

## CHALLENGES OF DIGITAL TRANSFORMATION IN THE AGRI-FOOD SECTOR

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### **Abstract**

Technology has been completely revolutionizing the present era and digital transformation is expected to have a major impact on almost any industry. Agri-food industry SMEs which face everyday problems and which could be possibly solved by digitalization. Considering the fact that other industrial sectors are often more advanced in digitalization than the agricultural sector, this article aims to analyze the challenges existing in the process of digital transformation by SMEs in the agri-food sector in Lithuania. Considering that, hackathons have become increasingly popular in recent years as a modern tool for innovation, the research is based on HackAgriFood'19 hackathon use case. It has attracted the attention of more than 60 SMEs acting in the Agri-food industry actively. As a result, challenges of adaptation of digitalized products and services by Agri-food sector SME's were identified and they are presented in this article.

### **Key words:**

Digitalization, digital transformation, agri-food, hackathon SMEs, Industry 4.0.

**JEL Classification:** F63, O13, O32, O33

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### **Introduction**

A number of important technological and organizational trends leads to digital transformation that gradually permeates all sectors, including the agri-food sector. The digital transformation has the potential to empower small-scale farmers (CEPS, 2019), but lack of skills, time, competences and resources connected with management, financial resources, market information and digital capabilities are only some examples of internal and external challenges connected with digital transformation.

European economy is driven by more than 25 million SMEs representing 99.8% of all EU enterprises (EASME, 2019) and digital transformation can bring new opportunities for SMEs, not only for big enterprises. Companies need to rapidly learn and incorporate innovative ideas into new products and services. According to Powell (2017) digital technologies will lead to the next agricultural revolution, potentially reversing some of the most negative effects of the "green revolution" witnessed by the sector a few decades ago.

The article aims at identifying the challenges existing in the process of digital transformation by SMEs in agri-food sector in Lithuania which were identified during the hackathon.

### **Industry 4.0 and Digital transformation**

Technology has been completely revolutionizing the present era and digital transformation is expected to have a vast impact on almost any industry, digitalization can bring new opportunities for SMEs by improving the entire value chain (Kilimis, 2019). In scientific literature, authors emphasize the importance of industry digitization (Wang, 2016; Qin & Liu, 2016). They state that companies need to implement the latest technology. The fourth industrial revolution will have a monumental impact on the global economy, so vast and multifaceted that it makes it hard to disentangle one particular effect from the next (Schwab, 2016).

Digital transformation can be defined as a "a change in all job and income creation strategies, application of a flexible management model standing against competition, quickly meeting changing demands, a process of reinventing a

business to digitalize operations and formulate extended supply chain relationships; functional use of internet in design, manufacturing, marketing, selling, presenting and data-based management model” (Schallmo et al, 2018).

Digital transformation can significantly contribute to improvement of products and/or services, management of operations in a more efficient way. It can also trigger costs reduction or can help to a gain competitive advantage in the market. Ulas (2019) pointed out several driving factors expediting digital transformation that include, among others, globalization, advancement of technology and innovation, electronic commerce and social media. The idea of an interconnected world has also gained attention from the industry sector, and the vision of a fourth industrial revolution is emerging, popularly known as Industry 4.0 (Kang et al. 2016).

Experts highlight four areas for which digitization technologies will have the greatest impact: productivity, revenue growth, employment and investment (Rußmann et al. 2015). The development of Industry 4.0, artificial intelligence, Internet of Things (IoT), blockchain, cloud computing, augmented reality, 3D Printers, chatbots, Big Data and nanotechnology have been speeding up the process of digitalization.

Industry 4.0 is referred to the fourth industrial revolution where manufacturing process is digitized, machines are directly connected to each other and personalized manufacturing is possible (Ulas, 2019). Experts highlight four areas for which digitization technologies will have the greatest impact: productivity, revenue growth, employment and investment (Rußmann et al. 2015). The increasingly affordable hardware and software solutions accelerate the transition towards the smart and interconnected factory envisioned by Industry 4.0 (Almada-Lobo 2016).

Stoldt et al (2018) highlights that companies can implement two strategies to digitalize their business - transform their processes and production sites incrementally or implement radical change by exchanging entire processes and systems with fully digitalized ones. According to Stoldt (2018) SMEs typically do not have the economic strength to sustain such a revolution but are eager to employ novel technologies in their factories to raise their competitiveness.

### **Industry 4.0 in Lithuania**

Despite efforts, Europe’s role in the global data and platform economy is limited and the uptake of digital technology by SMEs is low: 90 % of SMEs and 60% of large companies are lagging behind (Berger, 2015). While Lithuanian manufacturing industry is enjoying a period of dynamic growth, rapidly rising labour costs and lagging productivity as well as dominance of low value-added technology sectors in manufacturing systems in Lithuania’s put considerable pressure on the competitiveness of the Lithuanian manufacturing sector. Strengthening automation processes in EU industry can lead to additional competitive pressure on Lithuanian manufacturing companies.

Lithuania stands quite high in the size of the manufacturing sector (Eurostat, 2014) and occupy leading positions (higher than the EU average 15%). Lithuania managed to sustain or increase the share of manufacturing in GDP (Eurostat, 2017). In regard to the structure of the manufacturing sector, Lithuanian manufacturing is heavily dominated (80% of total production) by the medium-low and low-tech sector (Eurostat, 2014), while in many other countries’ economies, half of their manufacturing output is generated by the medium-high and high-tech sectors.

Obviously that situation of the lowest share of high-tech industry in manufacturing output in the whole EU has to change and manufacturing sector has to improve this by investing in business structure improvements and reorienting to this type of enterprise creation (Bickauske, 2020)

There are signs that businesses in Lithuania underinvest in digitalization processes. However, in order to remain competitive, companies will have to rethink their strategies concerning future investments.

### **Challenges faced by SMEs in their digital transformation**

Digital transformation can bring new opportunities for SMEs and open up new growth paths for development. According to Sommer (2015), only big enterprises will be able to reap the benefits from Industry 4.0 and that small and medium-sized enterprises (SMEs) can quickly become the victims of Industry 4.0. Many of SMEs find it difficult to know in which

technologies to invest and how to secure financing for their digital transformation. One of the most substantial contributions to future sustainability must come from a radical transformation of the agriculture and food (agrifood) value chain (CEPS, 2019).

Peillon and Dubrue (2019) propose a classification of possible barriers to digitalization for SMEs that include:

1. technical/technological barriers – related to financial limitations, lack of technical resources readily available that could easily upgrade and adopt digital technologies;
2. organizational barriers – connected to people’s unwillingness to change and need to change innovation management of key business operations, products, processes, organizational structures that require new competencies, resources, and collaborations
3. human resources-oriented barriers – linked to lack of qualified employees and lack of digital competences
4. customer-related barriers – associated with customers fear of a loss of control over information, such as privacy violations, security concerns and security of access to production and corporate systems.

Raymond (2005) listed the performance indicators that an SME can hope to improve after investing in new technologies: lower costs, improved quality, improved flexibility, improved productivity. Likewise, in his study of new technologies adoption in enterprises, Bayo-Moriones (2013) proposed a list of similar indicators with the addition of the criterion of reducing delivery lead times to this list. We therefore use the following performance indicators to measure the impact of Industry 4.0 on SMEs: flexibility, costs, productivity, quality and lead times. Despite that, SMEs feel lagging behind in digital innovation, its implementation process remains slow, and thus SMEs are at a risk of being left out from the digital supply chains. SMEs also tend to have misconceptions about the complexity and expense of digitalization (Kilimis, 2019).

Smaller enterprises will suffer because of the high investments needed, and the increased flexibility introduced by Industry 4.0 will allow bigger enterprises to steal market shares for customised products, a market segment now usually

dominated by SMEs (Rüttimann and Stöckli 2016).

Moeuf (2018) mention these industrial performance objectives of SME’s: flexibility, cost reduction, improving productivity, improving quality and delivery time reduction. According Moeuf (2018), flexibility is the most observed performance objective targeted by researchers, that could be surprising for practitioners, as flexibility is a common characteristic of SMEs that allows them to be differentiated from other firms.

### **Digital Transformation of Agri-food sector**

The application of digital and Industry 4.0 solutions in agri-food is very diverse – it can help to extend shelf life, monitor freshness, display information on quality, improve safety, and improve convenience - SMEs find it challenging to design new, digitalized business models adjusted to current economic realities. Rotz et al. (2018) focused on the technical and organizational challenges of digitalization in the agri-food. Moreover, they have problems in knowing which technology would be suitable for their business and how and where to find the right technology suppliers. SMEs of Agri-food sector are often located in rural areas with slow internet access and insufficient power supply. Lack of awareness, especially among the rural farmers, low level of digitalization of agri-food companies and low incomes of rural farmers, together with high costs of ICT infrastructure, insufficient personnel to handle ICT facilities and the absence of local content of language on internet are making digital transformation a challenge (Salampasis, 2013). On the other hand, the ICT companies are often located in urban areas, do not know technological needs of the agri-food sector and suffer the lack of knowledge on how to translate the benefits of digital solutions in an easy and understandable way.

Concerning the agricultural sector, multiple problems exist in the domain of agriculture, such as irrigation, the application of pesticides and fertilizers, and the monitoring of crops, land, and livestock (López-Morales, 2020). According to Brewster et al. (2012), a key challenge for ICT implementation in the agriculture industry is information management related to heterogeneity and very large number of actors along the supply

chain. Potential applications of ICT solutions in agri-food are very diverse, including, among others, software for supply chain or financial management, mobile applications for farm management, agricultural land use optimization, precision agriculture applications and other which fall into other categories of ICT-enabled services (Salampasis, 2013). Motivated by the digital transformation, the agricultural sector is providing its farms with new devices and services (sensors, actuators, weather information, drones, and satellite images) that allow for the optimization of the resources, to improve productivity and simultaneously reduce the impact on the environment (López-Morales, 2020).

Given that other industrial sectors are often more advanced in digitalization than the agricultural sector, it is useful to review innovations in other sectors as well. Cross-industry innovation, already existing solutions from other industries are creatively imitated and retranslated to meet the needs of the company's current market or products (Enkel, 2010).

This article aims to analyze the challenges faced by agricultural companies in Lithuania. In order to identify challenges in the agricultural sector in Lithuania, the hackathon method was used.

### **Hackathon - a method for challenge identification**

Recently, the necessity of interdisciplinary teams to address concrete challenges has become more and more apparent and hackathons are one of them. According to Oxford University Press (2020), hackathon is an event at which a large number of people work together developing computer programs, usually over several days. Hackathons are considered as emerging approach to supporting multidisciplinary innovation (Iqbal et al, 2018) and seen as an interdisciplinary experience where knowledge and skills gained could be applied in real world settings (Lyndon et al, 2018). Innovation requires extensive collaboration between a diverse group of stakeholders from disparate fields (Iqbal et al, 2018) and hackathon is a proper way to achieve this.

These events became widespread during the 2000s as software companies and venture capitalists used them to quickly develop new

software technologies, and to locate new areas for innovation and funding (Briscoe, 2014). The increasing application of digital tools in various environments have, and still are, reconfiguring organizational structures (Soltani, 2014).

Nowadays, hackathons can be implemented in many different ways. The most common elements that characterize hackathons are: (a) participants are organized into small groups that work intensely (sometimes around the clock), (b) a short time frame in which the project is taken from concept to prototype, (c) a centralized location where teams meet, work, and share resources and (d) support (technical, food, mentoring, etc.) provided by organizers and sponsors (Lara, 2016). Usually, the result of the hackathon is a created prototype for an innovative product, service or business model. One of the reasons for the popularity of hackathons is their symbiotic nature: everyone involved in a hackathon has the potential to benefit from it, including organizers, sponsors, and participants. (Lara, 2016). Innovation requires extensive collaboration between a diverse group of stakeholders from disparate fields (Iqbal et al, 2018) and hackathons provides a great opportunity for collaboration. Hackathons seduce and interpellate by enticing participants 'to subscribe to and desire their logic and to willingly and voluntarily participate in their ideology and practice' (Kitchinm 2011) through appealing to their sense of altruism and offering rewards, as opportunities, networks, friendship or prizes (Pernga, 2018). Being a part of the application of idea management and/or establishment of an ideation system, these ideation contests can be regarded as an early phase in the larger innovation processes undertaken by the firm (Cooper, 2008).

### **Methodology**

Hackathons have become increasingly popular in recent years as a modern tool for innovation. Therefore the research is based on HackAgriFood'19 hackathon use case. The case was chosen because it was the first hackathon, exclusively dedicated to Agri-food sector, in Baltic States. The event has attracted the attention of more than 60 SME's actively acting in Agri-food industry. This basically shows that the innovations and digital transformation definitely is a priority and the field of interest for the Agri-

food companies. The study was carried out between August and November in 2019.

The research has an exploratory character due to its novel topic and lack of similar studies in Baltic States. The studied companies were SME's from Agri-food industry based in Lithuania, but many of them having their offices in other Baltic states.

The information was gathered using expert interview method. Semi-structured interviews are a qualitative approach to collecting data. This method could also be described as an organized conversation that is guided by new information obtained. This case study is based on data collected during semi-structured interviews. These type of interviews helped to gather detailed and specific information from multiple perspectives on what challenges arise for the Agrifood SME's traveling the digitalization road. This research method is useful for understanding viewpoints of key stakeholders within an Agri-food sector because it allows the respondent to participate in the process and discuss concerns related to the research questions that are of primary importance to people acting in that particular environment. By digging deep into topic areas generated by participants, semi-structured interviews can help researchers understand how something occurs. The interviews were conducted with HackAgriFood'19 organizers, mentors and SME's owners, general managers, innovation and product managers. In total 100 experts have participated in the research.

### Empirical Data

"Digital agricultural revolution" is a new term explaining the changes as the traditional approach of the Agri-food industry is undergoing a fundamental transformation. As stated by Schwab (2016), by no doubt it offers significant opportunities through the availability of highly interconnected and data intensive computational technologies as part of Industry 4.0. Within it comes new struggles and challenges in adopting new ways.

HackAgrifood'19 stated main objective was to create new brake through innovations in Agrifood sector. To be the most efficient in pursuing the hackathon goal, it was decided to contact the most active Agri-food industry SME's which face everyday problems and which could be possibly solved by digitalization. More than 60 SME's

agreed to participate in the event and provide the teams with the challenges which need to be addressed. After gathering the information from companies there where six challenge topics created: data driven Agri-food; automatization, sensing and engineering; sustainability and efficiency; crowdfarming and sharing economy; post-harvesting; aquaculture. Based on these topics, during the interviews experts provided the challenges they think are faced the most.

### Agri-food sector SME's challenges

During the interviews almost all experts underlined the same global obstacles which arise no matter the type of Agri-food company during the process of adaptation of digitalized products and services.

Even though digital transformation of Agri-food sector is a highly prioritized topic, *the lack of understanding and picking the right digital skills* needed for the certain business is still a big deal. In many cases digital transformation is neglected simply because there is a low and in some cases even no understanding how digitalization should become the part of the business. How and where the technologies might help not only directly the SME's, but also to their end users, whom products and services are provided. Experts have pointed out that some SME's are more adaptable and easy transformable than others. It mainly depends on the business direct compatibility with digitalization. It is crucial to understand the potential of the digitalization for the SME's. Because in many cases it could lead to undesirable results or in worst case scenario cost the company more harm than good. So for successful transition careful analysis of processes should be performed by SME's decision makers to evaluate which digitalization steps would bring the biggest value for the company. Such a self-assessment could indicate the potential digital opportunities which could be directly applied to the company's structure.

*Recognition of the importance of digitalization* as such is another challenge. Experts agree that even though it seems very unlikely that one would not understand the role of the technology, the problem exists. It seems that Agri-food companies are very conservative in digital transitioning. In many cases for a company is quite hard to describe what digitalization should

really be. And it is not surprising since market is overfilled with different solutions, all being presented as digital transformation. Experts pointed out that it is in many cases forgotten that digitalization is not only about technology. For businesses it is important to remember that their customers' technologies usage increases rapidly every day. By saying that it should be pointed out that following everybody's direction to go digital, for SME' it is not a question of "if" anymore, it is rather a question of "when".

Agri-food industry players agree that they can be considered conservative towards technology. While mobile, social media, precision agriculture and remote sensing technologies are not new in Agri-food sector and have been used for a while. Big Data, cloud analytics, blockchain, deep learning, machine learning, Artificial Intelligence, robotics and autonomous systems bring meaning of the word "technology" completely to another level. The level where all the companies start to be concerned about how secure their data is and how can it be protected. So overcoming *the cybersecurity issue* becomes quite a challenge. This challenge is not easily handled for couple of reasons stated in the interviews. First of all it has always been quite a bit of distrust in Agri-food industry on cybersecurity. And now as the world becomes more and more digital, cyber-attacks are very common and by no means they bring much greater damage. So the consultation or even hiring the cybersecurity expert becomes a must for SME's. Which right away raises concerns not only on increasing expenditure, but the trust which must be built between a cyber expert and an SME. The data which must be protected is very sensitive since the business needs to be moved to the clouds. And another reason is that the most of the decision makers still do not except cybersecurity as a competitive tool that company could have. It is not yet seen as an advantage against competitors.

Lack of human (for example digital experts) and financial resources and the possibility of rising costs are one of the biggest fares for SME's aiming for digitalization in Agri-food sector. For many years agritech solutions have been seen as being expensive and in many cases they were. The perception of expensiveness and lack of trust in technology providers (which comes from not understanding the actual calculated costs) has created the thriving environment for such a

conception to grow. Despite overall mobile and internet services decreasing, affordability of technology products and services are still considered to be key barriers for digitalization adoption by most of the SME's. Experts agree that it needs to be put much effort to change that.

### Conclusion

There is no argument that AgriFood digital transformation is not easily achievable. SME's face many changes when pursuing the digitalization. The main challenges, as lack of understanding and picking the right digital skills needed for the certain business, recognition of the importance of digitalization and lack of human and financial resources were identified as the biggest challenges for digitalization in Agri-food sector during the research. Also, experts highlighted the importance of cybersecurity due to its growing importance related with Big Data, cloud analytics, blockchain, deep learning, machine learning, Artificial Intelligence, robotics and autonomous systems.

Digital Agri-food revolution, among all the sectors, is expected to deliver the highest impact in transforming the industry. It not only changes the way SME's handle their business, but also will transform the industry from the ground. The agrifood value chain is expected to change fundamentally. It will definitely affect market and change the way processing, retail, pricing and sales works. Consumer behavioural digitalization leaves no other choice for business but to adopt the technologies. Without moving forward, some SME's might not make it all.

There is no argument that AgriFood digital transformation is not easily achievable. SME's face many changes when pursuing the digitalization. With every change also come challenges for such a transforming strategy. SME's agree that the lack of understanding and picking the right digital skills are one of the most important bottle necks in digitalization. As the recognition of the importance of digitalization yet is one more very hard obstacle to overcome. Conservative view on technologies significantly slows down the chance to resolve the issues with cybersecurity, which might bring a lot of harm if unresolved. And finally the scarcity of the resources either human or financial brings out the fare of high technology costs. There is no doubt

that SME's which will remain the same and will not embrace the changing industry, sooner or later they will be disrupted themselves.

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