a lot of "generalists" amongst intermediation, facilitation and motivation service providers, but when companies need to solve concrete problems that require deeper, specialized knowledge, it becomes difficult to find such experts
Opportunities • The share of industry sector to Moldova GDP is on the rise; • Various strategic documents include industry sector as one of the priorities which has to be developed. However, industry digitisation isn't mentioned as a separate priority • Bringing back and attracting talents from abroad; • Vocational training and retraining of employees; • A promising innovative sector for the country is Information and Communication Technologies (ICT), which has gained weight similar to that of other CIS countries; • Integration with EU: Moldova is a member of Eastern Partnership with EU and has an Association Agreement with European Union signed in 2014. Integration with EU will provide various advantages and support measures. Country participate in Horizon 2020 and Smart Specialization Strategy; • International financial institutions readiness to support transformation processes; • Opportunities for business to get to know and use more financial support and measures; • In 2017 Moldova launched a number of reforms such as labour code or labour migration, however, the implementation and the effects of reforms are still unclear; • Clusters policy is present in some policy documents. Moldova is on the right track, understanding the importance of clustering, however there is a long way to go in regards to the development of it.	**Threats** • The industry digitisation market is, and remains, limited (due to industry domination by small companies or the state of the economy); • Manufacturing companies are not able to adapt and switch to global business models; • Imported digitisation technologies do not have an adequate support (in either projecting, installation or service) in manufacturing companies due to the lack of variety of such services and their quality; • Shortage of talents due to migration and flight of human capital ("brain drain") (internal migration from regions to cities; emigration from Moldova to foreign countries); • Deficit of professionals due to the current demographic situation; • The higher education institutions are not capable of preparing suitable specialists (due to the inappropriate digital technologies infrastructure aimed at study; due to insufficient lecturers'/vocational teachers' qualifications in industry digitisation matters); • Inflexible regulation of work conditions regarding organization and installation of digital workplaces in companies; • A fragmented and underdeveloped innovation support and innovation consulting services system that otherwise would make the creation and installation of digital innovations in industry more effective

Following the SWOT, the vision concerning the future of digitalized Moldova manufacturing sector can be established.

Internal/Company-related factors:

- Moldova is dominated by relatively small, smart and agile factories manufacturing higher value-added products for niche markets; flexible organizations can diversify rapidly to meet changing market needs.
- Moldovan capital and foreign capital companies operating in Moldova are deeply embedded in international value chains through ownership, production partners and realization markets.
- Moldova is a 'testbed' for new cutting-edge technological solutions created across Europe, Japan and USA – first deployed in Moldova industry for demonstration purposes; then,

spread across all of Europe. Therefore, Moldovan solution providers and solution integrators always work with the latest technologies.

External/Environmental factors:

- Moldova provides access to a variety of specialists that the industry demands, as required, for digitisation.
- Moldova provides opportunities for lifelong learning, non-formal education and competence enhancement, through industry-university/college-cooperation.
- Moldova is a destination of choice for talented professionals from abroad and international students (who stay and work in Moldova after their studies).
- Moldova remains in the top European states that continually sustain a state-of-the-art infrastructure for industry development (accessible transportation, logistics, and energy in every corner of the country, as well as ICT appropriate to the 5G network and Industry 4.0).

Moldova industry digitisation action plan should be supported by 4 pillars: Knowledge, People, Infrastructure and Environment. Each of these foundations encompasses distinct target priorities identified by experts and addressed by specific policy measures.

Knowledge considers technologies and business models that will become integrated through value chains.

People refers to policy-makers, researchers and creators, enablers, and intermediaries that will play a critical role in the digitisation of industry along the private sector and investors.

Infrastructure regards services infrastructure, demonstration infrastructure, and R&D infrastructure which, when combined, will provide the best possible conditions for manufacturing innovation.

Environment concerns the legal and regulatory environment, standards, and incentives system that will embed industry in a smoothly performing facilitation network within the local ecosystem.

Strategic pillars cover areas that are in most need of action in order to achieve the digitalised industry's vision (Picture 1). To overcome these challenges, digital competences and skills must be developed to assist companies in creation, adoption and implementation of digital solutions. By using opportunities provided by digitisation, companies would become enabled to increase their productivity, production value and to internationalise.

Conclusions. The country's competitiveness is directly proportional to the country's level of economic development. According to SWOT analysis, general strengths on which Moldovan industry digitalisation will rely can be distinguished. It rely on the fact that manufacturing sector output is increasing – the contribution of the manufacturing sector to national GDP is around 12%, however it is on the lower side compared to other EU countries. Despite that, recent years indicate the rise of the output of this industry segment and industry digitisation will further encourage this process. Secondly, public and private IRT infrastructure is well-developed – is consistently updated, provides world-class internet access, and allows faster digitization. Thirdly, the growing capacity of digitization solutions providers - supply a wide range of services by participating in local and global value chains.

Industry digitalization will address weaknesses such as SMEs dominate the local industry with low-level technology readiness, which currently limits investment in the overall advancement of manufacturing. Secondly, production is dominated by contract manufacturing of low value-added products, which limits the need for cutting-edge technological solutions and does not require much cooperation between Moldovan research and industry. Thirdly, siscrepancies appeared between academia and industry's needs and the digitization incentives system is fragmented and has many elements with poorly functioning links between them. Moreover, partnership culture develops slowly and hinders collaboration and cooperation between major actors in the ecosystem and ordinary B2B relationships.

Implementing these measures are expected to grant the following benefits:

- Higher rankings/better ratings across a range of indicators that measure the state's performance in digitisation and/or innovation at European level and globally
- An increased number of companies carrying out innovation activities
- An increased number of companies that benefit from tax reliefs
- A growing share of GDP generated by high-tech companies
- An increasing number of employees working in high-tech companies
- A more effective innovation system
- Better adaptation to pan-European and global standards
- New services for businesses
- The national network of Digital Innovation Hubs that provide specialized digitisation services
- An increased ratio of medium to high-tech companies compared to all companies
- An increased number of registered patents
- A reduced regulatory burden for companies carrying out innovation activities
- An increased number of PhDs working in the field of industry digitisation
- Reviewed and updated study programmes
- New and interdisciplinary study programmes in relation to industry digitisation
- New scientific and technology demonstration equipment
- An increased number of professionals attracted to industry from abroad
- Increased private company investments in innovation activities
- Increased added-value generated by manufacturing enterprises
- Increased manufacturing companies' turnover
- An increased number of projects funded via public-private partnerships
- An increase of exports in identified value chains
- An increased number of companies that benefited from state support to get involved in international value chains

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ЦИФРОВА ТРАНСФОРМАЦІЯ ТА ЗБІЛЬШЕННЯ ПРОМИСЛОВОСТІ МОЛДОВИ SWOT-АНАЛІЗ

Анотація. Цифрова трансформація стала реальністю в Молдові, оскільки Молдова почала переводити соціальні, юридичні та державні послуги в онлайн. Можна очікувати, що прискорена цифровізація створить нові бізнес-моделі та можливості для переходу на цифрові технології в традиційних галузях. Коронавірусна криза підкреслила потребу в підтримці та інвестиціях у цифрову трансформацію та ефективне цифрове управління, особливо для гарантування безперервності та виконання основних державних функцій. Цифрова трансформація змінює не лише бізнес-моделі, але й методи виробництва та розподілу, а також конкурентоспроможність галузі. Конкурентоспроможність країни прямо пропорційна рівню економічного розвитку країни. Відповідно до SWOT-аналізу можна виділити загальні сильні сторони, на які спиратиметься цифровізація промисловості Молдови. Він базується на тому факті, що виробництво промислового сектору зростає – внесок промислового сектору у національний ВВП становить близько 12%, однак він є нижчим порівняно з іншими країнами ЄС. Незважаючи на це, останні роки свідчать про зростання виробництва в цьому сегменті галузі, і оцифрування галузі ще більше сприятиме цьому процесу. По-друге, державна та приватна інфраструктура IRT добре розвинена – постійно оновлюється, забезпечує доступ до Інтернету світового рівня та дозволяє швидше оцифровувати. По-третє, зростає спроможність постачальників рішень для оцифрування – надавати широкий спектр послуг, беручи участь у локальних і глобальних ланцюжках створення вартості. Було проведено інтерв'ю з експертами, які тісно працюють у сфері цифровізації чи конкурентоспроможності, а також проведено SWOT-аналіз. На основі проведеного дослідження були підготовлені рекомендації для Молдови, які представлені в цій статті.

Ключові слова: *цифровізація, виробництво, промисловість, Молдова, конкурентоспроможність*
Табл.: 8, бібл.: 30.