

---

# Industry 4.0 in manufacturing enterprises

---

## Vladimíra Biňasová, Ing., PhD., DiS.\*

Department of Industrial Engineering, Faculty of Mechanical Engineering,  
University of Žilina,  
Univerzitná 1, 010 26 Žilina, Slovak Republic.  
E-mail: vladimira.binasova@fstroj.uniza.sk, Tel.: + 421 41 513 2727

## Peter Bubeník, doc. Ing., PhD.

Department of Industrial Engineering, Faculty of Mechanical Engineering,  
University of Žilina,  
Univerzitná 1, 010 26 Žilina, Slovak Republic.  
E-mail: peter.bubenik@fstroj.uniza.sk, Tel.: +421 41 513 2719

## Miroslav Rakyta, doc. Ing., PhD.

Department of Industrial Engineering, Faculty of Mechanical Engineering,  
University of Žilina,  
Univerzitná 1, 010 26 Žilina, Slovak Republic.  
E-mail: miroslav.rakyta@fstroj.uniza.sk, Tel.: +421 41 513 2737

## Marta Kasajová, Ing., PhD.

Department of Industrial Engineering, Faculty of Mechanical Engineering,  
University of Žilina,  
Univerzitná 1, 010 26 Žilina, Slovak Republic.  
E-mail: marta.kasajova@fstroj.uniza.sk, Tel.: +421 41 513 2707

## Katarína Štaffenová, Ing.

Department of Industrial Engineering, Faculty of Mechanical Engineering,  
University of Žilina,  
Univerzitná 1, 010 26 Žilina, Slovak Republic.  
E-mail: katarina.staffenova@fstroj.uniza.sk, Tel.: +421 41 513 2740

**Abstract:** The paper deals with the analysis the options available to companies for improving the production enterprises as part of the transformation to *Industry 4.0*. Digital transformation involves the integration of digital technologies and solutions into every area of business. This is a cultural change rather than a technological one, requiring organizations to make fundamental changes in the way they operate and how they deliver experiences and benefits to customers. Digital solutions also help expand the workforce and can lead to the transformation of business processes and business models.

**Keywords:** Industry 4.0, digital transformation, digital solutions, business models.

---

## INTRODUCTION

Businesses should consider steps and have a discussion with a software vendor to help begin creating a strategic transformation, plan, and learning which solutions are best for unique business needs.

The meaning of the individual steps is as follows:

- a) Determining the starting point: In order to give the project an initial head start, it is necessary to first search within the company for processes that have a high operational priority and have the least complicated path to transformation.
- b) Defining priorities: Digital transformation does not have to happen all at once. Like building

elements, smart technologies are designed to evolve, expand and integrate.

- c) Inventory building: A significant benefit of smart technologies lies in their enormous scalability and ability to quickly adapt and reconfigure. A great transformation plan should allow for agility and growth, but you need to start with a plan that has some strong and achievable goals. It is necessary to seek support from specialized professionals who understand unique needs and they can help chart the best course for the business.
- d) Preparing teams: Smart technologies can help reduce the number of repetitive and time-

consuming tasks, improve employee engagement and promote collaboration. However, these benefits can only be realized when everyone on the team agrees to the transformation. There is no need to mislead the teams with news. It is necessary to learn from their input and ideas, openly address their concerns and give them time to change.

When examining the issue more deeply, it is found that it is not actually the new technologies or business innovations that are at fault. The weaknesses were poor planning, poor communication and change strategies, and a general failure of executives and project managers to involve and seek to involve all teams affected by the change.

## **1 DIGITAL TRANSFORMATION ON THE TERRITORY OF THE SLOVAK REPUBLIC**

The results of the survey on the level of digitization and implementation of *Industry 4.0* in *slovak* companies show that only 8 % of companies are currently preparing an implementation strategy. A third of companies are still only collecting information about digitization and trying to find their way around the issue (35 %). Despite the still low share of digitizing companies, 58 % of the total number of businesses surveyed consider it important for their future. Of those that have not yet started with the *Industry 4.0* application, up to 86 % of businesses see the need to digitize. As part of internal processes, companies plan to digitize primarily production (66 %) and logistics (46 %). Regarding external processes, they see the digitalization of communication with customers (68 %) and communication with the supply chain (52 %) as the most urgent. Today, 23 % of enterprises in *Slovakia* are undergoing digital transformation. In a three-year view of the share of digitizing companies, a continuous decrease is recorded [1].

The pace of transformation is hindered by rising inflation, rising prices of materials, energy and fuel, as well as uncertainty associated with domestic political turbulence and the war conflict in *Ukraine*. These circumstances determine companies' priorities, influence the attitude towards digitization and the pace of *Industry 4.0* application. Despite the difficult situation, almost two-thirds of companies already digitizing continue to do so, 11 % of companies even intensified their application activities this year. Conversely, 14 % of companies stopped transformational changes due to unfavorable global circumstances. Almost half of all respondents (49 %) claim that digitization would help them in current situations associated with crises [6-7].

One of the fundamental problems that the survey re-

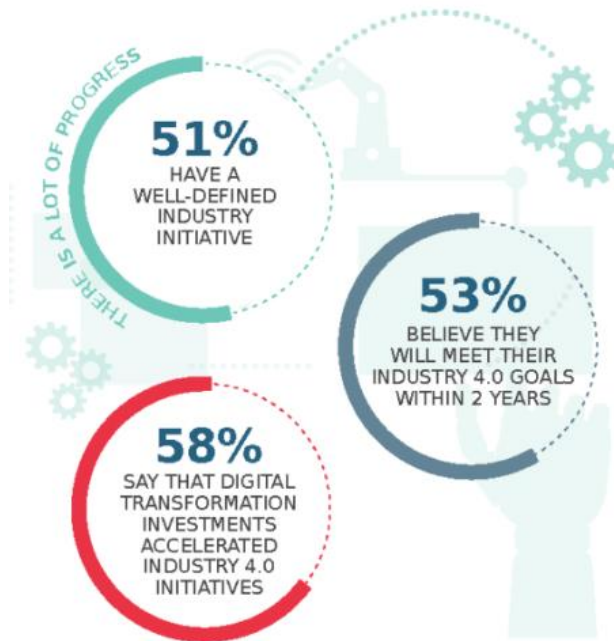
peatedly names is building a corporate culture supporting the digital transformation of businesses. Companies lack strategic and application teams, do not build an environment for the development of innovations, do not properly understand the role of management in connection with the preparation and management of a digital strategy. The survey showed that only 10 % of companies have established a separate department or a special team tasked with creating a strategy and dealing with the *Industry 4.0* application. Today, only 15 % of companies have an innovation management system. "The values in these parameters have been very low for a long time. Businesses still do not realize that it is innovations that drive industrial production and strengthen them against the competition [2-5].

The basic obstacle to the development of digitalization is the lack of knowledge about digitalization in industry. Businesses want to digitize, but don't know how. Despite this, almost half of the companies (43 %) confirmed the leadership of employees to learn and develop in the field of digitization and digital skills. This fact can be a promise for solving the persistent lack of experts with skills corresponding to the demands of current digitization trends. The need for a constant influx of information related to digitization remains urgent. More than half of the companies (55 %) lack the information needed to apply digital solutions, do not know where to get them, do not have an opinion on their availability or cannot comment on the issue. Only more than a quarter of enterprises (28 %) have the necessary information for their development [3].

## **2 SURVEY ON THE STATE OF PROGRESS IN THE FIELD OF INDUSTRY 4.0 IN THE WORLD**

Molex, a global leader in electronics and connectivity innovator, a *US*-based company, announced the results of a global survey of stakeholders in *Industry 4.0* manufacturing that drives advances in robotics, complex machines and devices or control systems. The findings reflect steady progress in the development of *Industry* initiatives 4.0 across the entire industrial automation ecosystem, including intelligent automation, connectivity and analytics that increase efficiency and intelligence throughout the manufacturing lifecycle. *Molex* commissioned a third-party research firm, *Dimensional Research*, to conduct a June 2021 *State of Industry 4.0* survey with 216 qualified participants in various roles such as *R&D*, engineering, manufacturing, strategy, innovation and supply chain management [9]. Key findings from the survey are that 51 % of respondents' report having a well-defined *Industry 4.0* corporate priority with executive sponsorship; 49 % have already achieved success, while 21 % are still in the

investment stage. More than half of respondents expect to meet their *Industry 4.0* goals within two years, while a third believe it will take three to five years to reach this milestone. 58 % of respondents say investments in digital transformation have accelerated *Industry 4.0* efforts. 44 % of respondents consider organizational and cultural barriers to adoption to be the most difficult to overcome [9].



**Fig. 1. Progress of Industry 4.0 in enterprises**

According to the survey, among the most influential business results are the ability to create better products (69 %), reduce total production costs (58 %), increase revenues (53 %), offer products at lower prices (35 %) and reduce time to market for new solutions (35 %). For machine designers, robot manufacturers and system integrators, the opportunity to expand automation and intelligence at the factory level is expected to bring significant gains [9].

## CONCLUSIONS

The following results were found from the analysis:

- Most of the world's enterprises and companies are already digitally transforming their production facilities [10-11].
- Digital transformation will pay off for companies, the cultural area of the company will take the most work during the transformation.
- Enterprises during the transformation should pay attention to better planning, better communication and change strategy, and in general senior staff and project managers should.
- Involve all teams that influence the change.
- The share of digitizing companies in *Slovakia* is continuously decreasing in a three-year perspective.

- Businesses in *Slovakia* want to digitize, but do not know how.
- Companies lack experts and teams that would plan and implement digital transformation in the company.
- Businesses in *Slovakia* consider digital transformation to be important and necessary for implementation.
- The transformation to *Industry 4.0* in the world is continuously progressing, more than half.
- Enterprises fulfill their transformation goals within two years.
- Companies in the world list organizational and cultural barriers to acceptance as the most difficult to overcome.
- Companies in the world have announced, thanks to the transformation to *Industry 4.0*, the creation of better products, production efficiency, reduction of production costs.
- Companies that upgraded their businesses to *Industry 4.0* managed the *COVID-19* pandemic.
- Businesses that did not innovate their businesses to *Industry 4.0* had major problems during the pandemic, and will also have problems with digital transformation after the pandemic.
- The *COVID-19* pandemic has significantly reduced the spread of *Industry 4.0* businesses around the world.

To make businesses more flexible, cheaper, faster and more responsive to business trends, *Industry 4.0* provides solutions and ways for businesses to meet these challenges through digital connectivity that will improve efficiency and accelerate innovation and introduce new business models. Today, customers demand individually tailored products and services, and smart objects, products and machines allow manufacturers to produce original products without increased costs. As machines gradually improve, work in production lines becomes more and more humanized, and workers will operate the machines and intervene only when the machines ask them to take action. Workers will be assigned where human intervention is needed.

## Acknowledgements

*This work was supported by the Slovak Research and Development Agency under contract No. APVV-19-0305.*

## REFERENCES

- Digitálne sa transformuje len štvrtina podnikov* (2022): [cit. 2023-04-04]. Dostupné z: <https://industry4um.sk/digitalne-sa-transformuje-len-štvrtina-podnikov-napriek-zlozitejhospodarskej-situacii-je-vacsina-odhodlana-digitalizovat/>

- [2] ELIAČIK, E. (2022): *AI in the manufacturing market will rise by 14 billion dollars in 5 years (learn why)* [online], [cit. 2022-07-06]. Dostupné z: <https://dataconomy.com/2022/08/artificial-intelligence-in-manufacturing/>
- [3] ANTONIUK, I. - SVITEK, R. - KRAJČOVIC, M. - FURMANNOVA, B. (2021): *Methodology of design and optimization of internal logistics in the concept of Industry 4.0*. In: *Transportation Research Procedia*, 55, 503-509.
- [4] BUCKOVA, M. - GASO, M. - PEKARCIKOVA, M. (2020): *Reverse logistic. InvEnt 2020: Industrial engineering – Invention for enterprise - proceedings*. In: Bielsko-Biała: Wydawnictwo Akademii Techniczno-Humnistycznej.
- [5] BENES, P. et al. (2014): *Automatizace a automatizační technika 3*. Bmo: Computer Press, 304 s., ISBN 978-80-251-2523-6.
- [6] BURGANOVA, N. - GRZNAR, P. - MOZOL, S. (2020): *Design of logistics system in production*. In: *Technologie, procesy i systemy produkcyjne Bielsko-Biała* : Wydawnictwo naukowe Akademii techniczno-humanistycznej w Bielsku-Białej, ISBN 978-83-66249-56-1, p. 11-18.
- [7] VAVRIK, V. - FUSKO, M. - BUČKOVÁ, M. - GASO, M. - FURMANNOVÁ, B. - STAFFENOVA, K. (2022): *Designing of machine backups in reconfigurable manufacturing systems*. In: *Applied sciences*, ISSN 2076-3417, Vol. 12, No. 5, p. 1-27.
- [8] FILIPOVA, I. - DULINA, L. - BIGOSOVA, E. - PLINTA, D. (2021): *Modern Possibilities of Patient Transport Aids*. In: 14th International scientific conference on sustainable, modern and safe transport (Transcom 2021). Virtual conference 26-28 May, Slovakia, *Transportation Research Procedia*, 55, pp. 510-517.
- [9] PASINI, R. (2021): *The state of Industry 4.0, survey says* [online], [cit. 2023-02-05]. Dostupné z: <https://www.designworldonline.com/the-state-of-industry-4-0-surveysays/>
- [10] SUKALOVA, V. - STOFKOVA, Z. - STOFKOVA, J. (2022): *Human Resource Management in Sustainable Development*. In: *Sustainability*, Vol. 14, No. 21, 14258.