METHODOLOGY OF GOVERNMENT ORGANIZATION DIGITAL TRANSFORMATION EVALUATION BASED ON THE MOVSESYAN-RASPOPIN DIGITAL MATURITY MODEL

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Abstract. This article is devoted to the current methodology for assessing the readiness of a state organization for digital transformation in Industry 4.0, based on the Movsesyan-Raspopin digital maturity assessment model.

The methodology reveals a systematic understanding of digital transformation and is designed to assess the digital maturity of an organization. The key feature of the methodology is the interrelation of the company's strategy, strategic goals of digital transformation, strategic priorities of the organization's development, and the available technologies, which allows determining the ways of its further development and economic effect to achieve maturity in Industry 4.0.

The article describes the Movsesyan-Raspopin digital maturity assessment model in detail. The basic design of this model consists of organizational domains and integrating elements and evaluates the current and target levels of digital maturity, as well as prioritizes development directions and a set of digital transformation initiatives.

The article also analyzes the concepts of "digital transformation" and "digital maturity", analyzes existing approaches to assessing digital maturity of Deloitte, Boston Consulting Group, Capgemini Consulting, PwC, and models developed by experts Berghaus S., Back A., Kaltenrieder B., Gimpel H., Newman, M. et al.

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Glossary of terms and definitions

Agile development methodology is a methodology for developing and updating software (IT solutions) where engineering requirements and code development are performed regularly by joint efforts of a self-organizing cross-functional development team and end users of such software. Flexible methodology aims to maximize software compliance with the user requirements, maximize the efficiency of development teams and reduce development time. Flexible development methodology is opposed to the cascade development model (the "Waterfall" model).

Competencies for digital transformation (digital competencies) - general corporate competencies required to implement digital transformation initiatives in accordance with the list of key competencies of the digital economy: ability to solve various tasks using ICT, working with large amounts of information (working with data), working in agile and design thinking methods, using product approach, continuous learning and innovation (rapid adaptation to change), working under uncertainty, cross-functional interaction.

Cyber-physical system is a complex system consisting of computational and physical elements that continuously receives data from the environment and uses them to further optimize control processes.

Customer centricity or Customer centric approach is a strategy that aligns a firm's design and delivery of its products and services with the current and future needs of a select range of customers in order to maximize their long-term financial value to the firm [5].

DevOps practices ("DevOps") are a methodology of interaction between IT Development and IT Operations and the mutual integration of their workflows. DevOps practices aim to reduce the time it takes to develop, deploy, and update software while ensuring high-quality software.

Digital infrastructure refers to the set of information and communication technologies, including hardware, software, documents, and business processes required to implement digital transformation initiatives. It includes IT infrastructure, IT architecture (such as micro-service architecture and API descriptions), and information security tools that have undergone compliance assessment.

Digital projects represent deliberate and significant changes in the way most public companies are organized, incorporating digital technology as part of their solutions.

Digital readiness of the company (digital maturity) - involves assessing the degree of digital transformation in its areas of activity, the adaptability of digital infrastructure to implement digital solutions, the level of digital competencies of employees and the company, and improving the digital transformation management system by comparing with international best practices.

Digital system is a set of interconnected technological solutions that provide an environment for interaction between two or more groups of participants in the exchange of information, services, and values.

Digital transformation of a company involves a comprehensive transformation of its business model, products, services, and/or business processes, aiming to increase competitiveness, achieve strategic goals, and meet economic efficiency criteria. This is achieved through the implementation of a portfolio of initiatives for digital technology implementation, data utilization, staff and competency development, cultural transformation, modern approaches to managing digital solutions implementation, and financing the implementation of digital solutions.

Digital Transformation Initiative is an isolated group of tasks of a company unit or workgroup within the framework of digital transformation, aimed at one of them:

(a) Implementation of a digital solution;

(b) implementation of corporate software or development of digital infrastructure;

(c) implementation of organizational changes (including the development of competencies of personnel and the company).

Digital transformation strategy is a company document that defines the company's goals, key performance indicators (KPIs), strategic development directions, digital infrastructure development, organizational changes, human resources and competency development, and the management model for digital transformation.

Guidelines - Guidelines for the digital transformation of public corporations and companies with state participation of the Ministry of Digital Development, Communications and Mass Media of the Russian Federation, taking into account the changes approved at the meeting of the Presidium of the Government Commission on Digital Development, the use of information technology to improve quality of life and business environment chaired by Deputy Prime Minister of the Russian Federation D.N.

Omnichannel - combining all communication channels of customers (partners, counterparties) with the company in a single system, keeping all the history of appeals and transactions.

Product-oriented approach is an approach based on creating utilitarian value for the product, focusing on its functional characteristics and benefits.

Roadmap is a work calendar plan of the implementation of the digital transformation strategy, taking into account the relationship between digital transformation initiatives, resource limitations and the equal use of resources. When developing the

roadmap, digital transformation indicators (target KPIs and economic indicators) are calculated for calendar periods, taking into account the timing of implementation of digital transformation initiatives.

Strategic areas of development of digital transformation - a list of areas of digital transformation of the state company, including the following areas of development: new business models, development of additional sources of income, new digital products and services, customer relationship management, design and engineering, service, efficiency of operations, supply chain management, human resources management, financial management, procurement management.

Value chain is a strategic analysis tool proposed by Michael Porter in his book "Competitive Advantage" [7]. It aims to identify sources of competitive advantage through the analysis of individual activities within the company.

Introduction

Today, the global trend is an accelerated transition to a new economic and technological paradigm known as the 4th industrial revolution. This revolution involves the convergence of the digital (virtual) world with the physical world, creating a unified cyber-physical system.

In Russia, the digital transformation of key sectors of the economy and the social sphere is one of the national goals until 2030 [1]. Despite the abundance of literature and new technologies, the process of digital transformation in state-owned companies remains challenging. Difficulties arise in both defining the essence of digital transformation and determining the required level of digital maturity. Additionally, selecting digital initiatives and prioritizing digital tools that have the greatest economic impact for the company and effectively address the challenges of the digital economy pose significant challenges.

There is a need to elaborate on the terms "digital transformation" and "digital maturity."

Digital transformation refers to the process of changing a company's operations in the digital economy. These changes include seeking and implementing innovations, altering corporate culture, establishing new business processes, significantly enhancing the efficiency of existing processes through breakthrough technologies, expanding the range of services offered in the market based on data utilization as a value and asset of the company, and introducing digital products and breakthrough technologies. Digital transformation involves a qualitative change in business processes or modes of economic activity through the introduction of digital technology [3].

Digital maturity entails adapting an organization to compete effectively in a digital environment. It involves aligning company strategy, workforce, culture, technology, and structure to meet the digital expectations of customers, employees, and partners by adopting new technologies. Therefore, digital maturity can be considered an ongoing process of adaptation to the changing digital landscape [6].

In Russia, Presidential Decree No. 474 of 21.07.2020 "On the National Development Goals of the Russian Federation until 2030" establishes that digital transformation is one of the national goals for the period until 2030 [1]. This national goal aims to achieve "digital maturity" in key sectors of the economy and the social sphere, as well as a fourfold increase in investment in domestic information technology solutions compared to the 2019 level.

The determining factors of digital transformations in public companies include: 1) the dynamics of changes in modern consumers' preferences and their mode of consuming goods and services, 2) the development of Russian technologies in Industry 4.0 [2], and 3) the development of digital competencies within the organizations themselves. The importance of customer-centricity, or focusing on the consumer, is also considered when selecting a business model that leads to success in the digital economy, as depicted in the matrix of P. Weil and S. Werner [4].

These three groups of factors driving digital transformation are evaluated on a digital maturity scale: "basic," "intermediate," "advanced," and "leading," which indicate the level of digital technology utilization in core business processes (Figure 1).

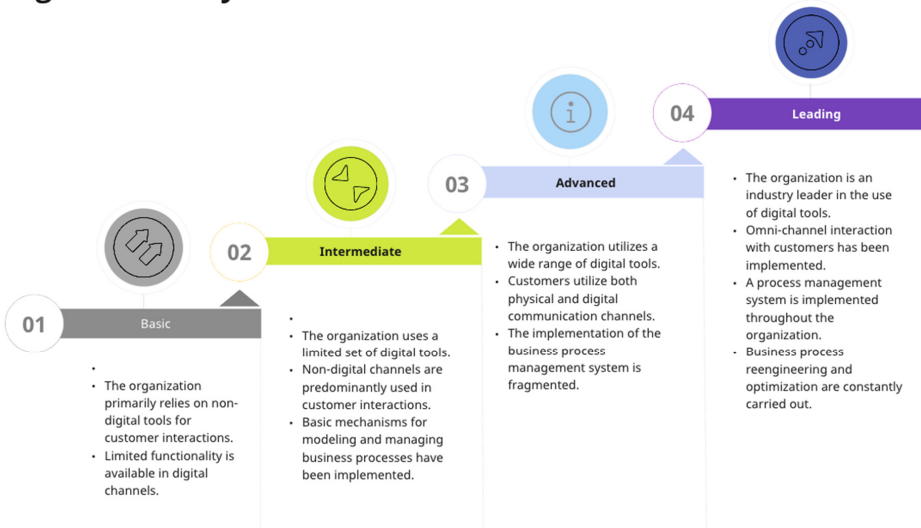## Digital Maturity Level

Figure 1. Levels of digital maturity

Accordingly, any methodology for assessing digital maturity must take into account both external market factors and internal processes within the companies themselves.

To date, the existing methodological recommendations of the Ministry of Digital Development, Communications, and Mass Media of the Russian Federation also include an analysis of the "key elements of the basic corporate conditions" for digital transformation. These elements consist of: 1) digital infrastructure and data management system, 2) human resources, 3) competencies and culture for digital transformation, and 4) digital transformation management model.

These recommendations also highlight another key factor that needs to be analyzed, which is the "key areas of digital transformation." It is important to consider the potential contribution of each area in achieving the strategic goals of the state company and the level of readiness of the state company for digital transformation in that area.

An analysis of the methodological recommendations of the Ministry of Digital Development has revealed that the document is primarily advisory in nature and does not fully outline the sequence of steps for assessing an organization's digital maturity. The recommendations also do not provide a methodology for assessing the contribution of adopted digital transformation initiatives to the company's strategic goals and directions of development.

A review of different models for assessing digital maturity levels.

Various models for assessing digital maturity have been reviewed in the literature. Scholars such as M. Egeli (2016), A.A. Neff et al. (2014), and Becker et al. (2009) emphasize the need for grounded and holistic models [11,15,19].

There is a wide range of frameworks and models available, offering different perspectives on how to approach digital transformation. Some frameworks take a generalized approach similar to traditional business strategy models, while others delve into specific dimensions unique to digital transformation. Despite the diversity of approaches, there is unanimous agreement among authors on the need for a holistic digital transformation strategy for success.

However, the literature presents a somewhat vague view of the strategy development process, prioritization of digital initiatives, and development of digital competencies and capabilities. There is a clear need for better articulation of the approach to these aspects of the digital transformation strategy.

For example, C. Anderson and E. William detailed Deloitte's digital maturity model, specifically developed for the telecommunications industry. The model provides a broad view of digital maturity, assessing digital capabilities across five separate business dimensions. The model emphasizes the value created and outcomes meaningful to the organization as the basis for focusing on digital capabilities and maturity levels [10].

S. Berghaus and A. Back proposed a cross-industry model of digital maturity that includes nine dimensions, such as customer experience, product innovation, strategy, organization, digitalization of processes, collaboration, information technology, culture and competencies, and transformation management [12]. The model highlights the importance of proactively and systematically examining emerging trends to identify new business opportunities and influence strategy development. However, the model does not provide approaches for prioritization.

Gimpel et al. presented a digital transformation framework with six action lines, including customer, value proposition, operations, data, organization, and transformation management [17]. They proposed a three-part approach to strategy development, focusing on internal and external action lines, questioning the organization's role in the value network, and prioritizing digital initiatives through a customer-centric approach and business case development.

M. Newman presented a model for the telecommunications industry focusing on five dimensions: customer, strategy, technology, operations, culture, people, and organization [14]. This model provides a snapshot of the organization's current state, identifies potential investment priorities, and manages the transformation process. Newman emphasized the importance of assessing the company's maturity in each area to determine investment areas.

G. Westerman et al., in collaboration with Capgemini Consulting, proposed a cross-industry roadmap for digital transformation tailored to the needs of large organizations [21]. This roadmap includes three main elements: customer experience, operational processes, and business models. The authors highlighted skills, culture, and inefficient information technology as potential barriers to digital transformation and suggested investing in initiatives that align with the new vision and address existing barriers.

The Boston Consulting Group's Digital Acceleration Index (DAI) is another diagnostic tool used by companies to assess their digital capabilities, compare their digital performance to others, and determine readiness to become a "bionic company" - an organization that integrates new technologies with human capabilities to drive growth, innovation, efficiency, and sustainability [13, 22].

DAI is used to build the evidence base for digital transformation strategies, identify priority areas for investment, and monitor and track digital KPIs. DAI results are also used to develop guidance for priority areas to help companies improve their digital maturity.

PwC's framework for digital transformation emphasizes the importance of developing organizational architecture maturity for successful digital transformation. This includes preparing companies for changes associated with adopting new technologies and business models, such as the Internet of Things (IoT), machine learning, or robotics [13]. The framework explains how a capability-based approach can help organizations overcome these challenges and consists of five phases: understanding

the current state, identifying gaps, defining requirements, defining initiatives and a roadmap. Phase four (defining initiatives) involves identifying and prioritizing the necessary initiatives to access distinctive capabilities and fill gaps. This phase connects existing initiatives to the organization's capabilities and validates them against the new requirements, leading to the development of a roadmap.

Commonalities among the models considered are:

1. **Assessing Digital Maturity:** All eight models provide a way to assess an organization's current digital maturity, using various categories, metrics, or measures to understand its digital capabilities.

2. **Strategic Focus:** All models emphasize the need for a digital strategy that aligns with the organization's overall business strategy. This strategy guides digital transformation initiatives, identifies areas of focus and investment.

3. **Comprehensive Approach:** All models recommend a comprehensive approach to digital transformation, covering various aspects of the organization, including strategy, technology, people, processes, and data.

4. **Continuous Improvement:** Each model encourages continuous tracking and measurement of digital transformation progress, allowing organizations to identify areas of success and those that require additional attention, leading to continuous improvement.

However, these models have common limitations in terms of prioritizing digital transformation initiatives:

1. **Contextual Considerations:** The models primarily provide frameworks and recommendations but may not consider the specific contextual factors affecting each organization. Each organization operates in a unique environment with distinct challenges, capabilities, resources, and culture that must be considered when prioritizing initiatives.

2. **Dynamic Nature of Digital Transformation:** The models often provide a snapshot at a particular point in time, but digital transformation is an ongoing and dynamic process. Changes in technology, market dynamics, customer expectations, and the competitive environment can affect the priorities of initiatives.

3. **Lack of Clear Prioritization Mechanism:** While the models highlight key areas of focus for digital transformation, they often do not provide a clear mechanism for prioritizing initiatives. Prioritization requires considering multiple factors, including urgency, potential impact, resource requirements, and strategic alignment, which are not always explicitly addressed in these models.

Thus, while these models provide valuable frameworks for understanding and managing digital transformation, it should be noted that the methodology for prioritizing digital transformation initiatives is not clearly articulated in any of the models.

Description of the Movsesyan-Raspopin digital maturity assessment model

The purpose of this methodology is to provide a practical tool for assessing a state company's readiness for digital transformation. The methodology is designed for digital transformation and development specialists, as well as IT service professionals. It can serve as a methodological guide and be utilized by university teachers, undergraduate and graduate students studying disciplines related to information technology, management, and the organization of state company digital transformation processes.

The methodology considers essential foundational elements of digital transformation, including: 1) business processes, 2) the advancement of Russian Industry 4.0 technologies, and 3) the enhancement of digital competencies within organizations. It offers a comprehensive tool to evaluate the potential impact of strategic initiatives on the achievement of a state company's strategic goals, development areas, and level of preparedness for digital transformation. Additionally, it outlines a method for prioritizing digital transformation initiatives.

The methodology comprises six sequential steps for developing a digital transformation strategy (Figure 2).

Figure 2. Steps in developing a digital transformation strategy

Step 1: Defining the future business model
The process of digital transformation encompasses three components: technological, process, and organizational. Analyzing all three components is necessary to determine the target business model.

The technological component relies on digital systems, which are developed by teams responsible for creating and launching digital services using digital technologies and platforms. Product teams can be established as separate units with the required resources, including technology, competencies, and personnel.

The process component involves optimizing business processes, implementing technological changes, providing necessary equipment, and updating regulatory documents.

The organizational component entails training staff on new technologies and raising awareness of the opportunities and experiences offered by digital technologies across the company's entire ecosystem. In the next step of defining the target business model, it is crucial to understand the underlying business approach within the organization's value chain.

To comprehend the functioning of the value chain, two power rules or principles determine the influence among different players in the market's value chain. Depending on the position of value creation in the chain, the company may focus more on one of the leadership strategies described by M. Tracy and F. Wiersema [13]. If value creation is product-focused, the company can rely on its position within the existing ecosystem of major market players, serving as a "modular manufacturer."

On the other hand, if the core value is created through processes involving interaction with end customers, the company adopts the "omni-channel player" business model. Strong positions that allow the company to leverage both aspects in the value chain enable it to adopt the "ecosystem driver" business model (based on Peter Weil's matrix [4]). This business model proves to be the most effective within digital transformation. However, it requires advanced digital and organizational skills, attractive and customer-friendly platforms, and robust digital management.

Step 2: Define strategic goals for digital transformation

The digital transformation strategy is primarily aimed at implementing the company's goals and objectives. Therefore, the approved development strategy of the company serves as the main defining document when determining the goals. The goals of digital transformation should primarily focus on enhancing the competitiveness of the state company, increasing economic efficiency, and achieving "digital maturity" in key sectors of the economy and social sphere, based on the scope of the company's activities.

Each strategic goal can be assigned a different level of importance for the company, categorized as High, Medium, or Low. The importance of a strategic goal is determined through expert assessment by the digital transformation team.

Step 3: Determine the current and future level of digital maturity (DM)

To assess the current and future level of digital maturity, various questions are considered to obtain an overall understanding of the digital transformation situation at the present moment and the desired target state. This involves analyzing the basic corporate conditions for digital transformation, which include the following:

1) **Integrating elements** linking key areas (domains) of digital transformation into a unified system, encompassing processes, digital infrastructure, and competencies.

2) **Key areas (domains)** of digital transformation, which are fundamental elements of the model, encompassing customers, competitors, data, innovation, value, and organizational flexibility. These areas reflect the processes and entities in different organizational domains within the context of digital transformation (refer to Figure 3).

Figure 3: Movsesyan-Raspopin model

1) **Integrating elements** consist of:

A. Processes

This element analysis assesses the current state and level of application of process management practices and optimization methods, as well as the degree of process automation and robotization.

B. Competencies

Competencies serve as the second integrating element of the basic corporate conditions. They assess the readiness level of personnel in structural divisions to implement digital transformation and work in the digital economy. This section includes competencies such as digital process management, data management and utilization, application of digital technologies, IT infrastructure development, digital development management, and fostering a digital organizational culture within the company.

C. Digital infrastructure

Digital infrastructure represents a complex system of interconnected subsystems that interact with each other and the external world to support business processes. The digital infrastructure block comprises various technological and IT solutions used for data handling, analytics, information security, cloud solutions, DevOps, and processes for continuous software development and implementation.

To determine the development level of each subsystem (referred to as "domain"), it is necessary to assess the availability of supporting technologies for each domain (refer to Figure 4). As domain development progresses, higher-level technologies emerge. Therefore, the presence or absence of relevant technologies provides a reliable means to assess the domain's development level.

Since most domains are interconnected, certain technologies support multiple domains, while some domains require a range of technologies. The absence of any of these technologies would hinder the performance of higher-level business tasks.

For instance, categorizing data based on business criticality is related to the "Data" domain. However, this categorization is a prerequisite for developing the "Security" domain since the absence of documented data categorization based on this attribute would hinder the establishment of an appropriate system for access, identification, and information protection.

It's worth noting that certain aspects of domain development are more closely tied to technological issues, while others pertain to organizational matters. When analyzing domains, specific issues or characteristics are typically considered. For example, "cloud service lifecycle" and "cloud archives" are characteristics of the general domain "cloud solutions."

IT Infrastructure	IT services	Data	Information security
Equipment: servers and storage systems	**IT service catalog**	**Working with data**	Employee awareness
Resource allocation	IT service management	Data acquisition	Threat analysis and prevention tools
Virtualization technologies	Alignment of IT services with key IT processes	Data input automation and templates	Threat analysis and prevention measures, process monitoring
Cloud solutions	Understanding customer needs	Security for data storage and archiving	Security Information and Event Management (SIEM)
Consolidation and automation of resource allocation	IT service as a business process	**Data modeling**	Data protection, system access control, cryptography
Data protection and archiving	Execution of IT service	Data models	Information Security (IS) strategy
Strategy for managing storage resources	Monitoring and quality assessment	Modeling policies	Identity and access management
Archiving and backup	**Incident management**	Data model alignment strategy	Unauthorized access prevention tools
Cloud archives	Managing incident workflow	**Information lifecycle**	Information security event management tools
Communications	Automation of incident documentation and resolution processes	Compliance with ILM standards	Firewalls

Local networks		Alignment of data storage architecture with ILM principles	Negative content filtering tools
Use of global networks	**Cloud services**	**Data application and analytics**	Protection tools for cloud services, online payments, if applicable
Remote and mobile workplaces	Cloud landscape	Data consistency	Antivirus protection tools
Data centers	Business problems and reference architecture	Data access security	Data leak detection and prevention tools
Data center building strategy	Lifecycle of cloud services	Data analysis toolkit	Cryptography tools for information protection at the user level
Backup/recovery issues	**Continuous software development and deployment**		Information and data lifecycle management systems
Consideration of catastrophic disaster possibility	Agile technology compliance		Information security process automation tools
Consideration of bandwidth	Testing and quality control		Endpoint protection
	Participation in testing processes by business analysts and product owners		
	DevOps engineers		

Figure 4. Digital infrastructure (in detail)

To assess the digital infrastructure in terms of "current" and "future" metrics, a scale is selected to evaluate the situation based on four main levels of development: "Initial," "Basic," "Advanced," and "Advanced+."

- At the Initial level, most of the necessary steps to create a complete system are yet to be undertaken, resulting in low levels of process automation and optimization.

- The Basic level includes separate projects and elements of a complete system, addressing issues such as building a coherent architecture. However, it represents a fragmented execution of tasks within this domain.

- The third level signifies that most tasks have been partially thought out, developed, and implemented. However, there may still be a lack of coverage for the entire enterprise or a coherent complete system (architecture, strategy, etc.), although work is underway to address these gaps.

- The fourth Advanced level is typically achieved when most tasks have been solved, the systems implemented cover the entire enterprise, and may extend to working collaboratively with the ecosystem.

2) **Key areas (domains)** of digital transformation

Additionally, the methodology considers six key areas (domains) of digital transformation: customers, competitors, data, innovation, value, and organizational flexibility. Each domain is further explored through its respective subdomains (Fig. 5).

Fig. 5. Movsesyan-Raspopin model. Key domains and subdomains.

For each subdomain, the company's current and target levels of digital maturity are discussed. Subsequently, initiatives necessary to achieve the desired state of digital maturity within the company are formulated based on assessments of the integrating elements and key areas of digital transformation.

Step 4: Identify strategic directions for development
Generally, strategic directions for digital transformation development are determined based on key business processes and the company's future business model. Here are some common examples of strategic development directions:
1) Managing relationships with partners.
2) Project lifecycle management.
3) Expertise management (by branch).
4) Developing a personalized customer experience.
5) Managing relationships with suppliers of goods and services.
6) Supply chain optimization (TMS - Transportation Management System).
7) Inventory Management System (WMS - Warehouse Management System).
8) Technical support and operation management.
9) Improving the efficiency of key business management processes.
10) Increasing the efficiency of employee interaction processes.
11) Creating a digital culture (human resource management).

12) Import substitution and transitioning to predominant use of domestic software.

To prioritize the selected areas, it is necessary to assess the importance of each direction in achieving the company's strategic goals and determine its feasibility.

The significance of each direction in achieving strategic objectives is determined using the direction significance matrix (Fig. 6), which considers:

o   Potential contribution of the direction to achieving the strategic goal, determined by experts.
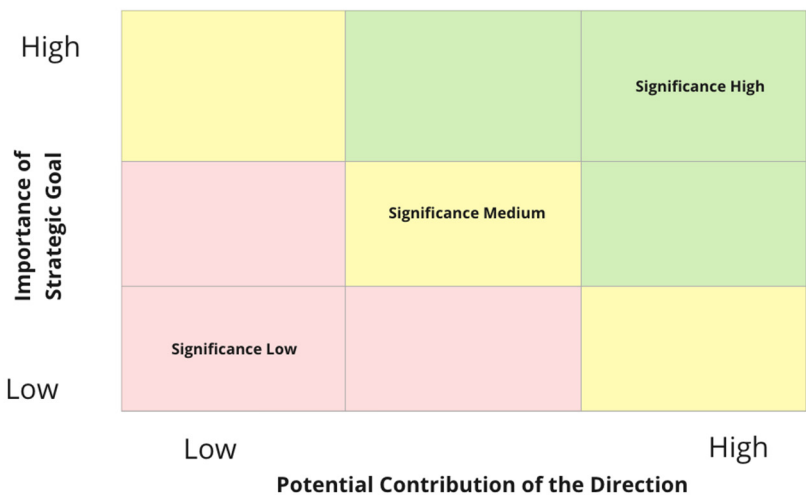
o   Importance of the strategic goal defined in step 2.

Figure.6 Direction Significance Matrix

The level of feasibility for each direction is determined by the weighted average feasibility of all initiatives (from step 3) included in that direction. The feasibility of each initiative is evaluated based on:

o   Availability of competencies to implement the initiative.

o   Stage of project supporting the initiative.

o   Gap between current and target levels of digital maturity.

Thus, the strategic directions for the company's development in digital transformation are defined.

Steps 5 and 6: Identifying and prioritizing digital transformation initiatives

In the fifth and sixth steps, initiatives are developed for key areas (domains) and integrating elements, considering priority areas such as:

o   Digital solutions.

o   Development of digital infrastructure.

o   Development of digital solution providers.

o Import substitution measures.

o Measures to ensure information security.

o Initiatives aimed at scientific and technological development of the state company.

The preparation of a budget for all initiatives is conducted based on the company's budget forecast. The final prioritization of these initiatives considers the requirements set forth by the Ministry of Finance and the economic ramifications associated with their implementation.

The Movsesyan-Raspopin methodology offers a valuable approach to evaluating the digital transformation readiness of a state-owned company and determining priority strategic initiatives. This methodology provides a substantial enhancement to the Methodological Recommendations of the Ministry of Digital Development and existing digital transformation models.

This methodology could be used to prepare the following documents as part of the digital transformation strategy for a state-owned company: "Digital Maturity Assessment," "Strategic Goals of Digital Transformation," and "Strategic Directions for Digital Transformation."

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