

Good Practices and Recommendations for Success in Construction Digitalization

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Abstract – Constantly increasing competition and challenges for construction enterprises in combination with the rapid development of information and communication technologies require digitalization of business processes related to this industry. The purpose of this research paper is to present analysis of good practices and recommendations for success in construction digitalization. Some common features of modern digitalization in the sector are outlined. Different approaches to digitalization and types of governance models that relate to these approaches are distinguished. Based on researched good practices for digitalization, a set of factors is derived, related to its potential for success. Guidelines for companies to follow in order to increase their chances of successful digitalization are proposed. The main method of analysis is content analysis of scientific publications and expert opinions of specialists from construction area.

Keywords – good practices, recommendations, digitalization, digital transformation, construction.

1. Introduction

Digitalization, as a progressive process of widespread use of information and communication technologies in business, is the focus of many companies' attention. Improving business models, work efficiency, innovation and the quality of management decisions, reducing costs, increasing company visibility and communication, putting the

customer in the center of activities and many other positive effects are the benefits that companies receive in the digitalization process. Awareness of its potential goes closely together with understanding the inevitability of the transition for those organizations that wish to prosper.

Digitalization in construction sector is developing at slow but steady pace in recent years. Substantial changes are noted, which are due to certain interrelated directions:

- Developing customer expectancies – influenced by different quickly changing markets, customer requirements are growing fast and getting more complex, with expectancies, focused more on the "use" than on the products.
- Advanced technological opportunities – there are a number of different technologies, available on the market, the cost of using them is decreasing and their efficiency is increasing.
- A new generation of professionals – innovative academic programs prepare young generations for jobs, related to new technologies. The implementation of new processes and software tools in the following years is expected to lead to the creation of lots of new jobs, which are not known today.
- Growth of start-up companies in the sector – start-up companies take advantage of market circumstances triggered by these tendencies, and try to occupy the newly created vacancies with added value.
- Supportive legal structures – Governments of many countries are increasing their regulations and targets. There are also increased requirements for data usage and cybersecurity in buildings and infrastructures.
- Launching major infrastructure changes – market needs are huge both in terms of new inter-city infrastructure networks and of partially upgrading current structures.

All participants in the industry – providers of equipment and materials, builders, engineering companies, vendors or promoters are expected to be affected by digitalization. Each of them can achieve it differently, but it is certain that the coming transition is significant. In this regard, the study of

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good practices for digitalization in the field of construction and making of recommendations for its successful implementation plays an essential role in this process.

The purpose of this research paper is to present analysis of good practices and recommendations for success in construction digitalization, based on a summary of scientific publications, practical examples and expertise of specialists in the subject area. The findings show some common features of modern digitalization in the sector, different approaches to digitalization and types of governance models that relate to these approaches. Based on the good practices for digitalization explored in the selected area, a range of factors is derived, related to its potential for success, and they are divided into five groups. Furthermore, guidelines for construction companies to follow in order to increase their chances of successful digitalization are proposed. The study is useful for other researchers, who work in the field of digitalization, including professionals and practitioners, who are considering how to implement the digital transformation in construction.

2. Literature Review

The impact of digitalization on the development, growth of businesses, and of national economies in general, poses and requires issues of a different nature to be addressed. The focus of digitalization in the construction industry has increased rapidly in the last decade and there are expected great changes in the years to come [1]. Different aspects of digitalization and digital transformation with application in construction companies are considered in large number scientific publications. For the industry to fully exploit the potential of digitalization in the future, it is necessary to study and implement good practices for successful digitalization in the sector.

A number of scientific publications and studies show that organizations in the sector are aware of the importance of digitalization for the construction industry. A group of authors [2] has conducted a literature study on digitalization to identify main research subjects in this area and to suggest guidance for future research. The researchers have linked digitalization, innovations in the business model and sustainability in industry environment. Their purpose is to bring forward academic discussion about the ways in which industrial companies can benefit digitalization for innovations in the business model. Especially, they search for knowledge regarding achievement of sustainable benefits for the industry, which represent the greatest potential for economic, environmental, and social impact.

Other author [3] explores the expected industry dynamic changes of potentially fully developed BIM-

usage in the construction industry. He finds out that BIM-maturity vary among the industry actors where the construction companies and engineering consultant companies are the most mature and the manufacturing companies, wholesaling companies and installation companies are in the early stage of BIM development and have a lower BIM-maturity.

Several scientists [4] present good practices and key learnings about how a company in the traditional construction industry can transform by adding digital technology throughout the value chain. They describe the digital transformation journey of Hilti Corporation – one of the world's largest companies in the construction and building-maintenance industry, manufacturing tools and providing services to construction professionals around the world. The case study outlines the digital innovation and transformation journey of the company that redefined its business processes and work, and made it a globally integrated enterprise that has achieved operational and customer-service excellence. Nowadays, Hilti uses the latest technology trends, such as cloud, mobile, Internet of Things and big data analytics, which facilitate innovations in digital quality and speed.

Other group of authors [5] focuss on digitalization in construction and explores the transformation in the UK construction industry that should ensure digitalization at scale to realize productivity increase, the creation of highly skilled jobs and increased UK export opportunities. They set out the potential for digitalization, comparing external factors with priority areas for the construction sector. Furthermore, enablers and recommendations for development are presented.

Some publications [6] are focused on BIM and its integration with ERP systems for better management and execution of construction projects. Furthermore, the integration of both systems (BIM and ERP) provides opportunities for positive impact on monitoring of business processes in construction companies.

In his research work Holzer [7] investigated various approaches for connection of BIM and ERP systems with Product Lifecycle Management. The provision of such a link allows exchange of information between BIM database, production planning and product structure.

Another study [8] addresses some problems connected with integration and interoperability between BIM and ERP systems – platforms for data exchange, impact of Leadership in Energy and Environmental Design (LEED) required documentation, building systems, guidelines for sustainable design, cost. Moreover, sustainable governance process is proposed which integrates project management practices and the organizational

competence to manage complex projects in construction lifecycle.

Some applications, future trends and opportunities of BIM - GIS integration in the architecture, engineering and construction (AEC) industry are also examined by a group of authors [9]. They use spatio-temporal statistical modelling for this purpose. Results show that BIM-GIS integration enables more comprehensive applications through the life cycle of AEC projects. The solutions, based on this integration, significantly benefit the management methods and coordination mechanisms, including quality management, progress management, time reduction, reduction and control of costs, improvement of health, safety and environment performance, information management and the coordination of various sectors.

Digitalization and BIM are also explored as processes for remodeling the construction industry [10]. Digitalization of the construction sector significantly reduces risks and enhances bankability of infrastructure projects, besides improving their viability and asset lifecycle. A great motivation from participants in the construction industry is noticed for identification of solutions that transform productivity and project delivery by innovative technologies and enhanced practices.

Other interesting topic that is examined in some scientific papers is the application of big data in engineering and construction industry [11], [12], [13]. The adoption of big data analytics and data-driven operations is becoming the new norm in the companies from this sector. Recommendations are given, which can help them to leverage their big data more effectively and without the need of a major investment in staff, equipment or devices. Current competitors and new entrants can use the results from the data analysis to compete, introduce innovations and gain value. Moreover, big data helps E&C organizations to drive out new growth opportunities, use new resources and optimize processes in unique ways.

This research paper is based on a qualitative review of academic articles, white papers and reported projections for the future of construction. In addition, practical examples are explored and expertise of specialists in the subject area is taken into account.

3. Analysis of Good Practices for Digitalization in Construction

The analysis of good practices for digitalization in construction shows some common features of modern digital transformations. The most frequently mentioned goals of organizations are to digitalize their operating model, launch new products and/or

services and use digital channels for interaction with their external partners. Usually, digital transformations have a broad scope, and they are associated with various functions or business departments, or with the entire company. In addition, the adaptation of different technologies takes up a significant part of digitalization and traditional web tools are used most often.

The study of successful digital transformations in the construction organizations shows that they involve more technologies than others. Such companies also use more advanced technologies, such as artificial intelligence, Internet of Things, cloud technologies and machine learning techniques.

More developed companies in terms of digitalization in the studied industry are focused on innovation in business models. Improving the value, convenience and overall customer experience are the key to their success.

Companies that are still lagging behind in digitalization are looking for ways to use modern digital technologies to change the way they deliver value or significantly reduce their costs. Therefore, they are mainly focused on transforming the cost structure through automation and innovation in business processes.

Since companies are at different stages of digital transformation, their approach to digitalization is different. There are two different approaches to digitalization and two types of governance models that are related to these approaches:

- Top-down approach – when digitalization involves changing the business model driven by strategic innovators. In this case, changes are needed throughout the value chain, value proposition and revenue model. The long-term vision of the company is well defined and the financed projects are in line with it. Responsibilities and impact are not limited to innovation through technology, but also include strategic business decisions such as new acquisitions, new products and service rollouts. Attracting technology companies is not about interest in specific products, but about looking for long-term partnerships.
- Bottom-up approach – when digitalization involves multiple small or medium-scale initiatives in the organization, led by digital experts. The focus is on specific goals (for example innovations in a business process), that stimulate a gradual change in productivity, employee engagement and improved customer experience. The emphasis is on quick profits, such as forecasting maintenance, automating repetitive tasks, making the workplace a safer place through the use of modern technologies, etc.

Both approaches have their own opportunities and challenges, but ultimately success comes down to how well digital initiatives are planned, prioritized and executed. Companies that intend to fundamentally transform their company culture apply both approaches simultaneously, i.e. strong digital leadership at the top to support digital professionals involved in various functions. The common thing among successful companies using these approaches is the emphasis on value for customers and business, while digital technology is a favourable factor.

Based on the digitalization good practices explored in the selected areas, a range of factors can be derived from its potential for success. These factors can be divided into five groups:

- leadership – the presence of appropriate, digitally literate management bodies in the organization that are engaged in digitalization;
- building digital capabilities – development of talents and skills in the organization related to the workforce of the future;
- new opportunities for employees – supporting new behaviours and working methods for employees by using formal mechanisms;
- improving tools for digitalization – adapting and using digital tools as a new standard for organizations;
- relationship – ensure frequent and good communication and collaboration between employees through traditional and digital methods.

These categories show the areas and ways that help companies on the path to successful digital change in their businesses.

4. Recommendations for Successful Digitalization in Construction

As a result of the analysis of the good practices for digitalization in the studied area and the factors outlined above, guidelines can be proposed for companies to follow in order to increase their chances of successful digitalization.

- Developing a digitalization strategy

Digitalization requires strategy. In order to guide and coordinate the vision, customer experience, processes and technologies, the digitalization strategy has to outline the main goals, expected developments and related actions. The digital strategy has to represent the identity of the organization in the digital world. Its rigorous implementation is of particular importance for the successful completion of the transformation. However, having a good strategy is not enough. Business success depends mainly on the involvement of employees and the company culture.

- Rethinking the workplace

Success requires both leaders in the digital realm and a workforce capable of making changes in digitalization. The implications of technological trends, automation and digitalization are essential for employees. In this regard, companies should consider carefully how their business is affected by digitalization in the short and long term, and to provide and hire people with entirely different skills and abilities. One important step for any organization is to develop a clear strategy to modernize its workforce. This should include adapting technology to engage employees and determining their digital skills and abilities necessary to achieve the company's future goals.

- Improving internal organization

For the reason that digitalization requires new methods of work and changes in the overall culture of the organization, employees should have the opportunity to work in different ways and to follow the faster development of the business. The introduction of digital tools and the modernization of business processes, together with the development of a flexible operating model, support these changes. In addition, programs for leadership development can help management and staff to make the necessary changes to their attitudes and behaviour.

Companies need to consider the following digital opportunities for innovation in business processes that create value:

- ❖ Putting the customer in a central location – to provide products, services and information tailored to customers' needs at a time and place of their choice.
- ❖ Real-time business – to use up-to-date information from a variety of sources to be able to respond immediately and meet customer requirements.
- ❖ Forecast models – to institutionalize forecasting and simulation capabilities to make proactive decisions, to reduce latency and increase profitability.
- ❖ Collaboration between organizations – to connect seamlessly workforce, business partners and processes to better serve customers and operate at less costs throughout the value chain.
- ❖ Human-machine collaboration – streamline operations through integrated workflows, related assets and full automation or significant reduction in manual tasks.

These opportunities can be used in various combinations to create value. If implemented properly, they can lead to a gradual change in the productivity and profitability of any organization.

- Communication transition

A key factor for the success of digitalization is good communication. In this context, companies need to become more creative in relation to the used channels. They should enable new and faster ways of working and changes in attitudes and behaviour. One possible change is to introduce platforms, which are more interactive (such as internal social media) and allow open dialogue within the organization.

- Digitalization of customer experience

Companies are looking for a quick return on their digital initiatives investments through customer experience. Significant benefits can be gained by digitalizing the way customers engage with an organization. This provides increased automation, improved quality, reduced costs and a better overall customer experience. The best companies in the sector are digitalizing customer processes across all channels and parts of the organization to provide them with a consistent experience. In addition, access to internal processes is provided to increase the level of self-managed clients. The integration of partner companies in the business processes of organizations provides real added value for clients or potential new services.

- Building a digital platform

When implementing digital solutions, it is best to build a digital platform that integrates with all legacy third-party key services and applications. It needs to interact with all social networking platforms and maintain customer engagement across every channel and device. It also needs to be cloud-based and capture the huge amount of information generated in the digital business. Appropriate big data databases and data analytics tools should be part of the digital platform. With their help the organization can respond to relevant transactions/posts in real time from its customers, but also analyze the resulting information to impose new and interesting trends and business ideas.

Leading organizations in this category use NoSQL databases to find interesting connections between data that seems unrelated and to better understand their customers. They automate their processes to the fullest extent in order to support rich customer and partner experience. This includes automating knowledge-based processes.

Digitalization should be an essential element of any serious organization's development plan. There are numerous opportunities for those who invest in the right digital initiatives for their industry and organization. They relate not only to the customer experience, but also to efficiency, productivity, collaboration and communication between employees. Opportunities exist in all industries, including construction. The transformation towards business digitalization and taking advantage of these opportunities should always be driven by the top of the organization. This paper highlights some of the considerations, recommendations and good practices used by digital leaders in the construction industry.

5. Conclusion

Digitalization is becoming a determining factor in our time. It is a tool that provides greater efficiency, speed and individuality for different industries. It is also a prerequisite for developing new services and innovative business models.

Digitalization in the field of construction is still in its infancy. Despite the progress of innovation, it remains fragmented and insufficiently organized. In recent years, many companies in the construction industry have begun to prioritize digitalization as they understand the significant benefits it brings to the current business environment. The opportunities offered by state-of-the-art technologies, the rapid growth of different start-up companies, the increasingly demanding customer expectations make the need to apply good practices and follow a real comprehensive digitalization strategy with a clear and extended long-term vision. In this regard, the present paper analyzes and compares leading global and national good practices for digitalization in construction. Applying them with a positive mindset to change is the key to success of organizations, and ensures that the construction industry can respond to its competitors.

In addition, some common features of modern digitalization in the construction sector are outlined. Furthermore, different approaches to digitalization and the types of governance models that are associated with these approaches are presented. Based on the explored good practices for digitalization, a number of factors have been identified that relate to its potential for success. Moreover, recommendations are proposed to help construction companies on their road towards success in digital transformation.

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