Conventional and Digital Technologies Convergence as an Additional Advantage in Ensuring of Supply Chain Counterparties Economic Growth

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Abstract. Hybrid business models of digitalization are relevant for most companies at the stage of digital transition, since digitization of business models occurs partially, digitalization projects are implemented in close connection with traditional technologies, previous ways of providing consumers with a value proposition, and it is often impossible to implement digital projects in isolation from traditional ways of organizing the provision of services. Business faces not a full-fledged digitization of business, but a partial or so-called hybrid model. The article proposes the definition of a hybrid model of digitalization, substantiates the economic advantages, as well as the risks and threats of additional losses during the introduction of hybrid digitalization models, offers a combined matrix-scheme of the effects of digital transformation projects of the Russian Railways Holding and the parameter "degree of project hybridization". Based on the method of analyzing hierarchies for a separate sample of projects, the technology of ranking them according to the multicriteria principle, taking into account the degree of hybridization parameter, is shown. The methods of descriptive diagnostics, content analysis, hierarchy analysis and a number of others were used. The results are useful for companies' management to understand the essence of transitional – hybrid models within the framework of corporate digitalization projects and programs.

Keywords: Hybrid models · Hybrid digitalization · Digital technologies · Hierarchy analysis method

1 Introduction

A hybrid business model of digitalization means the simultaneous application of a traditional business model (previously existing traditional technologies, methods of organizing sales and management tools that work not on a digital basis) and an innovative business model (involving the digitization of both internal processes and the creation of digital channels, platforms, consumer interaction services, as well as the introduction of cyber-physical assets into the production process).

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The hybridization process combines various elements of two business models into one hybrid model, which is considered as a special form of the management object at the stage of the digital transition of companies. The hybrid form of synthesis of digital and non-digital technologies, market channels for the sale of products and services, the specific structure of the cost budget, combining the former items of expenditure with new digitization projects ultimately lead to competitive advantages that companies receive at the stage of digital transition of their business and the environment. On the one hand, there is a business model based on the traditional mechanism of rendering (in our case) transport services. Currently, we are witnessing a movement towards a hybrid market, characterized by a transition from the simple coexistence of two markets (traditional and virtual-digital) to a hybrid one. An example of the difference between a traditional market and a hybrid one is the basis, as a rule, a digital platform, where in addition to basic services, additional services are offered: related, potentially in-demand services, the purchase of which on a digital platform becomes more convenient and economical.

2 Materials and Methods

The information base of the study consists of statistical indicators included in the databases of international and Russian statistics, public reporting data on the Russian Railways Holding and its individual companies, open sources and analytical reviews providing information on the research topic. At the level of the Federal State Statistics Service of Russia (Rosstat), the indicators «Information on the use of information and communication technologies and the production of computer equipment, software and services in these areas» were used; «Information on the development and use of advanced manufacturing technologies».

Representatives of the foreign scientific community are mostly showing great interest in the study of hybrid business models today. Among the most informative works, we note the works of the authors: Cavalieri A., Saisse M. [2], Endres H., Stoiber K., Wenzl N.M. [3], Estrada M.A.R. [4], Goldsby C., Hanisch M. [6], Jacoby M., Jovicic B., Stojanovic L., Stojanovic N. [8], Tabak E. [16], Tabares S. [17]. The significant research potential and practical significance of the studied area predetermine its great prospects in Russia. The basis for the study of hybrid models of transport and logistics business is laid in the works of the authors: Bozhko L., Sapanova R., Shtykova I., Wijayanti F. [1], Fedorenko R.V., Khramtsova E.R., Pokrovskaya O.D. [5], Green L., Zhuravleva N. [7], Kazanskaya L., Proskuryakova E. [9], Pokrovskaya O., Fedorenko R. [11].

3 Results

3.1 Features of Hybrid Models of Digitalization

The introduction of hybrid business models, the essence of which consists in the coexistence of two complementary technological spheres: traditional methods of production and implementation, the creation of a value proposition for the consumer and digital transformations, in particular, electronic channels of interaction, digital services,

platform solutions, new cyber-physical systems, represents a new scientific and practical problem. Hybrid models of digitalization also include such methods of describing business processes, which are characterized by additions of non-improvised traditional technologies with separate fragments of digital technological innovations. For example, digital projects are not implemented throughout the company, but only in a limited part of divisions, in a narrow segment of the main technological process, have the character of partial selective digital additions and minor transformations.

Hybrid models of digitalization will be in great demand, because in conditions of a limited budget of companies, hybridization undoubtedly contributes to companies obtaining an additional effect, greater added value, better orients their attention to the increasing demands of consumers in terms of the speed of operations, transparency and visibility of technological and logistics processes.

But the development of hybrid business models of digitalization is fraught with obvious risks and problems, in particular:

- hybridization leads to the duality of ensuring the operability of two convergent forms within one hybrid, performing operations, repairs and maintenance, updating digital and non-digital equipment and other assets (for example, servicing both ticket sales equipment at ticket offices and online information and communication devices);
- often, the digital form of a hybrid cannot function normally and smoothly in isolation from the traditional non-digital form: for example, errors that occur, failures in digital systems must be corrected and eliminated by employees (the probability of high costs here is high), and cyber-physical systems themselves are not able to do this;
- the work of cyber-physical devices, platforms, Internet of Things, etc. takes place under mandatory external supervision, the presence of a person;
- there are threats caused by possible cyber attacks, interference, hacking, information leakage;
- the limitations of the hybrid model, the impossibility of its full application at the request of customers due to the fragmented, point-based nature of the implementation of digital projects only in certain areas, divisions, decorative content, when individual technological solutions are implemented not to build a real business model on a digital basis, but to create a formal appearance of digitalization;
- the risks of reducing the investment budget after the launch of projects or the initial underfunding of large-scale events, which will lead not to real economic results, but to partial digital improvements and additions that create minimal effect.

In the Russian Railways holding, digital transition projects also have signs of a hybrid. Some of the projects are most practically feasible and low-risk within the hybrid model (dynamic pricing within the framework of the customer experience management platform; predictive analytics of technical condition based on mobile diagnostics data; predictive analysis of the technical condition of freight cars; management of customer experience and minimizing customer churn in CRM services). Individual projects, such as the introduction of a system of motorists on mountain locomotives; the system of assistance to the driver when driving due to technical vision; automatic disbanding of wagons on sorting slides, are characterized by increased risks within the framework of the hybrid digitalization model for many of the reasons outlined above.

Despite the risks, the hybrid digitalization model has great advantages in terms of generating additional effects.

The obvious advantage is the creation of additional competitive advantages in the hybrid model due to the differentiation of the offer. Various products and services are combined with digital services and additional services. Multi-channel sales options, both offline and online, increase the reach and flow of consumers.

Customer orientation in hybrid models is ensured, among other things, thanks to the close digital exchange and cooperation of companies, often competing. In digital environments, the consumer is provided with a variety of choices, a fast speed of obtaining information, and an additional value of multi-channel access is created.

Another significant positive effect of the hybrid business model is saving transaction costs, reducing unproductive losses and time costs that do not lead to the creation of value and value. We also note the economies of scale, the possibility of savings for both the company and its consumers (for example, in mobility services as a service, last-mile delivery services).

All this will lead to an increase in operating profit, an additional increase in the return on investment in hybrid digitalization projects.

Using a single example - the project of unmanned railway traffic - we will show that along with the advantages in the hybrid digitalization model, there are risks and a number of unresolved problems.

The introduction of unmanned technologies in railway transport will ensure the optimization of train traffic, high accuracy of the process without the participation of the driver, the release of human labor when performing routine operations, a significantly higher degree of awareness of dispatchers and, in general, traffic management information content, a greater level of safety and predictability of the system.

But the problems of autopilot rail traffic can arise over long distances (not within the agglomeration, but between regions). For example, the probability of a system failure when entering the path of an animal, a person, the appearance of foreign objects, snow debris, etc.

The occurrence of failures in the operation of systems will lead to the need for human intervention, the direction of a group of workers to the place of occurrence of the situation, will cause downtime and disruption of the arrival and delivery of goods in a certain direction.

With the transition to automation, the information load on the operator, the central dispatcher for the control of unmanned vehicles increases (for example, false alarms, erroneous warnings, etc.).

Catastrophic risks are also possible, which can lead to software failures, possible cyber attacks and hacking of control systems.

Therefore, hybrid digitalization business models should be implemented with very serious crash testing and performing a large number of technical and economic calculations.

3.2 Using the Hierarchy Analysis Method in the Study of Hybrid Models of Digitalization

In conditions of high risks of investing in hybrid digitalization projects, existing financial constraints on the implementation of large and large-scale investment projects, business investors need a high reliability of evaluation of the results and effectiveness of investments. Fragmentation, conditionality, multivariance, and the probability of achieving effects in hybrid digitalization models determine the importance of improving and deepening the methods of their assessment.

One of the tools here is matrix analysis, as well as multi-criteria analysis taking into account the hierarchy of evaluation indicators.

For the empirical evaluation of hybrid digitalization projects based on matrix analysis, we propose a specific analytical tool - a combined matrix-scheme of the effects of digital transformation projects of the Russian Railways holding and the degree of their hybridization. The matrix scheme is based on existing studies of elements of the corporate strategy of digital transformation of the Russian Railways holding until 2025, additional expert assessments based on the results of meetings and project presentations [10].

We introduce the concept of "relative degree of hybridization of the project" - a conditional value showing the combination, the ratio in the project of the critical mass of basic digital technological innovations and traditional non-digital technological units. In our study, we propose to differentiate the parameter by levels:

- absent hybridization – the project is completely based on full-fledged digital transformations, the processes of creating and implementing a product, services are fully implemented on the basis of digital technologies;
- weak hybridization – the project is mainly associated with a digital technological basis, and the addition of traditional technologies is insignificant;
- moderate hybridization - the project is associated with two forms of technologies in approximately equal proportions, digital solutions and traditional non-digital means of production are synchronized in importance, the contribution of each form to the creation of added value of a product, service is approximately the same;
- significant hybridization - the digital component in the project is of the nature of improvement, improves the basic form; the creation and implementation of products and services are effective even in the absence of digitization of business processes; the project is difficult to implement without traditional technologies;
- strong hybridization – the project is extremely slightly digitalized, the digital basis included in it is characterized by insignificant and barely noticeable influence; or the implementation of the project is impossible in isolation from traditional technologies.

Table 1 shows the formed empirical matrix-scheme of effects on a sample of projects of digital transformation of the Russian Railways holding and the degree of their hybridization.

A mathematical tool, the use of which is promising for further analysis of hybrid models of digitalization, is the method of hierarchy analysis. Its use does not lead to obtaining any single correct solution for the investor, but allows in a ranked sequence

Table 1. Empirical matrix-scheme of effects on a sample of projects of digital transformation of the Russian Railways holding and the degree of their hybridization

Evaluation parameter	Effect - cost reduction of:	Effect - additional income by (from):	Degree of hybridization
Project name			
1. Integrated system of interaction with customers participating in the freight transportation market (CRM)	Transactional costs, including for act-claim work	Cargo transit in international traffic, responding to customer requests	Moderate
2. Unified digital service - blockchain of smart contracting and interaction of freight transport participants	Transaction costs, losses from waiting times during paperwork	Monetization at the expense of additional services, due to the growth of cargo turnover with a decrease in the turnover time of wagons	Significant (complexity of full coverage)
3. Digital paperless transportation using Intertran technology	Losses from downtime and fines	Growth of the transit flow of goods	Weak
4. MaaS ticket solutions for passengers (basic and related services)		Generation of commission income, promotion of services in related industries, a single value proposition	Moderate (difficulty of full coverage)
5. Customer experience management platform «digital passenger footprint»	Individual unproductive costs and losses	Mobile response to demand, flexible tariff schemes	Weak
6. Predictive analysis of the technical condition of freight cars	Maintenance and repair costs, losses from unplanned downtime		Moderate
7. Artificial intelligence («unmanned locomotive», «traffic controller», etc.)	Cost reduction due to downtime of wagons, due to accurate compliance with the schedule, reduction of staffing		Strong (the value of constant convergence with traditional technologies)

Source: compiled by the author using data [19]

of alternatives to find an option that best fits with the understanding of the problem and the tasks at hand.

Table 2 shows the calculations of matrices and vectors performed by us using the hierarchy analysis method, which build a list of projects in a hierarchical sequence (determine the priority of projects) by synthesizing two criteria: “degree of hybridization” and “potential effect”.

Table 2. Coordinated calculations and the final solution of hierarchical prioritization of the considered projects, found using the hierarchy analysis method

Project	Matrix of paired comparisons for the parameter «degree of project hybridization»							Approximate value of the main eigenvector	Matrix of paired comparisons for the «potential effect» parameter							Approximate value of the main eigenvector	Hierarchical synthesis vector - priority vector
Project 1*	1	3	1/3	1	1/3	1	5	0.126	1	3	1	3	5	5	5	0.282	**0.2430**
Project 2	1/3	1	1/5	1/3	1/5	1/3	3	0.058	1/3	1	1/3	1	3	3	3	0.143	0.1218
Project 3	3	5	1	3	1	3	9	0.270	1	3	1	3	5	5	5	0.282	**0.2790**
Project 4	1	3	1/3	1	1/3	1	5	0.126	1/3	1	1/3	1	3	3	3	0.143	0.1388
Project 5	3	5	1	3	1	3	9	0.270	1/5	1/3	1/5	1/3	1	1	1	0.050	0.1049
Project 6	1	3	1/3	1	1/3	1	5	0.126	1/5	1/3	1/5	1/3	1	1	1	0.050	0.0689
Project 7	1/5	1/3	1/9	1/5	1/9	1/5	1	0.023	1/5	1/3	1/5	1/3	1	1	1	0.050	0.0433

* Note: the numbering of the projects corresponds to the first table.
Source: developed by the author.

When using the hierarchy analysis method, we took into account two levels of hierarchy: the degree of hybridization and the possible effect for the company (medium, significant, high). Based on the results of calculations of the matrix of the hierarchy analysis method, the best solution according to the criteria: «income maximization/minimization of the «degree of hybridization» parameter are the projects: «integrated system of interaction with customers participating in the freight transportation market (CRM)» and «digital paperless transportation using INTERTRAN technology».

4 Discussion

Along with the obvious certainty and evidence of the results of the study, we can assess its limitation in terms of the lack of a set of statistical data to predict the effects and assess economic growth due to projects of specific technologies of the fourth industrial revolution: industrial Internet of things, big data analytics, distributed ledger platforms, artificial intelligence, etc.

The available statistical data arrays of «Russian statistical agency» and international statistics only allow ranking information on the use of individual technologies. Following the trend of new trajectories and problems of digitalization, relying on the experience of [12–15] we described not only the dialectical relationships between digital and traditional business models, but also formed matrix calculations using the hierarchy analysis method, which ranked the list of projects of digital transformation of «Russian railways» company in a hierarchical sequence, taking into account two criteria: «degree of hybridization» and «generated potential effect».

We can assess the limitations of our research in terms of the lack of procedures for predicting the effects of hybrid digitalization in transport using Big Data and artificial intelligence. This important direction of increasing the reliability of the results of the introduction of hybrid digitalization is used by a number of authors, in particular [10, 18, 20], and is the most important direction for further research.

5 Conclusions

Hybrid business models of digitalization have unconditional advantages, but at the same time their implementation is fraught with many risks and difficulties. The risks of hybrid digitalization are associated with fragmentation, the inability of the cyber-physical system to correct errors and eliminate their consequences, additional investment burden on businesses using a hybrid of traditional and digital factors for creating goods and services.

Hybrid business models of digitalization are a promising object of analysis, one of the tools of which is the matrix of the ratio of parameters: effects, degree of hybridization, priority in the portfolio of projects, investment costs, the value of return on investment.

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