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MODERN REQUIREMENTS FOR THE DIGITIZATION OF THE TRANSPORT SYSTEM AND CRITERIA FOR EVALUATING THEIR EFFECTIVENESS

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INTRODUCTION

Modern requirements for the digitization of the transport system represent the interdependence of technical and technological, operational efficiency and socio-economic aspects. These demands for the digitalization of the transport sector require a concerted effort to use advanced digital technologies and strategies to not only optimize the existing transport infrastructure, but also to fundamentally revise its architecture.

Digitization of the transport system requires the continuous integration of advanced digital technologies and data-based decision-making, as well as a flexible management style.

In this scientific research, the multifaceted impact of modern requirements for digitalization of the transport system is studied. By studying the technological, operational and regulatory legal conditions, the possibilities of creating a digital transport ecosystem that is not only technically and technologically advanced, but also socially inclusive, ecologically sustainable and economically efficient are analyzed.

Determining the basic criteria for the modern requirements of the digitalization of the transport system involves a nuanced study of multifaceted dimensions. These dimensions include factors related to technological capability, system interoperability, data-driven insights, cybersecurity measures, user-friendly design, and innovation.

METHODOLOGY

The purpose of the article is to develop modern requirements for the digitization of the transport system and main criteria for evaluating their effectiveness. To achieve this goal, the following methods were used: comparative analysis, graphical representation method, systematic approach, abstraction and logical analysis, systematization and classification, modeling theory, analogy and extrapolation.

RESULTS

Peter C. Verhoef., et al. (2021), in their research paper, 'Digital Transformation: A Multidisciplinary Approach and Research Agenda', examine the external factors of digital transformation in the company, also, authors analyze strategic processes and requirements, the processes of digital transformation, and the factors necessary for successful digital transformation in the workplace [1]. First of all, scientists list the external factors that affect the digitization of the enterprise or the decision to digitize the processes. In addition, these advanced digital technologies can have a positive impact on the reduction of supply chain costs by automating service delivery with the help of robots or virtual agents or optimizing logistics flows, and using artificial intelligence and blockchain. Moreover, due to these digital technologies, the competition is changing dramatically. For example, in Retail trade, technology has radically changed the competitive environment, and relatively young companies that have been able to effectively apply digital technologies have achieved a dramatic increase in sales

volumes. These changes began to affect the service delivery methods and strategies of enterprises. Global competition is pushing companies to digitize their service processes and revise their business models based on digital technologies. Third, consumer behavior is changing in line with digital transformation. Research shows that consumers are making most of their purchases online, and digital touchpoints play an important role in attracting additional customers. So, with the development of digitization and digital technologies, enterprises are changing their services based on the wishes of customers.

Digital transformation processes in the enterprise are mainly divided into 3 parts [1].

Digitization is the integration of information technologies with existing tasks and the transition from analog to digital methods in performing business processes using information technologies. This involves converting analog data into digital data.

Digitalization describes how information technology or advanced digital technologies can be used to transform existing business processes. For example, creating new online or mobile communication channels that allow all customers to easily connect with company and change the traditional business-to-customer relationship.

Digital transformation is the last stage and describes the changes that lead to the development of new business models for an enterprise or industry.

Moreover, Gimbel, H and Roglinger, M (2015), in their research paper, Digital Transformation: Changes and Opportunities, based on empirical findings from interviews, workshops and case study projects, six key factors for successful digital transformation list the factors: customers, value proposition, processes, data, organizational factors and transformation management[2].

Customers - Digitization empowers customers. New digital technologies are significantly changing the way customers stay up-to-date, evaluate and purchase products. Through digitization, customers not only get the latest information, but also have the opportunity to connect more with other customers and the enterprise.

Creating additional value – The ever-increasing advancement of digital technologies and changing customer behavior present many opportunities for innovative business models and value propositions. However, studies [2] have shown that it is not easy to realize and implement the opportunities that digitalization can bring. Survey respondents[2] emphasize the huge potential for smart products that will emerge from the integration of physical products with digital innovations such as mobile applications and sensor technologies. can expand their value proposition. These may include new solutions that extend existing service offerings, digital services that enrich physical products, or hybrid product-service packages. In this regard, information technology has become an integral part of the product or service today.

Processes - digitization has changed the external business environment at an unprecedented rate. Businesses are constantly trying to adapt to these changes in terms of adapting their internal operations. Research results show[2] that a central area that is currently challenging for most enterprises is the provision of an integrated IT infrastructure. This implies that different parts, systems and networks work together and is a necessary and first step to determine the effectiveness of digital transformation. Scholars[2] conclude that new digital technologies create additional value only when there is a strong foundation and integration of information technologies.

Data - data integration is one of the key requirements for successful digital transformation. Well-organized data, integrated into a common database or accessible through a standardized input layer, is the basis for data analysis. Complex technologies such as recommendation systems and predictive modeling require not only data integration, but also high-quality data sets. Extracting and categorizing information not only helps identify customer behaviors, but also helps evaluate ideas, optimize internal operations, and identify new revenue streams. Businesses strive to turn data into information, and information into business insight. For example, a trucking company aims to reduce and optimize the downtime of expensive trucks by keeping their trucks always on the move and performing pre-scheduled maintenance. To do this, the company monitors the movement of the vehicle by analyzing the data about the state of the vehicle transmitted to its operational and analytical systems in real time. A smooth flow of analytics and data enables a better visualization of vehicle traffic and idle time, ultimately leading to reduced fuel consumption and improved delivery times.

Organizational Factors - organizational flexibility is critical to succeed in a fast-paced digital world. Digital transformation requires not only bimodal information technologies, but also bimodal organizational controls that ensure stability and agility. The future workplace will require flexibility in time and space for new ideas and new forms of collaboration (for example, organizations should focus more on encouraging autonomous teams). Instead of top-down vertical hierarchical structures, a horizontal team and project culture fosters a new capacity for innovation. A workforce with up-to-date skills and in constant touch with the latest developments and technologies, and in tune with the influx of new digital talent, lays the groundwork for a successful digital transformation. Transformation management - most enterprises fear that digital transformation will completely change the business model of the enterprise. At the same time, many people are one step ahead of their competitors by realizing the new opportunities it offers. Finding the value-added areas of digital transformation is the starting point for developing a digital strategy that includes the organization's vision, goals, capabilities, and related activities to maximize the business benefits of digital initiatives. Digital value assurance is a comprehensive approach to proactively ensure that a company benefits from digital transformation. In particular, the scope, progress, interactions and realized benefits of all digitization efforts should be monitored to enable a controlled technological evolution.

In addition, Microsoft (2016), one of the world's leading technological companies, stated that the company's "Digital transformation: in the research report "ways to achieve success", the main five factors in the successful implementation of digital transformation in enterprises are analyzed [3].

1. Management - in the implementation of digital transformation, advanced technologies are not a goal, but a tool. All this is carried out by managers, leaders and workers who have technological skills and are quick to adapt to changes. First of all, managers need to develop their own technological development plans, analyze them with internal management and subordinates, and then start implementing them.
2. Forming a digital culture through effective change management - the concept of becoming a digital enterprise is how the enterprise makes decisions; how to attract customers; how to manage the supply chain; will fundamentally change how innovations are implemented, design

and manufacturing processes. In this case, it is appropriate to organize continuous trainings that increase the qualifications and skills of employees.

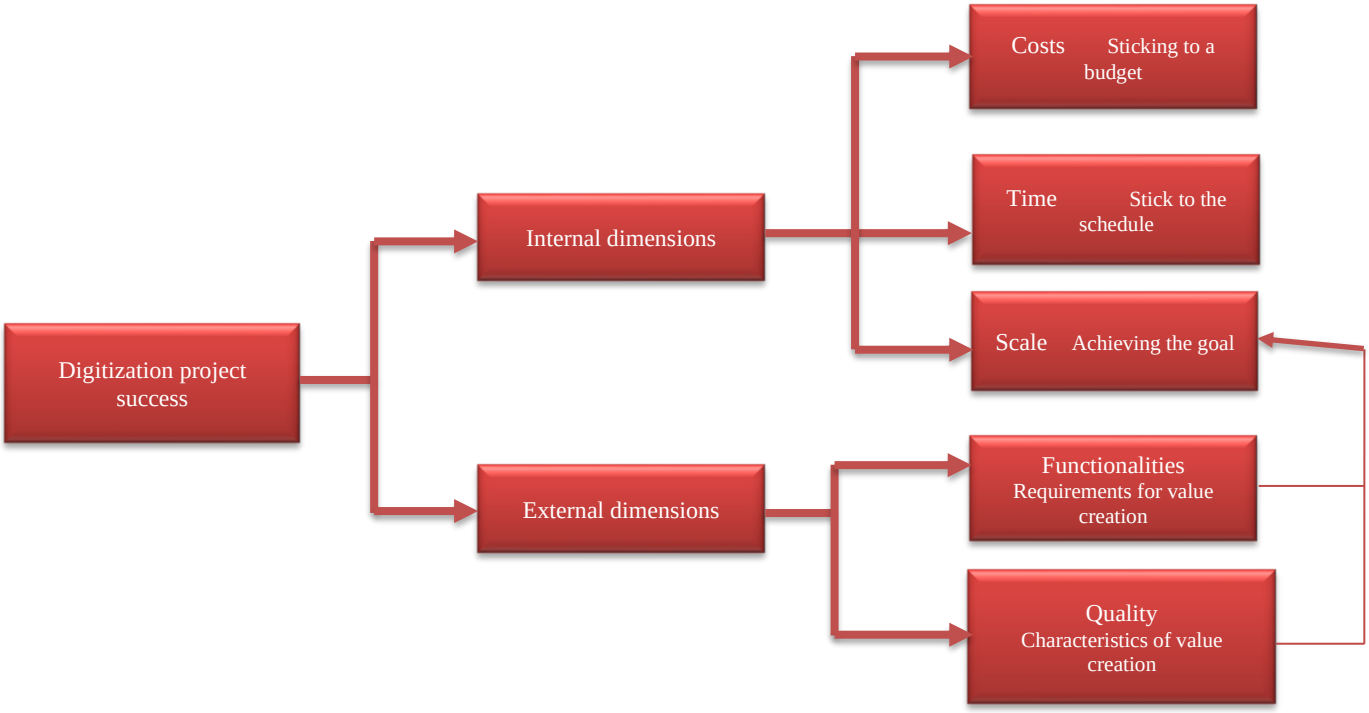
3. Connecting customers, products, assets and people - digital technologies today enable seamless 24/7 communication with services, customers and employees of enterprises and continuous real-time access to data allows to cloak. This means that the managers of the enterprise will have unlimited information at their disposal.

4. Conducting small experiments and drawing conclusions from failures: in the field of IT, large projects, designed for the long term and lasting for years, have been implemented. Now this period is over. In today's digital era, experiments are carried out very quickly, and in some cases, monthly results are analyzed and necessary changes are made. Now is the era of "fail fast" or "learn fast".

5. Building an Ecosystem Organizations can no longer function alone as enterprises. Even those with partner-based businesses need to think about their partners, ecosystem(s) and supply chain. This is no longer just a one-time relationship, but includes plans to restore the industry, create new ecosystems, and markets.

Above is an analysis of the modern requirements for digitalization of the transport system, and below are the criteria for evaluating the effectiveness of these requirements. Giovanni Romagnoli, Giovanni Esposito and Davide Reverberi (2022), in their research entitled "Project Success: A Method for Evaluating the Success of Digitization Projects", present a method for evaluating the effectiveness of digital projects[4].

The method proposed by the authors suggests evaluating the effectiveness of digitalization projects not only by financial indicators, but also by external dimensions of projects, that is, by the opportunities provided by digitization and their quality. These external project measurements are reflected in the scope of the project and therefore evaluate the requirements for the results and the extent to which they meet the quality objectives.



DISCUSSIONS

- Digital transformation provides a business model by creating value and effectively turning that value into profit[1].
- In addition, the authors list the modern requirements necessary for the successful implementation of digital transformation:

1. Digital resources are the factors that indicate the potential of the enterprise to use digital technologies on a large scale: digital assets, the speed of adoption of new digital technologies, the ability of digital collaboration and the ability to analyze big data.

- - Digital assets. To compete effectively in the digital age, businesses require digital assets, such as data storage, information and communication infrastructure, and accompanying technologies. Modern businesses are investing heavily in artificial intelligence, machine learning, the Internet of Things, and robotics. The possibilities created by the latest technologies and a huge database create the basis for increasing revenues while creating additional value for customers. For example, Big data as a digital asset (customer journey history) can be leveraged by a firm's data analytics capabilities to individualize services and offerings.
- - The speed of adoption of digital technologies - the ability to sense and take advantage of the market opportunities presented by digital technologies. In today's dynamic and unpredictable markets, businesses must be flexible to: (1) frequent changes in organizational roles; (2) timely advancement of ever-changing customer needs and introduction of new digital technologies; and (3) it is necessary to respond to intense competition due to the elimination of barriers to market entry. In order to avoid these problems, enterprises must realize the possibilities of advanced digital technologies and implement them in time to constantly change and reconfigure existing digital assets and capabilities.
- - Digital collaboration capability. Digital collaboration capability, that is, the ability of an enterprise to connect and adapt different users to meet their mutual needs through digital means, is important. In an increasingly digital environment, businesses understand that they must take a collaborative approach and co-create value with digitally connected firms. Recent research shows that 75% of executives say that their competitive advantage is not determined by the company's internal resources, but by the capabilities of the partners and ecosystems they choose to work with.
- - Ability to analyze large amounts of data. In the digital transformation phase, the ability to collect and analyze large amounts of data and rely on digital data for decision-making is essential. Despite the availability and ease of collecting large amounts of data, businesses are not doing enough to develop the ability to analyze and use large amounts of data. 79% of executives surveyed say that their most important systems and strategies rely on collected data, but most of them have not invested in verifying the reliability of this data and deriving actionable business conclusions from it.[1] .

2. Organizational structure - In addition to the digital resources needed to successfully implement digital transformation, the key issue is the organizational changes needed to adapt to digital change, particularly the organizational structure that is flexible to digital change. Digital transformation affects the organizational structure, in which a flexible system

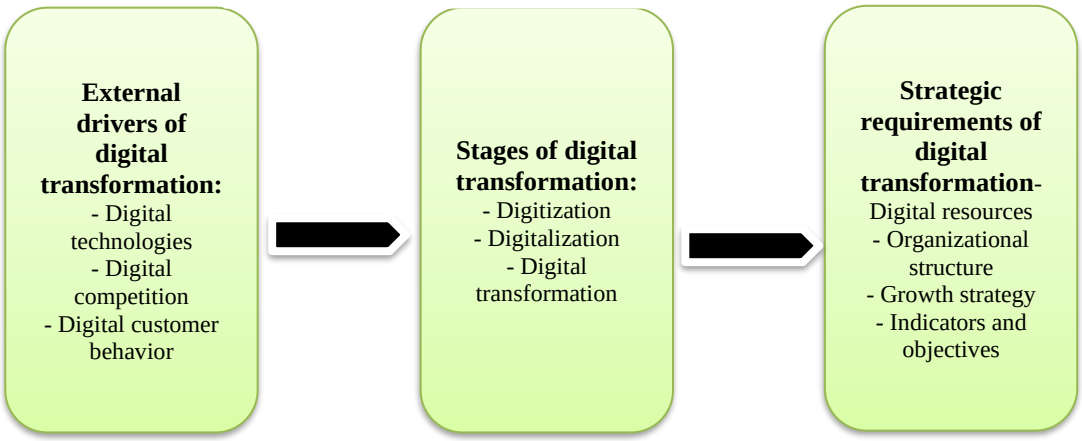
consisting of separate business units, agile organizational forms and digital functional areas plays an important role.

- - Separate business units - giant enterprises are slow to implement advanced digital technologies and determine their effectiveness. To solve this problem, autonomous business units separated from the head office, which have the ability to make decisions quickly and independently, have a more effective effect.
- - Digital functional sections. An important feature of digital transformation is the increased reliance on information technology and analytical functions. Most importantly, the IT department must become a more proactive and regulatory role in supporting digital value creation. From the perspective of human resource management, digital transformation refers to the recruitment of employees with digital and analytical skills to replace the existing workforce[1].

3. Digital Growth Strategies – There are various digital growth strategies for digital firms, but the most popular growth strategy involves the use of digital platforms. For example, ride-sharing platform Lyft grew from 2.7 million in 2013 to 162.6 million in 2016, an annual growth rate of nearly 300%. The two main drivers of this growth are the high efficiency of the platform and the effective partnership effects. Platforms can scale quickly and handle an increasing number of users, including customers, suppliers, and additional service providers, because the cost of servicing additional users is low.

4. Indicators and objectives. To realize the full potential of digital transformation, digital businesses need to measure performance against key performance indicators (KPIs). Aggregate metrics related to results such as return on investment, profitability, and revenue growth are typically important metrics for digitizing businesses. While the ultimate goal of new business models created by digital transformation is to increase revenue, profitability and value for investors, it is particularly useful to track intermediate results through process-related metrics of how the new business model is creating value.

Model of stages of digital transformation



Manba: Peter C. Verhoef., et al (2021)[1]

Evaluating the effectiveness of digitization projects:

Technical quality criteria.

- - support for single sign-on (or at least a sign-on system based on a federated environment)
- - customize the user experience (e.g. add innovative and targeted features such as context-sensitive booking) and learning data
- - advanced dashboard and easy visualization for accuracy and statistics
- - adopt standard certified (i) payment protocols (e.g. credit card, online payments) and (ii) payment data security

Organizational quality criteria

- - accessibility (according to system accessibility scale indicators)
- - reliability (reliability factors according to SCOR indicators)
- - stability (availability of resources, financial stability)

Criteria for instructional quality

- - necessary technical qualification requirements
- - availability of instructional material
- - improvement of material and instructional tools
- =user satisfaction

CONCLUSION

Based on the analysis above one may conclude that there several factors that may have an impact on successful transition period of digital transformation in the transport sector. These may vary depending on the market condition, industry and companies. However, if we generalize the whole picture, technical capacity, organizational structure and budget of the company are the main factor that may driver the digital transformation towards success. Regarding the criteria we may conclude that technical quality criteria, organizational quality criteria and didactive quality criteria are the most influential on digital success of the company.

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