Igor Ilin, Svetlana Maydanova, Carlos Jahn, Jürgen Weigell, and Wolfgang Kersten

Digital Logistics as a Perspective for the Northern Sea Route

HICL

Published in: Adapting to the Future:
Carlos Jahn, Wolfgang Kersten and Christian M. Ringle (Eds.)
ISBN 978-3-754927-71-7, September 2021, epubli

Digital Logistics as a Perspective for the Northern Sea Route

Igor Ilin[1], Svetlana Maydanova[2], Carlos Jahn[3], Jürgen Weigell[3] and Wolfgang Kersten[3]

1 - Peter the Great St.-Petersburg Polytechnic University
2 - Unifeeder A/S St.-Petersburg, Russia
3 – Hamburg University of Technology

Purpose: *This paper aims to provide an approach to the digitalization of the Northern Sea Route. Current research and best practices analysis do not contain solutions for such large-scale projects like the digitalization of the Northern Sea Route (NSR). The findings of this paper can help to ensure support for the development of digital services for the NSR.*

Methodology: *The problem is considered in terms of the Enterprise Architecture approach. This study uses The Open Group Architecture Framework (TOGAF), a modern approach to the information systems development, and the Model Based System Engineering (MBSE) method, based on unified models.*

Findings: *Conducted studies suggest that the Northern Sea Route IT-architecture requires a holistic and consistent approach due to the involvement in the process of many different stakeholders. To create a competitive advantage, digital services of the NSR should be implemented on the basis of available best-in-class technologies, and their implementation requires a specific approach, based on the development of reference architecture models and their evaluation.*

Originality: *The Northern Sea Road implementation is a large-scale project and demands a detailed study and thorough elaboration in regard to different aspects. The results of this paper will create a foundation for the modelling of digital services for the NSR which correspond to a modern level of maritime industry development.*

First received: 24. Apr 2021 Revised: 29. Aug 2021 Accepted: 31. Aug 2021

1 Introduction

Currently, the Russian Federation (RF) put a lot of effort into the Northern Sea Route (NSR) development. Since the transported cargo on the NSR is increasing annually, experts promise the NSR a great future as one the most important maritime transport routes of the RF. Currently goals and accompanying documents are specified in these regards, including the target for "national container operators to increase cargo turnover by 2024 to 80 million tons per year, mainly on the NSR and to 160 million tons per year by 2035, including at least 40 million tons per year of containerized cargoes" (News Agency TASS, 2019). However, latest data shows that the project will not reach the goal set by the President of the RF in the May 2019 decrees to increase cargo traffic to 80 million tons on the NSR by 2024, and government agencies and companies are discussing the reduction of the target cargo turnover to 50-60 million tons (INTERFAX, 2020).

This active development of the NSR requires a development of innovative and up-to-date solutions that will enable a year-round use of the NSR in an environmentally friendly way.

The digital platform, which is developed by the NSR directorate of the "Rosatom" State Corporation, aims to fulfill this task. The design of this digital platform has been started in August 2020, and currently the concept of an integrated platform of the NSR digital services is being developed. Rosatom was appointed as the NSR infrastructure operator by the Federal Law No. 525-FZ of December 27, 2018 "On Amendments to Certain Legislative Acts of the Russian Federation". The goal of the digital platform development is to fulfill the need of corporations to provide services on the NSR and the government's goal is to make the NSR more attractive as a new transport route.

The decision to create the platform was also influenced by the increasing growth of cargo traffic along the NSR and as a consequence, the development of a nuclear icebreaker which is needed to provide year-round navigation possibilities. This, in turn, entails the need for a more effective ship navigation management in severe ice conditions, which is the goal of the digital platform.

On the other hand, the need for a digital platform at the state level is determined by the strategic importance of the NSR. This also concerns modernization, development and

ensuring reliable operation of the NSR, which are considered strategic priorities of policy by the RF. In addition, it partly concerns the socio-economic growth of the Arctic regions due to the timely transport of goods there, strengthening of scientific, transportation, navigational and partly military infrastructure to reliably secure the interests of the RF in the Arctic, as well as the development of the NSR as a new modern transport way of Russia, which may in the long term, according to estimates, by the 2030s to create a new, additional transport corridor within the Eurasian continent (Volovik 2021).

The development of platform solutions for the NSR involve in several directions. First, they are based on the consolidation of national experiences, combining all the best solutions of existing corporate digital platforms from companies which are currently handling cargo along the NSR and their needs for a uniform digital platform. Secondly there are digital logistic services being developed, which are oriented toward international partners so that the platform is not only to work as a domestic platform but can be linked with global digital logistics platforms.

The platform will focus on a wide range of services. At the first stage two big blocks can be singled out: navigational safety and environmental monitoring on the NSR. Rosatom plans to implement an ice navigator, which will make it possible to create safe routes through the NSR. Later it can be supplemented with other services e.g. further navigational or hydrometeorological services.

Furthermore, there are plans to create a domestic trading ecosystem platform for promoting and sourcing products as well as developing sales strategies and trade execution.

At this stage, foreign companies are not involved in the development of the concept. However, the platform is supposed to be built on the basis of accepted international standards and the platform concept will be discussed with a wide range of participants, in order to make final revisions and adjustments to the best of stakeholder needs.

Currently, the stakeholders can be roughly divided into several subgroups. The first group are the federal bodies of the executive branch of the RF, which are concerned with the Arctic zone in their respective functions. For example, the Ministry of Transport, the Ministry of Natural Resources, the Ministry of Defense, the Ministry of Emergency

Situations, the Border Guard Service and a number of others. Further, the Arctic subjects of Russia, whose sea coastline is the NSR directly as well as the subjects economically connected with it, for example not only Murmansk, Arkhangelsk and Kamchatka, but also St. Petersburg and Vladivostok. The third group is comprised of large companies such as NOVATEK, Rosneft, Sovcomflot, Gazprom Neft, Nornickel, AEON and Kazminerals, and the fourth group are scientific organizations. International companies and organizations will represent the fifth group of stakeholders.

This paper aims to provide an approach to the digitalization of the NSR. The findings of this paper can help to ensure support for the development of digital services for the NSR, which are capable to meet the requirements and characteristics of services for the involved maritime industry participants.

2 Method

"Enterprise Architecture (EA) is a discipline which focuses on the holistic management of the enterprise, based on aspects of its architecture, such as business processes, applications, information, hardware, as well as the relationships between them" (S. Buckl, F. Matthes, 2013).

Currently there are many EA frameworks that have been developed. Normally these EA frameworks cover four interrelated domains:

- Business architecture (business processes of an organization are considered),
- Data architecture (structure of the logical and physical data resources is analyzed),
- Application architecture (landscape of applications, their interactions, and relationships to processes is examined),
- Technology architecture (determines software and hardware capabilities required to support the business processes, data, and application services of the organization).

The Open Group Architecture Framework (TOGAF) is the most widespread open standard which provides a practical, industry-managed way for the design of Enterprise Architecture and it contains viewpoints, techniques and reference models for this design.

- "TOGAF standard considers an enterprise to be any collection of organizations that have common goals. For example, an enterprise could be:
- A whole corporation or a division of a corporation
- A government agency or a single government department
- A chain of geographically distant organizations linked together by common ownership
- Groups of countries or governments working together to create common or shareable deliverables or infrastructures
- Partnerships and alliances of businesses working together, such as a consortium or supply chain." (The Open Group 2018).

In accordance with TOGAF, "the term Enterprise in the context of Enterprise Architecture can be applied either to an entire enterprise and to one or more specific areas of interest within the enterprise. In both cases, the architecture crosses multiple systems, and multiple functional groups within the enterprise". Nowadays the term an "extended enterprise" is used frequently and includes partners, suppliers, and customers as well as internal business units (The Open Group 2018).

Thus, the Enterprise Architecture approach can provide support for clarification of digital services for the NSR, as well as elements, layers and aspects of the NSR architecture, but such a large-scale project requires a special methodology for the design and development of the IT-architecture. The Model Based System Engineering approach can be used as an effective tool to reach this goal.

Model Based Systems Engineering (MBSE) is a unified and integrated modeling approach of high-tech activities based on unified models and the System Tool Kit. The model is an artificially created object based on the recording of information about the object using symbols and an accepted notation. The model partially takes into account the entities of the object, replaces the object representation in its applications, and has a variety of uses depending on the target object life cycle stages.

The model typology is represented in Figure 1.

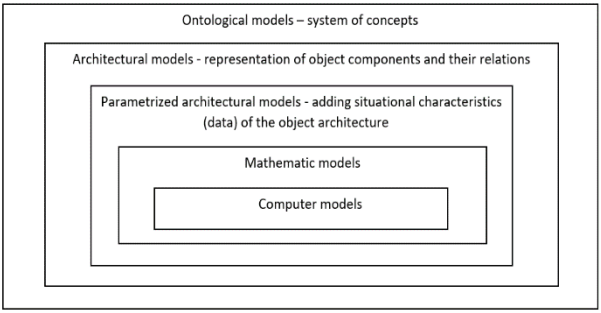

Figure 1: Model Typology [Kondratiev, 2020]

The MBSE methodology is realized via unified models which are consolidated into metamodels, platforms and the System Tool Kit. Parallel engineering and dynamic iterative redesigning is increasingly being used as well. Metamodels and platforms are increasing step by step, starting with the rapid creation of working prototypes; information modeling is transformed into computer modeling, systems become hybrid systems of systems from model and natural components, methodologies are consolidated: multi-physical modeling, engineering, management, cyber systems, computer engineering (Kondratiev 2020).

The reference framework of modelling is a requirements and constraints matrix which contains directories, system structures, metadata, and mathematical models of system constraints. MBSE allows the user to develop a multi-level matrix containing formalized requirements for the system, which in the process of development is broken down and cascaded to target metrics and resource constraints. The simultaneous fulfillment of requirements, achievement of target indicators and satisfaction of resource constraints of the system is achieved by conducting virtual tests.

MBSE tools support capabilities as developing and presenting the structure of ontological and architectural models of systems; forming the description elements reference lists; maintaining element relations tables, as well as model representation and visualization notations.

Thus, the development of digital services for such a large-scale project as the NSR requires a holistic and consistent approach due to the involvement of many different stakeholders in the process. To create a competitive advantage, digital services of the NSR should be implemented on the basis of available best-in-class technologies, and their implementation requires a specific approach, based on the development of reference architecture models and their evaluation.

3 Results

The authors have already written about the creation of digital services platforms and have been made proposals for digital services, which could be provided on the NSR in the past (Ilin et al. 2020). Digital platforms, which exist in the shipping industry were classified based on the Capability Driven Approach – an approach to the information systems development. Capability, in accordance with TOGAF, is a "particular ability or capacity that a business may possess or exchange to achieve a specific purpose or outcome, detailed definition of the capability requires an understanding of how this can be achieved by combining such supporting components as roles, processes, information, and tools" (Sandkuhl 2018). Three major types of maritime shipping industry digital platforms types were identified: the Maritime Community Cloud, the Single Window and the Maritime Business Ecosystem. "The Maritime Community Cloud e-platforms support business capabilities of cross-border trustworthy e-services to all commercial ports and their users in a cost-effective way; the Single Window e-platforms perform submission of standardized information and documents with a single-entry point to fulfill all regulatory requirements; the business ecosystem e-platforms ensure supply chain transparency and agility and support e-commerce capability" (Ilin et al. 2020).

Additional technologies used to operate e-platforms in maritime shipping, were identified, for example the Internet of Things, Cloud Computing, EDI (Electronic Data Interchange), Big Data, Inmarsat and Global Positioning System (GPS), robotic-aided systems, cyber-physical systems, blockchain, radio frequency identification (RFID) tags, and sensors. These technologies are widely used in the maritime shipping industry as digital solutions and will also be used on the NSR as well.

The authors also have identified digital platforms of the logistic sector of the RF (Ilin et al. 2021). “Currently there are several types of digital platforms in the transport industry in the RF. There are digital platforms which enable functional support of logistic operations, another type of digital platforms enable the submission of standardized information and documents to state bodies. But a modern digital platform of the transport sector needs to be able to support a business digital ecosystem. All participants of the Russian transport industry, as well as the Russian government, understand the value of such an integrated digital platform and some steps in this direction have already been made” (Ilin et al. 2021). One project which should be mentioned is the digital platform of “Rossiyskie Zhelesnye Dorogi” (RZD) which enables the activity support of business ecosystems (Marusin, Dmitiev 2019). The implementation of this could be a significant breakthrough in the use of digital services in the logistic sector of the RF as it supports not only the Business to Government (B2G) information exchange, but also the Business to Business (B2B) information exchange as well and provides thus opportunities for all involved parties. Another advantage is the future possibility of value co-creation and the cooperation of involved business ecosystems participants.

Another project, is the implementation of a digital platform in the transport sector of the RF (Zubakov 2019) which was approved by the Ministry of Transport of the RF. “Digital platforms of the transport sector of the RF shall provide B2B, B2G, Government to Government (G2G) information exchanges on local, regional, and national levels and sustain processes of business ecosystem participants such as companies and state bodies. In addition to e-commerce and online bookings, cargo monitoring, and transport process modelling; digital platforms should provide the capability for the Single Window mechanism” (Ilin et al. 2021).

Both projects are currently not implemented but they outline areas of the digital platform development for the logistics sector of the RF. The digital platform of the NSR could provide a number of capabilities to ensure a competitive advantage for the new transport corridor.

In this paper the elements and steps for the modelling of the NSR digital platform are outlined.

The first step of modelling is the identification of the capabilities of the Northern Sea

Route digital platform which are represented in Table 1.

Table 1: Capabilities of the Northern Sea Route Digital Platform

Capability	Functional support of operations	Submission of a standardized information and documents	Supply chain transparency and agility / Trade execution
Roles	Technological processing of information	State control and monitoring	Business ecosystem
Business processes	Shipping management Ice navigation Ship control Terminal management Fleet maintenance Infrastructure maintenance Safety Ecological monitoring	Single Window	E-commerce Cargo monitoring Value co-creation
Information	B2B, B2G Information Exchange on local / national level	B2G, G2G Information Exchange on local / national / international level	B2B Information Exchange on local / national / international level

Capability	Functional support of operations	Submission of a standardized information and documents	Supply chain transparency and agility / Trade execution
Tools	Cloud Computing, EDI, EDM, Big Data, sensors, GPS, Inmarsat, IoT, RFID, sensors, cyber-physical systems, blockchain, Artificial Intelligence		

The NSR is a large-scale national project, that is why capabilities of its digital platforms should not be limited by just functional support of operations but also provide opportunities for all business ecosystem participants. It should provide resources for controlling and monitoring, as well as resources for e-commerce and value co-creation tools. On the base of the NSR digital platform creation the Single Window concept for the maritime logistic of the RF could be realized.

The legislation of many countries require companies which are involved in the international transportation process to submit information and documents to the government agencies, and often to several different agencies, each with their own systems and paper forms. These requirements and the compliance costs represent a significant burden and can also become a major obstacle to the development of international trade.

The requirements of the Russian government are no exception. Information about the vessel arrival need to be submitted by sea agents (representatives of the sea carriers) simultaneously to four government authorities (sanitary control, state port control, customs and border services). Information for sanitary control is sent to the Rospotrebnadzor by e-mail, to the Rosmorrechflot (port control) and customs via departmental information systems of the Rosmorrechflot and CPS "Portal of the Sea Port" of the FCS of Russia, and to the border service - generally in paper form, either by courier or by fax. And only in the Big Port of St. Petersburg the border guards have begun to use e-mail. At the same time the Ministry of Transport of the RF requires the upload of 34 forms of scanned ship documents at every arrival and 39 forms of scanned documents

at every departure to the departmental informational systems of the Rosmorrechflot. Also, regardless of the information transmitted by fax or through information systems, sea carriers are required to submit the same 34 and 39 scans of ship documents to border and customs control authorities at every vessel call to the port (Korostelev 2020).

The solution of this problem is the creation of a Single Window where information and/or documents only need to be submitted once at a single point of entry. This approach could improve the information availability and processing, speed up and simplify information flows between businesses and the government and can lead to significant benefits for all parties involved in cross-border trade. Such a mechanism can provide more efficient and effective official controls and reduce costs for both the government and the companies.

The Single Window concept in the maritime logistic of the RF was already proposed by the authors before (Maydanova, Ilin 2018). “In general, the following obligatory characteristics are inherent for the Single Window:

- Existence of a Single Authority that receives information, either on paper or electronically, disseminates this information to all relevant governmental authorities, and coordinates controls to prevent undue hindrance in the logistical chain;
- Existence of a single-entry point for information exchange between the government agencies and business (B2G);
- A single submission and repeated use of the data transferred through single-entry point;
- A uniform standard format of data elements (uniform data model)” (Maydanova, Ilin 2018).

As the NSR development is controlled by the Government of the Russian Federation (Russian Federation, 2019), there are strong opportunities for the adoption of the Single Window concept and thus makes the collaboration of companies and government bodies easier. This concept could be subsequently extended to be used at all maritime checkpoints of the RF.

The creation of a Single Window capability on the NSR will allow for a breakthrough in the relationship between businesses and the government, as well as to reach a new level of international cooperation.

Currently, the creation of digital business ecosystems as a modern way of cooperation

and development of companies from different sectors of the economy has become widespread. Electronic platforms are one of the most effective means to ensure the functioning of such digital business ecosystems. The NSR digital platform will generate a new environment for all Arctic subjects of Russia and provide essential support for their access to national and international markets.

It is obvious that the platform needs to be developed on the basis of modern technologies which will secure a competitive advantage and high operational effectiveness. In order to model the digital services of the NSR platform, access to accumulated information on the implementation of the best-in-class technologies is needed. Representation means benchmarking of the implementation of these digital technologies by industry leaders. Such technologies could be used for a digital platform creation but could be refused due to risks and constraints in connection to its implementation. In this regard, the creation of a strategic resources ontology is an important step in the process of the NSR digital services modeling.

The second step of modelling is the setting of motivation elements, which need to be done with the EA approach help.

As was done described above, the NSR digital platforms shall provide to all involved parties certain business capabilities. In turn, “a capability requires or is supported by specific business processes, provided by specific roles, as well as it needs certain resources and IS components. The distinguishing characteristic of the capability is that it is designed to be provided in a specific context. The desired goal fulfillment levels can be defined by using a set of goal fulfillment indicators – Goal KPIs“ (Stirna et al.,2017).

The Balanced Scorecard (BSC) (Kaplan, Norton,1992) indicators are suited perfectly for this task. The Financial, Customer, Internal and Learning and Growth perspectives will provide a complete model, where indicators should be able to be identified, measured, and presented in a coherent way. It is important to note, that BSC metrics need to be done for several levels: the general level, the business-unit level and the business process level.

The BSC area should balance the interest of stakeholders. Different stakeholder groups have different concerns, specific views and often different positions and priorities. For

the BSC purpose stakeholders can be divided into external and internal ones. External stakeholders drivers, goals and concerns need to be reflected in the Customer perspective, and internal stakeholders ones – in the Learning and Growth perspective.

Another element of modelling are drivers. A driver is an "…external or internal condition that motivates to define goals and implement the changes necessary to achieve them. As the NSR stakeholders significantly differ, drivers could be grouped according to their goals" (TOGAF, 2018).

The next element is an outcome, which "represents an end result that has been achieved. Outcomes are high-level, business-oriented results produced by capabilities, closely related to requirements, goals, and other intentions" (TOGAF, 2018). Thus, the outcome of the functional support of operations could be ice routing service, and navigational and hydrographic services.

Requirement represents a "…statement of need that must be met by the architecture and represent the "means" to realize goals" (TOGAF, 2018). For example, to maintain ice navigation, satellite images of the NSR once a day are required.

"A principle represents a qualitative statement of intent that should be met by the architecture" (TOGAF, 2018). Principles define intended properties of a platform in a certain context and is motivated by some goal or driver. For example, digital platform services should support safety of navigation.

A constraint is defined as a restriction on the way in which a digital platform is realized. Risks are a wider category and characterize the probability of negative events.

As was described before, strategic resources represent first of all informational technologies, which could be used for digital services development. Other strategic resources could be financial, human and tangible assets.

All elements are addressed and monitored on all architectural layers. Principles, goals, drivers, stakeholders, constraints, and indicators must be combined in a digital model and have their own digital twins, links and digitized influence paths (chains of dependent influences) on each other and on all other elements of the enterprise architecture as presented in Figure 2.

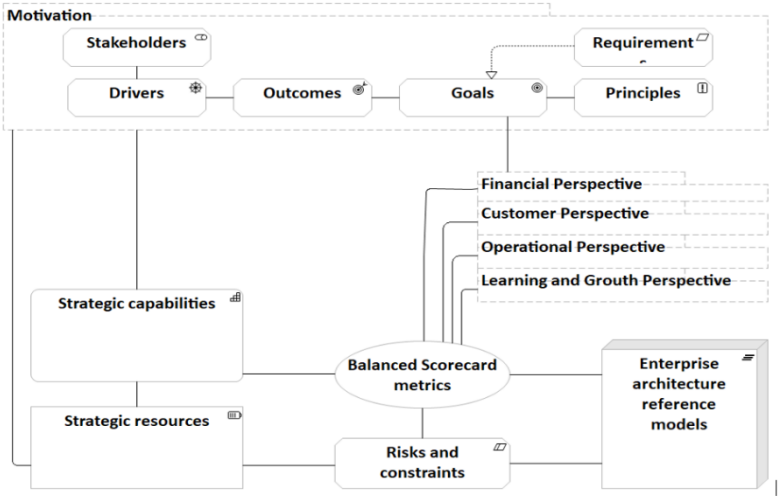

Figure 2: Elements of MBSE Modelling

Thus, to develop a model of the NSR e-platform with the help of the MBSE method, elements of modelling should be identified and combined in a digital twin.

For this propose an approach as follows is proposed:

- strategic capabilities;
- strategic resources;
- motivation;
- BSC metrics;
- risks and constraints;
- EA reference models.

These properties help to represent the digital twin, it should be done on the virtual modelling platform capable to correlate a number of metrics with Enterprise Architecture reference models. For this purpose, a multi-level matrix comparing and linking the indicators and the IT-architecture models is proposed as presented in Figure3.

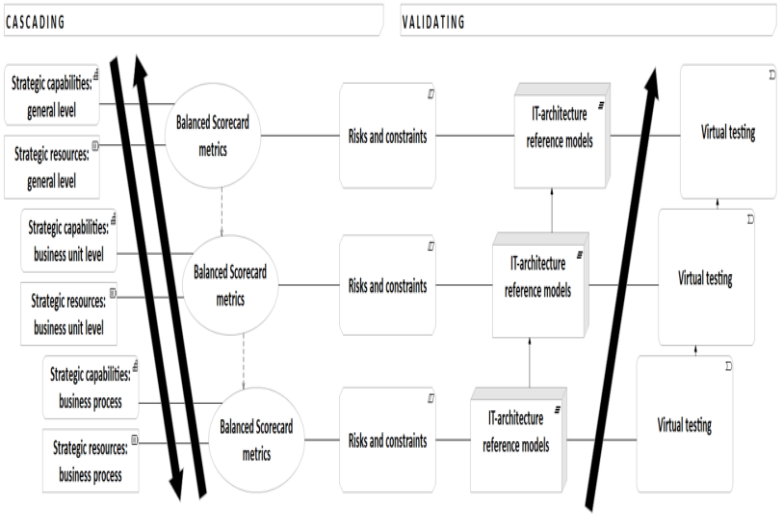

Figure 3: Multi-level Matrix Comparing and Linking Indicators and IT-Architecture Models

This matrix is in accordance with MBSE modelling as the reference framework which contains directories, system structures, metadata, and mathematical models of system constraints. As a result of this process, a large number of indicators and thus a balanced model is guaranteed, while initially the indicators can "conflict" with each other.

The multi-level matrix of comparing and linking indicators and the IT-architecture model is capable to provide a correlation in the process of virtual testing. First on a business process level, then on the business-unit level, and finally on the general level of the NSR digital platform. A top-down or bottom-up approach could be used to define strategic capabilities, resources, BSC metrics, risks and constraints, and the IT-architecture reference models. The choice of the particular approach depends on stakeholders interests and strategic goals.

Thus, the NSR IT-architecture requires a holistic and consistent approach due to the

involvement of many different stakeholders in the process. To create a competitive advantage, digital services of the NSR should be implemented on the basis of available best-in-class technologies, and their implementation require a specific approach, based on the development of reference architecture models and their evaluation.

The results of this paper create a foundation for the modelling of digital services for the NSR which corresponds to a modern level of maritime industry development by using EA approach and MBSE modelling.

4 Discussions and Recommendations

This paper considers several aspects of the NSR digital services development. Firstly, it is a review of the capabilities, which should be provided by the NSR digital platforms. Besides fulfillment of the requirements of the companies, which currently handle cargo along the NSR the digital platform need to becomes a powerful tool which is capable to enable a breakthrough and thus a substantially change in all relationships of the participants in the process. This large-scale national project could change the relationships between the government of the RF and businesses as well as create an environment for the development of the Russian Arctic territories and thus could help to change the landscape of international trade.

Secondly, this paper provides an approach to the digital services modelling, by proposing elements and the modelling structure as well. Although the proposed approach provides the benefits of simulating digital services of the NSR by offering a virtual testing of technologies and architectural models, it requires a careful study of the data and indicators obtained as a result of such tests, as well as comparing them with the actual results after implementation to be able to make the necessary adjustments. It is also necessary to conduct a benchmarking process to compare the results of virtual testing with existing best practices. This process could have limitations, for example a structured database of the necessary KPI's is needed.

5 Conclusions

Currently, the NSR becomes a more and more important transport corridor, the cargo turnover has increased exponentially and beat the record of USSR times cargo turnover on this direction several times from 6.5 million tons in 1987 to 33 million tons in 2020 (Volovik 2021). Nevertheless, state management of the Russian Arctic territory is extremely difficult, the reason lies not only in climatic, environmental or logistical features that affect development, the main difficulty is the critically high cost of human error. The Arctic is one the most dangerous regions in the world, since the price of development mistakes in the Arctic are disproportionally high. (Dolgova et al. 2018).

Therefore, all developments, including the digital services deployment, should be done with transparency and commitment and all stakeholders need to be involved into this process.

The digital platforms of the NSR should not become just new corporate platforms of the state corporation, they could make a significant contribution to the development of the Russian economy, strengthen relations between the government and businesses, and promote international trade relations.

References

Aldea, A.I., 2017. Enterprise strategic alignment method: a cross-disciplinary capability-driven approach. [online] Available at: <https://ris.utwente.nl/ws/portalfiles/portal/6045124> [Accessed 14 June 2020].

Buckl, S., Matthes, F., Schneider, A. W. and Schweda, C. M., 2013. Patternbased design research in enterprise architecture management. International Conference on Advanced Information Systems Engineering, Springer, pp.30–42.

Christopher, M., 2005. Logistics and supply chain management: creating value-added networks. 3rd ed ed. Harlow, England ; New York: FT Prentice Hall.

Dmitriev, A.V., Plastunyak, I.A., 2019. Integrated digital platforms for development of transport and logistics services. International Conference on Digital Technologies in Logistics and Infrastructure. ICDTLI 2019, Atlantis Highlights in Computer Sciences, vol.1, pp. 136-141

Economic and Social Commission for Asia and Pacific, 2013. Single Window Planning and Implementation Guide. [online] Economic and Social Commission for Asia and Pacific. Available at: <https://www.unescap.org/ resources/single-window-planning-and-implementation-guide>.

Fruth, M. and Teuteberg, F., 2017. Digitization in maritime logistics—What is there and what is missing? Cogent Business & Management, [online] 4(1). Available at: <https://www.cogentoa.com/article/10.1080/ 23311975.2017.1411066> [Accessed 25 April 2019].

Ilin, I., Levina, A., Abran, A. and Iliashenko, O., 2017. Measurement of enterprise architecture (EA) from an IT perspective: research gaps and measurement avenues. In: Proceedings of the 27th International Workshop on Software Measurement and 12th International Conference on Software Process and Product Measurement on - IWSM Mensura '17. [online] the 27th International Workshop on Software Measurement and 12th International Conference on Software Process and Product Measurement. Gothenburg, Sweden: ACM Press.pp.232–243. Available at: <http://dl.acm.org/citation.cfm?doid=3143434.3143457>. [Accessed 10 September 2019].

Ilin, I., Maydanova, S., Lepekhin, A., Jahn, C., Weigell, J. and Korablev, V., 2021. Digital Platforms for the Logistics Sector of the Russian Federation. In: H. Schaumburg, V. Korablev and U. Laszlo, eds. Technological Transformation: A New Role For Human, Machines And Management, Lecture Notes in Networks and Systems. Cham: Springer International Publishing.pp.179–188.

Ilin, I., Maydanova, S., Levina, A., and Lepekhin, A, 2020. Northern Sea Route e-platforms: tools for competitive development. In: Carlos Jahn, Wolfgang Kersten and Christian M. Ringle (Eds.), ed. Data science in maritime and city logistics. pp. 441-455.

INTERFAX.RU, 2020. The Russian Federation is thinking about reducing the target cargo turnover along the Northern Sea Route. [online] INTERFAX.RU. Available at: <https://www.interfax.ru/russia/718789> [Accessed 07 April 2020].

Kaplan, R.S. and Norton, D.P., 1992. The Balanced Scorecard – measures that drive performance. Harvard Business Review, January-February, pp.71–79.

Kondratiev V., 2021. Architects of the Future World. Unified process modeling for the North Sea Transport Corridor infrastructure creation. Economic environment of activity modeling. Macro and meso level digital model. Expert Session of GK Rosatom. Ontology of NSTC digital modelling. [online] Available at: <https://youtu.be/Dnz5vZV7bTs> [Accessed 25 May 2021].

Korostelev, V., 2020. Relevance of the sea «single window» mechanism in B2G interaction. [online] International Conference on Digital Technologies in Logistics and Infrastructure. ICDTLI 2020. Available at: <https://seanews.ru/wp-content/uploads/2020/11/icdt-2020> [Accessed 26 Nov. 2020].

Lankhorst, M., 2017. Enterprise architecture at work: modelling, communication and analysis. New York, NY: Springer Berlin Heidelberg.

Marusin, A.V, Ablyazov, T.H., 2019. Perspektivy cifrovoj transformacii logistiki. Bulletin of the Altai Academy of Economics and Law, 4–2, pp.240–244.

Maydanova, S. and Ilin, I., 2018. Problems of the preliminary customs informing system and the introduction of the Single Window at the sea check points of the Russian Federation. MATEC Web of Conferences, 239, p.04004. [online] Available at: <https://www.matec-conferences.org/10.1051/matecconf/201823904004> [Accessed 24 February 2021].

News Agency TASS, 2019. The Government of the RF intends to increase cargo transportation on NSR by 2035 to 160 million tons. [online] News Agency TASS. Available at: <https://tass.ru/ekonomika/7273475> [Accessed 07 April 2020].

Russian Federation, 2019. Regulation of the Government of RF № 3120-p dd 21.12.2019. The development plan of the Northern Sea Route (NSR) infrastructure until 2035. [online] Available at: <http://publication.pravo.gov.ru/Document/View/0001201912300038> [Accessed 20 January 2021].

Sandkuhl, K., 2018. Capability management in digital enterprises. 1st edition ed. New York, NY: Springer Berlin Heidelberg.

Stirna, J., Grabis, J., Henkel, M., Zdravkovic, J., 2016. Capability Driven Development – An Approach to Support Evolving Organizations. Springer-Verlag Berlin.

The Open Group, 2018. The TOGAF® Standard, Version 9.2. [online] Available at: <https://pubs.opengroup.org/architecture/togaf9-doc/m/> [Accessed 25 May 2021].

United Nations Centre for Trade Facilitation and Electronic Business, 2005. Recommendation №33. Recommendation and Guidelines on establishing a Single Window to enhance the efficient exchange of information between trade and government. [online] Available at: <www.unece.org/cefact>. [Accessed 11 May 2021].

Volovik , K., 2021. Gryadet tsirovizacia Sevmorpui. Morskie Vesti Rossii, [online] Available at: <http://www.morvesti.ru/exclusive/89076/>. [Accessed 25 May 2021].

Zubakov, G.V., Protsenko, O.D., 2019. Tsifrovaya platforma transportnogo kompleksa Rossiyskoy Federatsii. Nekotorye aspekty realizatsii. Kreativnaya ekonomika, № 13 (3), pp.407–420.