The Principles of Forming the Architecture of The Digital Space of Russian Business

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Abstract

Successful digital business transformation requires the right approach to building business architecture. The article describes an approach in which, based on the identification of the main stakeholders and drivers of the digital transformation of Russian business, a model of motivational expansion is built. This, in turn, allows developing a methodology for the formation of digital architecture from the level of enterprises to the state level. As a methodological basis of the research, a combination of an architectural and service-oriented approach at various levels is applied. The article provides examples of digital architecture at the enterprise level and its distribution to the level of industries and regions as an architecture of the digital business space.

Introduction

Digital transformation is a process that businesses around the world need to adapt to the new conditions and preferences of the digital economy society. The main driver of changes is the consumer. Digital transformation is a process of business change that provides a set of transformations through the introduction of an innovative culture in the company, adaptation of business models, widespread use of data, customer-centricity and value management (Gimpel and Röglinger, 2015). Customer-centricity, partnership, data use, search and implementation of innovations can be considered as the key directions of digital transformation (De la Boutetière et al., 2018). Business needs all the tools and the ability to adapt to the rapidly changing culture of consumption and communications. The product now is a complete process of interaction with the client, in connection with which it is necessary to study, analyze and manage customer experience in order to use it as a platform for the growth and creation of new products and services. Digital transformation is based on the principle of developing infrastructure as a platform or an entire ecosystem of a company. An important component in this concept is the principle of an open API and flexible integration. Digital partnership is becoming one of the important factors of scaling. The key to successful business transformation is the correct formation of the company's structure, the selection of personnel with the necessary qualifications and motivation, the selection of the right

approach to conducting business and management methodology. Accordingly, it is required to build a digital architecture relevant to the tasks.

A set of social and socio-technical arrangements, activities for the organization and management of digital processes, technological environment (including digital infrastructure, digital platforms), digital processes, digital data, etc. forms a digital space (De Smet et al., 2018). The pace of change in different spheres of life directly depends on the quality of digital transformation, including the degree of use of data flows (digital processes). The density of connections and relationships in the social world has significantly increased due to the use of technology and information and communication technologies, and will continue to grow to new structural changes that are being shaped in socio-technical systems: digital infrastructures, digital platforms, data warehouses (information or digital data), virtual worlds, etc. The formation of digital space must begin at the enterprise level and extend further to the level of the industry, region, etc. for inclusion in large-scale global digital transformation processes. At the same time, regional and industry strategies should be consistent with transformation strategies in the breakthrough sphere.

One of the main principles of digital modernization is the use of an architectural approach to the description of processes, the introduction of a digital architecture management system from strategic planning and risk planning to project planning, maintenance of project management at all levels with personalization of responsibility in all areas (Bharadwaj et al., 2013).

In order to develop the architecture of the digital space of Russian business, a study was conducted, during which the main drivers of the digital transformation of Russian business were identified. On this basis, the model of motivational expansion is constructed (Fig.1).
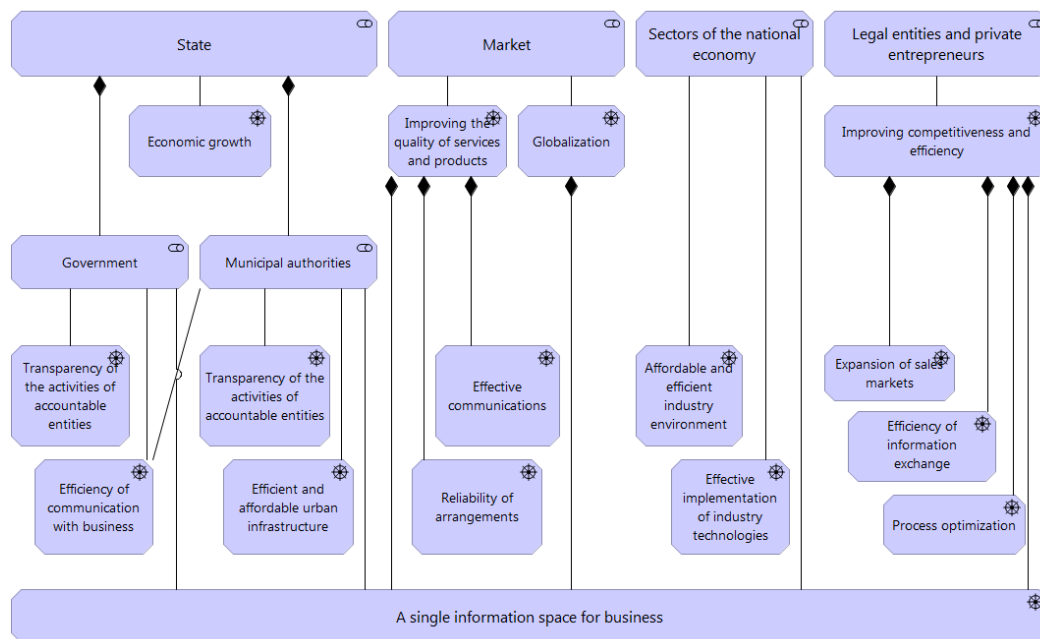

Fig.1: A model of motivational expansion of the Russian business system in the transition to a digital economy

Further research is devoted to the development of a methodology for the formation of digital architecture from the level of enterprises to the level of industries and regions.

Methodology

The methodological base of research includes:

1. Enterprise architecture as an integrated approach to integrating heterogeneous elements (business processes, functional structure, organizational structure, information systems and technologies, digital technologies, manufacturing technologies, assets) into an effective business system (Ilin et al., 2017; Lankhorst, 2004).
2. Service-oriented approach as a means of harmonizing (aligning) the requirements and capabilities of business and IT elements of a single system (Papazoglou and Van Den Heuvel, 2007).

The research methodology for the purpose of constructing a digital transformation methodology should be considered by levels:

1. Level of enterprise
   1.1 Formation of business process models and architecture of IT support for enterprises.
   1.2 Identification of digital technology capabilities and the formation of digital services architecture.
   1.3 Formation of approaches to the implementation of digital technologies (based on the concept of ERP3).
   1.4 The introduction of digital technology in enterprises.
2. Industry level
   2.1. Development of reference (replicated) industry models of digital architecture.
   2.2. Identify end-to-end digital technologies for industries.
   2.3. The formation of the architecture of the industrial digital environment.
3. Region level
   3.1. Integration of regional and corporate technologies.
   3.2. The formation of the architecture of the regional digital environment.

Principles of the formation of digital space architecture:

1. interaction of subjects at the selected levels;
2. a single information space.

Results

The study showed that the main stakeholders of digital transformation in Russia are the state, the market as an institutional environment, sectors of the economy, legal entities and private entrepreneurs. These stakeholders are interested in the stable growth of the national economy, in the general improvement of the quality of services and manufactured products, in the competitiveness of national products and services in the global market, in the formation of a single information space accessible to all participants in the business environment (Ilin and Grigoreva, 2017, Lukyanov et al., 2019). The main drivers for using digitalization technologies are economic changes, cost reduction while increasing profits, and establishing a stable business.

On this basis, a methodology for the formation of digital architecture from the level of enterprises to the level of industries and regions (up to the state level) has been developed. At each level, the key interests of key participants are taken into account.

For instance, for the health care organization, the organization's management, line ministry, suppliers of medical equipment and medicines, insurance companies are identified as the main stakeholders of digitalization. The main drivers of digitalization for healthcare organizations are an aging population and changes in the nature of morbidity (with a tendency for chronic diseases to prevail), the increasing cost of providing medical services, and the use of new technologies. This analysis shows that a change in the architecture of the medical organization is required to increase the efficiency of its work with a constant increase in the quality of medical care. The solution is the Smart Hospital model, implemented on the basis of the Health 4.0 concept combined with the medical principles of P4 (Hood, 2013).

This model enables predictive, preventive, personalized and participatory delivery of health services. Also, the implementation of the model requires the expansion of the competencies of medical and administrative personnel. Implementation of Smart Hospital architecture allows to automate activities, move to client-centric criteria for effectiveness, and strengthen the organization's market position. Thus, at the enterprise level, models of architecture and IT architecture of a medical organization that implements the concept of Smart Hospital were developed and the procedure for transforming the architecture of a medical organization during the transition to the concept of Smart Health was determined. Based on this, a reference model of the business processes of a medical organization has been developed at the industry level. At the regional level:

- a reference model of the business processes of a geographically distributed medical organization has been developed;
- requirements for digital technology services to support the management of geographically distributed medical organizations have been defined;
- an architecture for telemedicine services based on the Internet of Things technology has been developed.

For the field of maritime logistics at the enterprise level:

- a business model of the global shipping container line in the context of digital transformation has been developed;
- a method for analyzing the impact of digital transformation on key resources and key capabilities of the global shipping container line has been adapted;
- a strategic architectural alignment method has been adapted to harmonize business and IT architecture global shipping container line;
- a method of forming a balanced scorecard to evaluate the effectiveness of the digital transformation of the global shipping container line, taking into account the specifics of the industry, was developed.

Important in this business model are the use of paperless electronic document management, Internet of things technology (Golosovskaya et al., 2019, Maydanova and Ilin, 2018, Popova et al., 2019). Based on this, a reference model of the digital architecture of the global shipping container line has been developed at the industry level.

For the housing and communal sector and urban infrastructure at the enterprise level:

- the requirements of resource-supplying organizations and consumers of resource-supplying organizations for a monitoring, control and management system for the distribution and consumption of energy resources were analyzed,
- software and hardware complexes for monitoring and managing housing and communal services objects were introduced and integrated.

For example, for the purposes of managing the urban transport system, the city authorities, the population, the business community, emergency services, and law enforcement agencies are defined as stakeholders. The main objectives of the management are information, efficient and safe use of road infrastructure, fast and high-quality feedback. Data collection is carried out from cameras, detectors, GPS / GLONASS devices. Data transfer to the intelligent system is also carried out using mobile phones, TV/radio, information screens. Intelligent transport system processes the data and transfers the results to the control center of the urban transport system. In this architecture, the Internet of things technology, service-oriented architecture (SOA) is widely used. Business models in the housing and communal sector are focused on the use of energy efficiency principles. For example, a business model was developed using piezoelectric materials to illuminate urban spaces. The stakeholders in this business model are municipal authorities, transport companies, population, and production enterprises (Kalyazina and Lepekhin, 2018). Similar business models can be used for other alternative renewable energy sources. There are projects of an automated resource accounting system in homes; on the development of infrastructure for electric vehicles; on the implementation of a hardware-software complex for monitoring and managing resource supply, which allows for weather regulation of the supply of thermal energy, monitoring of overflows / underflows, prompt reporting of operational failures in resource supply networks; on equipping streetlights with radio-controlled relays to save energy when street lighting (Kalyazina et al., 2018). In general, such solutions are focused on the application of the Smart City concept, the main stakeholders of which are the population, government, and business. Based on this, at the industry level:

- a business model for the interaction of housing and communal services market participants has been developed;
- the possibilities of development and implementation of housing and communal services solutions using digital technologies (the Internet of things, machine learning and predictive analytics, big data processing, cloud computing) were identified;
- the architecture of digital services in the field of monitoring, control, and management of distribution and consumption of energy resources using the concept of the Digital Twin has been developed and approaches to its implementation in enterprises have been identified;
- a typical industry solution (software and hardware complex) for monitoring and management of housing and communal services has been developed;
- a promotion plan and an approach to integrating the developed solution into the existing IT architecture of enterprises has been developed.

Conclusion

Identification of stakeholder expectations from digital transformation and the main drivers of the development of Russian business enterprises allows formulating an approach to the formation of digital architecture of enterprises, which allows extending the digital architecture to the level of the industry, region, up to the state level. Such a single directed approach allows shaping the architecture of the digital space of Russian business according to predefined principles, methodology, taking into account the interests of all stakeholders. As a result, an effective digital transformation will provide a timely and adequate response to the challenges of the economy and consumers.

Acknowledgement

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