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Developing the digital platform strategy in rail freight transportation in Russia

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All materials, assumptions and conclusions presented are the author's developments formed within the framework of the master's thesis research based on data collected from open sources and interviews conducted. The value of the research is confirmed by a diploma with honors, as well as by victories and nominations in the framework of national competitions. The approach formed within the framework of the study and the results of its application can be extrapolated to international freight rail transport markets, since they meet common customer research standards.

Abstract

The research presents a parametric comparison of digital railway platforms, formed on the basis of a bi-directional investigation: industry analysis, including interviews and processing of statistical data on major Russian freight rail operators, and a comparative analysis of existing Internet solutions for optimizing railway logistics. This research refers to the strategic analysis of an investment project for the development and implementation of a digital platform for selecting and tracking cargo railroad cars. The author compares the key properties of digital platforms and determines their applicability in railroad logistics. The blockchain ecosystem is considered as one of the possible technological bases of the innovative project, and applicability of this technology is reasoned in the context of industrial demands. The benchmarking of competitive digital platforms resulted in a set of features making up a value proposal for potential users of the digital platform. The concept of the target product has been formed in order to meet the requirements of key participants in the transportation of railway goods – shippers, consignees, car owners, freight forwarders and control authorities – within a single digital environment. Conclusions and recommendations for further commercialization of the created concept are formulated. The research was conducted as part of a master's thesis commissioned by the Distributed Ledgers Technologies Center of St. Petersburg State University as part of one of the innovative projects on the digital transformation of sectors of the Russian economy. The nearest goal of the project is to form and test a prototype of a blockchain platform within minimal user requirements.

For citation

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Keywords

Digital economy, digital platforms, railroad transportation, product strategy, distributed ledgers technology, Russian Railways, freight logistics.

Introduction

When bringing software products to the markets of transport and industrial branches in the modern settings of the national economy, the strategic analysis quite frequently consists in the analysis of plans for digital transformation. For example, in 2016, the representatives of federal executive authorities noticed the need to implement digital platforms on the market of railroad transportation. Speaking about the benefits of an electronic platform for railway cars, which was a relevant topic of discussions with Russian Railways JSC in the recent years, the head of the Federal Anti-Monopoly Service Igor Artemyev gave the following example: "Remember what happened to the market of taxi services when intermediary companies appeared, such as Yandex.Taxi. It must be nice for a consumer to be able to press a button on an iPad and have a taxi waiting for them in under five minutes" [Zibrova, Petlevoi, www].

The updated strategy for digital transformation of Russian Railways JSC, which was adopted in August 2021, is directly related with the long-term development program of the company itself and with the digital transformation strategy approved by the Ministry of Transport of the Russian Federation. Advanced technologies being the focus of attention include informational modeling (BIM systems) in life cycle management of the railway infrastructure, predictive analytics and big data analysis for advanced logistics, Internet of Things based on RFID tags for rolling stock elements, smart contracts in blockchain networks used to organize a trusted interaction environment, and a variety of others. Import substitution as a means of ensuring technological independence and security is highlighted as another priority in the strategy [Pravlenie…, www].

All listed above gives favorable ground for implementing national IT developments in the considered branch. However, due to the rising competition among developers, the strategic analysis plays a growing role in creating and launching innovative projects for implementing branch-wise digital platforms.

Digital platforms as a growth catalyst of the IT industry

Despite the close attention paid to digital platforms by the public, there is no unified interpretation of this term since many authors focus on its different properties.

The international consulting company Accenture refers to digital platforms as a *group of technologies* "used as a basis providing a concrete and specialized system of digital interaction" [Mesropyan, www].

For experts of the Massachusetts Institute of Technology, this is a *business model*, "which creates costs facilitating exchange between two or more interdependent groups of participants" [Stepnov, Koval'chuk, 2019].

Another American researcher, Geoffrey Parker, known globally for his best-selling work *Revolution of Platforms* believes that a digital platform is a *business* "enabling value-creating interactions between external producers and consumers. The platform provides an open, participative

infrastructure for these interactions and sets governance conditions for them" [Parker, Van Alstyne, Choudary, 2017, 21].

A representative example of a definition of digital platforms in the Russian tradition is the interpretation proposed by the vice president of Rostelecom B.M. Glazkov. According to him, digital platforms are a *system* of "algorithmic mutually beneficial relations of a significant number of independent participants of a branch of economy (or an area of activity) performed in the unified informational environment, which leads to reduced transaction expenses by using a package of digital technologies for handling data and by changing the labor division system" [Tsifrovye platformy…, www].

Despite the fact that these definitions differ in categories ("group of technologies", "business model", "business", "system of relations"), they all underline the mutually beneficial interaction of participants, which warrants the creation of certain conditions in the digital environment. Therefore, a digital platform can be defined as a system of software solutions and organizational measures ensuring synergy of interaction of its participants through the unity of technological and process infrastructure, increased transparency of information flows, and reduced transaction expenses.

In practice, digital platforms represent complex informational systems establishing stable links between market players and open to members of the business community, app developers, service suppliers, and other agents. In other words, platforms create a digital structure of markets, eliminate intermediaries and complex hierarchic links, and promote innovative business models in the economy [Tsifrovye platformy, www].

Most prominent examples of digital platforms include companies that have revolutionized entire fields of the economy: Uber, Yandex Taxi and BlaBlaCar in the field of passenger transportation; Booking.com and AirBnB in the field of hotel business; Facebook and VKontakte in the field of social interaction; Aliexpress, Avito, and Yandex Market in the retail industry [Vorontsovskii, 2020].

Essentially, the specifics of operation of digital platforms in terms of advantages they grant to businesses can be divided into 4 categories:

– *de-verticalization and de-monopolization*. Preventing domination of a single company within the entire chain of added value. Implementing digital platforms can destroy hegemony of large companies in the field as they are stripped of their pricing function based on oligopoly rights;
– *disintermediation*. Removal of intermediaries. Due to the technological features of digital platforms ensuring direct interaction of participants, there is no need in intermediary services. An ideal model of a digital platform must only have beneficiaries (contractors), which increases the interaction rate and reduces the price;
– *commoditization*. Minimizing differences in individual characteristics of products. Modern providers of commodities and services usually implement innovation for improvement (rather than radical innovation), such that consumers are able to select between practically identical products of various brands aggregated on the digital platform;
– *reduced loyalty*. Refusal of clients to support certain brands. Digital platforms give ample opportunity to select from multiple products based on specific parameters due to information transparency. Under these conditions, the consumer has enough data to conduct integrated comparison of the offers on hand and to make a substantiated decision with account for their own needs [Dostov, Shust, Khor'kova, 2018; Kochergin, Pokrovskaya, Dostov, 2020].

As noted above, these specifics must be taken into account in order to develop a viable strategy for bringing high-tech products to industrial markets.

Prospects for implementation of digital platforms on the market of cargo railroad transportation in Russia

In 2020, the share of the transport branch in the national GDP amounted to 6.5% (RUB 6,952.88 bln), according to the Federal Service for State Statistics [On the production…, www]. At the same time, the potential for its digital development in the country is poorly realized: as stated by McKinsey consulting company, this branch fails to make it to the top 10 most digitized branches of the Russian economy [Tsifrovaya Rossiya…, www]. The Russian consulting agencies define the digital transformation status of transport and logistics as "catching-up" with "low digital maturity" [Tsifrovaya transformatsiya…, www].

To find the reasons for the current low rates and prospects of further acceleration of branch digitization, one must analyze the market dynamics of cargo railroad transportation in Russia over the last few years.

The market under consideration started to contract even before the pandemic, in early 2019, when, after a stable 3-year growth period, loadings in the Russian Railways networks fell down by 0.9%. The primary reason was the reduced turnover of highly profitable cargoes – ferrous metals (by 6%) and scrap of ferrous metals (by 8%). In 2020, affected by adverse macroeconomic trends, the turnover fell even more: the reduction in loadings was 2.7% (down to 1,244 mln tons) [Pogruzka…, www].

At the same time, positive trends were seen. Construction cargoes, whose loading had been falling for several years, began to grow in the second half of 2019, and their loadings increased by 6.1% as of 2021. This was mainly caused by the implementation of national projects in the construction of accommodation and motor roads, as well as the growing number of available railway cars in the network [Obzor…, www].

Recent years show a positive dynamics of container transportations, which are now one of the most dynamically developing cargo segments. In 2020, the growth of transportation here was 16%, up to 5.8 mln TEU (twenty-foot equivalent unit, used to estimate cargo capacity), and the highest growth was recorded in transit transportation – 38% up to 0.8 mln TEU, most of it being cargoes transported in the China – Europe – China direction [Perevozki…, www].

The state is not indifferent to one of the key branches of the national economy. In August 2020, to stimulate the growth of transit transportations, Decree of the Russian Government No. 1265 "On approving the Rules for granting subsidies from the federal budget to the Russian Railways JSC for compensation of short-received revenues resulted from reduced tariffs for transit transportation of cargoes in containers by public railroad transport in the Russian Federation" was adopted. According to the document, Russian Railways JSC received a compensation of income from providing a discount for transit transportation of containers in the East – West – East direction in 2020. Therefore, the plan is to subsidize transportation of 7,500 TEU and make the railroad transportation tariffs closer to sea transportation tariffs by using subsidies.

The overall dynamics of the market of cargo railroad transportations in Russia over the last 5 years is represented in Figure 1. It is clearly seen that the reduced growth rates of loadings in 2017-2018 developed into a negative dynamic of loadings in 2019-2020.

The noted reduction in loadings of coal and ferrous metals affected the market of semi-cars, the most mass-scale type of rolling stock, whose share in the fleet of cargo cars of all country operators amounted to 48% as of December 2020.

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The surplus of semi-cars occurred due to the abnormal balance of demand and supply that has been affected, in addition to the reduced loadings, by a high production volume of semi-cars in 2017-2019 due to vast decommissioning. The demand for new semi-cars fell down in 2020, but the purchase volumes in the post-Soviet countries still greatly exceed the volumes of decommissioning (20,600 semi-cars were produced in Russia over the given period, while about 3,300 units were decommissioned) [Ibidem].

The overall negative dynamics of the market in 2020 are not quite as prominent this year. The first three quarters of 2021 showed an overall growth of cargo transportation in the country. According to the statistics provided by Russian Railways JSC, from January to September 2021, the loadings were 956.2 mln tons as compared to 922.1 tons, with a growth of 3.7%, in the same period of 2020. The highest positive dynamics was shown by transportation of iron scrap (21.9%) and hard coal (8.1%) – cargoes that directly influence the demand for semi-cars [RZhD…, 2021]. A moderate reduction of the surplus of the rolling stock fleet is the most probable scenario, taking the recent trends into account.

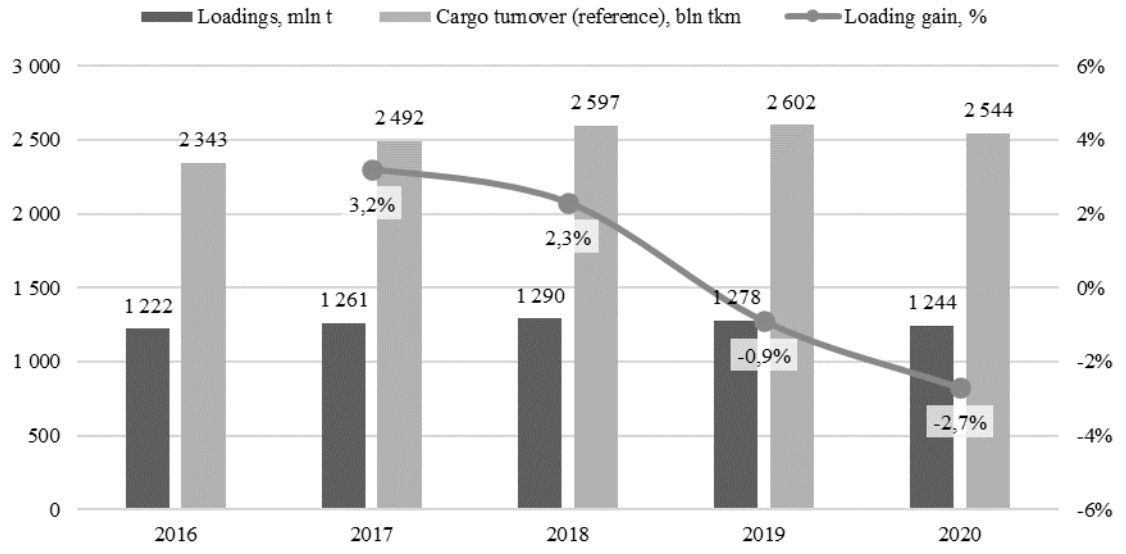

Figure 1 - Loadings and turnover of railroad transport on the Russian Railways network in 2016-2020 [Obzor…, www]

The market overview led to the following conclusions in terms of analysis.

Cargo transportation in the Russian Railways network were going down starting with 2019, but the last months of 2021 showed slow recovery, which indicates possible economic rehabilitation of key markets that could lead to a rise in demand for third-party IT projects.

The considerable surplus of the most numerous type of rolling stock – semi-cars – that was formed in 2019-2020 is going down, although insignificantly, i. e., this trend will remain in the nearest future. This points to the immediate need of cargo operators in new car trading tools, including digital platforms to search for forwarders and consignees.

Transit and export cargo transportations (both railroad and multimodal) will probably grow because of the state policy implemented for the development of these areas.

The current analysis shows that the base market in its current state generally supports the implementation of digital innovations.

Benchmarking of digital platforms for cargo railroad transportation in Russia

Digital platforms on the market of cargo railroad transportation are also referred to as *digital car exchanges*, as they are by nature platforms for interaction between consumers (forwarders and consignees) and suppliers of transport services (owners of cars and transportation operators). As noted above, the active development of these platforms started in 2016, influenced by a rise in attention to the de-monopolization of the industry by federal authorities.

Indeed, according to the advantages of digital platforms considered above, car exchanges prevent mediation in chartering (renting) cars since demand and supply data are open for all registered participants. The influence of large players is also minimized since the users can select parameters of logistics (location, car model, quality, etc.) pursuant to their personal needs, without regard for the operator brand.

Products dominating the market include:

– *the Cargo Transportation electronic trading platform (ETP GP)*. Developed by Digital Logistics Limited Liability Company, an enterprise in Russian Railways JSC (51% share), and Intellex Limited Liability Company (49% share). The initiators aim to digitize the process of selling cargo railroad transportations and create a completely new digital channel for sales of integrated logistical services for Russian Railways and their partner companies [O kompanii, www];

– *the VNIIZHT blockchain platform*. Russian Research Institute of Railway Transport (VNIIZHT) JSC and Russian Railways JSC implemented a pilot project in 2019 for a cargo transportation monitoring platform using the technology of distributed ledgers. The primary goal of the project is to create a trusted environment for the interaction of cargo transportation market players [Gruzovye perevozki…, www];

– *the Ezdok system*. Digital logistical platform of multimodal transportations: users can combine railroad transportations with other modes of transport, forming convenient routes on a turn-key basis [EZDOK, www];

– *the RailCommerce system*. This project has been a Skolkovo resident since 2018, focusing on the auction format (by price and transportation conditions) and planning doubled operations (online search of orders accompanied by loading and unloading to minimize non-loaded trips) [O proekte…, www].

Detailed characteristics of the listed large projects and summary data for other undertakings in the industry are given in Table 1, including the average count of such platforms as of today that shows that neither platform cannot capture the entire market, which indicates a potential for platform competition.

Table 1 - Comparative analysis of Russian digital railway car exchanges

Parameter	ETP GP	VNIIZHT	EZDOK	RailCommerce	Others
Examined advanced technologies					
Routing algorithms (Big Data)	+	+	+	+	+
Satellite positioning	-	+	-	-	-
Dislocation (+ Internet of Things)	+	+	+	-	+/-
Blockchain and smart contracts	-	+	-	-	-

Parameter	ETP GP	VNIIZHT	EZDOK	RailCommerce	Others
Experience, format, scale					
Year entered the market	2016	2019	2018	2014	2010 – today
Developed by Russian Railways / approved by Russian Railways	+	+	-	-	-
Involvement of users	More than 6,000 users	Pilot routes	N/A	About 2000 users	Varies
Integration with Russian Railways systems	+	+	-	-	-
Price / commission	0 for operators	1%	N/A	1.5% of the transaction	N/A
Stage	Product	Prototype	Product	Product	Varies
Partially foreign-sourced software	-	Hyperledger Fabric, Apache	-	-	-
Innovative partner	Russian Railways JSC	VNIIZHT	FSI	Skolkovo	N/A
Distinctive features					
Target participants	Operators, owners, forwarders, consignees, terminals, customs, banks	Operators, owners, forwarders, consignees	Operators, owners, forwarders, consignees	Operators, owners, forwarders, consignees	Operators, owners, forwarders, consignees
Interface	Interactive fields	Map, interactive fields	Map, interactive fields	Interactive fields	Varies
High-level list of services (except for car selection)	Car data, terminal services, forwarding, loading schemes and drawings. export/import	Dislocation tracking, smart-contacts for turn-key transactions	Dislocation tracking, car data, cargo arrival prediction, electronic document flow, multimodal planning, insurance	Selecting further loading, auction-based principle of trading, selling and buying cars, selecting parts and repair services, organizing car layover, insurance, own index of car rate	Auction-based principle of trading, forming accounting documentation, contractor rating system
Geography	Russia, Belarus, Finland, Latvia, China, Kazakhstan	Russia	Russia	Russia	Russia

In terms of developing the strategy of a digital car exchange, the industry benchmarking resulted in the list of functions demanded on the market. It should be noted that the range of functions is broad and their simultaneous implementation would require significant forces to develop and integrate processes greatly spaced in time. This would give competitors an opportunity to strengthen their positions. A possible solution here is the iterative implementation of functions in a wave-like manner, starting with the implementation of minimal critical requirements according to flexible methods for software development. These waves can be as follows.

Minimally viable product (MVP). Platform for selecting cars and orders thereon, arranged as classic two-sided digital platforms ("seller – buyer"). Tracking dislocation statuses and recording key data for cars and cargo. An innovative high-tech component (to overcome commoditization) such as a blockchain ecosystem ensuring confidential electronic document flow demanded by users because of regular arguments arising from non-compliance with agreement terms, leading to penalties and legal proceedings.

Comprehensive product. Advanced smart contracts used to organize turn-key transactions based on combined engineering of business processes together with major industry players. Combined use of the blockchain and Internet of Things – collecting data from radio probes and controlling this information in a trusted environment. Predictive analytics for transactions (automatic selection of transactions taking into account the collected statistics for platform users). Auction-based principle of interaction between participants and a ranking system.

Maximum product. Appeal for sole leadership (acquisition of competitive platforms) in case of successful progressive promotion at previous stages. Cross-industry solutions: support of multimodal transportation (combined "railroad – road" and "railroad – port" routes), integration with digital services of Russian Railways JSC (terminals, forwarding, customs, insurance, payment delay), expanding the geography to the neighboring countries.

An obvious success criterion that must be noted is cooperation with the natural monopolist at the earliest stages of project development; so, one of the key objectives in the beginning would be locating and engaging specialists to the project team with the tailored network of contacts with Russian Railways.

Due to the innovative nature of the project, it is also important to involve participants possessing skills and experience in implementing advanced technologies. For instance, in terms of blockchain solutions, the primary specialized scientific and practical cluster of the country is the Distributed Ledger Technologies Center of the Saint Petersburg State University (DLTC SPSU) formed in 2018 in order to implement the programs of the National Technological Initiative [Tsentr…, www].

Conclusion

The research forestalls the comprehensive strategic analysis. Current results enable making the following key pre-requisites for bringing the innovative software product to the market of digital services of cargo railroad transportations in Russia.

Implementing digital platforms in the considered industry is supported at the federal level, therefore the analysis of digitization areas in Russian Railways JSC must be done as an integral part in developing a strategy for any relevant product.

The digital strategy of Russian Railways JSC promotes Russia-based players to emerge on the related market of software solutions due to the existing plans for active import substitution and development of advanced digital technologies. It is important that Russian Railways JSC have

experience of own developments and cooperation with external software developers.

The industry of railroad transportation shows slow recovery, which indicates possible economic rehabilitation of key market players, which could lead to increased demand for external IT projects. The considerable surplus of the most numerous type of rolling stock – semi-cars – that was formed in 2019-2020 is going down, although insignificantly, i. e., this trend will remain in the nearest future, which points to the need of cargo operators in new car trading tools, including digital platforms to search for forwarders and consignees.

Key advantages of the platform-based approach to digital transformation lies in "blurring" the influence of large players (de-monopolization) and reducing the loyalty of their consumers, as well as in excluding spare links (intermediaries) from the added-value chain (disintermediation). Such advantages will be found interesting by small forwarders and consignees not included in the network of large-scale long-term contracts and having no advanced logistical expertise.

Developers of digital car exchanges should not disregard commoditization – availability of multiple similar product solutions, which improves probability of random selection of the platform by the user. On the one hand, this speaks of the existence of an open market with low entrance barriers; on the other head, it suggests the need to implement innovations to achieve a substantial competitor advantage. A shining example of innovations in the industry can be the organization of a blockchain ecosystem of trusted electronic document flow as part of cargo transportation expediting.

The existing experience of digital car exchange shows that consumers expect more – namely, a single window to solve the entire complex of issues associated with organizing turn-key cargo transportation. It is reasonable to implement this large-scale feature set in several iterations. The initial stage should involve the selection of a basic innovative technology and fulfilment of the fundamental needs of users (car selection and tracking). Further development has to include simultaneous use of multiple high-tech options (such as IoT data and digital twins in a blockchain network or predictive analytics based on algorithms for big data collection and analysis). The maximum version of the product is impossible without large-scale integration with the IT landscape of Russian Railways, expansion to new geographic markets, and advancement beyond the railroad logistics (supporting multimodal transportation).

Regular cooperation (ideally, contracting) with Russian Railways JSC starting with the early stages of project development is a key factor of success, along with innovations. No cooperation may be a critical barrier or even a cause for forced shutdown of the project and re-orientation of used assets.

Further studies can be dealing with adopting a practical plane: developing a specific innovative project in terms of strategy (analysis, internal and external environment, formulating a value proposition and business model framework, business planning, and financial and economic modeling).

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Разработка стратегии развития цифровых платформ в сфере грузовых железнодорожных перевозок в России

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Аннотация

В исследовании представлено параметрическое сравнение цифровых железнодорожных платформ, сформированное на основе двунаправленного исследования: отраслевого анализа, включающего интервью и обработку статистических данных о крупнейших российских грузовых железнодорожных операторах, и сравнительного анализа существующих интернет-решений для оптимизации железнодорожной логистики. Данное исследование относится к стратегическому анализу инвестиционного проекта по разработке и внедрению цифровой платформы для выбора и отслеживания грузовых железнодорожных вагонов. Автор сравнивает ключевые свойства цифровых платформ и определяет их применимость в железнодорожной логистике. Экосистема блокчейна рассматривается как одна из возможных технологических основ инновационного проекта, и применимость этой технологии обоснована в контексте промышленных требований. Сравнительный анализ конкурирующих цифровых платформ привел к созданию набора функций, составляющих ценное предложение для потенциальных пользователей цифровой платформы. Концепция целевого продукта была сформирована с целью удовлетворения требований ключевых участников перевозок железнодорожных грузов – грузоотправителей, грузополучателей, владельцев вагонов, экспедиторов и контролирующих органов – в рамках единой цифровой среды. Сформулированы выводы и рекомендации по дальнейшей коммерциализации созданной концепции.

Для цитирования в научных исследованиях

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Ключевые слова

Цифровая экономика, цифровые платформы, железнодорожный транспорт, продуктовая стратегия, технология распределенных реестров, Российские железные дороги, грузовая логистика.

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