
Business Performance Management Models Based on the Digital Corporation's Paradigm

Sergei Naumovich Bruskin¹, Aleksandra Nikolaevna Brezhneva¹,
Ludmila Pavlovna Dyakonova¹, Olga Viktorovna Kitova¹, Victoria
Mikhailovna Savinova¹, Tamara Petrovna Danko¹, Vladimir Dmitrievich
Sekerin²

Abstract:

Digital development of the global economy has increasingly severe implications for business, society and State. The so-called digital transformation (DX) has already turned from a scientific paradigm to reality, adjusting the development strategies of entire states, changing the face of social infrastructure and reformatting business processes. The market participants now face serious challenges: how to build their own business model and how to find their place in the digital ecosystem of the nearest future, drawing on digital technologies.

That is precisely why the research and approbation of approaches to building an information model of a digital corporation are not only topical, but also very timely. The article provides an overview of several important studies in the field of DX, along with a comparative analysis of classical and digital models of corporate governance; it also shows the potential for the development of the CPM concept (Corporate performance management) considering the DX requirements and the advantages of the evolutionary planning approach.

The authors present the paradigm of building information and analytical systems for digital corporation management with the use of advanced business intelligence based on dynamic intellectual models. The article describes examples of real projects on the development of support systems for decision-making in terms of marketing and financial management, including business effects from the use of similar systems.

The authors have summarized project experience in the field of building a digital system of corporate management based on the Academic Competence Center of IBM "Reasonable Commerce" (located in Plekhanov Russian University of Economics) and outlined the prospects for further research.

Keywords: digital transformation (DX), Digital performance management, advanced business analytics, digital ecosystem.

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¹ Plekhanov Russian University of Economics, 117997, Russia, Moscow.

² Moscow Polytechnic University, 107023, Russian Federation, Moscow.

1. Introduction

Global digital transformation (DX) currently affects all the aspects of human life, rapidly changing a private life, business, markets, state and social institutions. As reflected in the published results of the study "Digital Universe" (Research and analysis of IDC, commissioned by EMC "Digital Universe study", 2014), conducted by EMC and IDC, by 2020 there is likely to be a 10-fold growth of the "digital universe" compared to the level of 2013. According to the report of Deloitte (Deloitte's seventh annual report Tech trend 2016), some technological trends in 2016 might change the business rules in various areas in the nearest future – within 18-24 months. While researchers identify capabilities of the so-called "third platform" (cloud, mobility, social business, advanced analytics and large data), major corporations face serious challenges – how should their target business architecture and associated processes and technologies change in order to become competitive market participants in a new digital reality (Westerman, Bonnet and McAfee 2014a; Olanrewaju, Smaje and Willmott 2014; Digital transformation in the Age of the Customer, 2015; Westerman, Bonnet and McAfee 2014b; Thalassinou and Politis, 2012).

Paradoxical as it may sound, corporations themselves are a significant barrier to DX – their business models, business processes and corporate management tools, created and proven successful in the predigital era of development: methods and technologies of targeted management based on KPIs, corporate performance management, strategic and operational marketing management, etc. Table 1 summarizes the results of comparative analysis of classical and digital models of corporate governance.

Table 1. Comparative analysis of classical and digital models of corporate governance

	DX Key Indicators	Classical models of corporate governance	Digital models of corporate governance
1	Digital development strategy	Traditional business strategy in which digital technology is given a supporting role	Digital technologies underlie the business strategy (digital services, digital products, digital management)
2	Digital operational performance management	Monitoring of implementation of operational plans, in which digital technologies provide data for the plan-fact analysis	Digital technologies largely assume the role of operational forecasting and analysis, as well as operational decision-making on the sales of products and services
3	Institutional transformation	Efforts are being made to introduce digital management approaches within the framework of the outdated institutional structure (traditional	Institutional structure is flexible, flat and "open" towards the market (part of the digital ecosystem)

		management pyramid)	
4	Digital business processes	Digital technologies support outdated business processes	Digital technologies are an integral part of digital business processes
5	Information support for digital control	Efforts are being made to integrate digital technologies with the existing corporate information systems (classical implementation methodologies of business applications)	Digital technologies are applied throughout the value chain of the core business (flexible implementation technologies of business applications)
6	Speed of decision making	In accordance with corporate policies and procedures	Real-time
7	Work with digital data	Largely, the inhouse data from corporate information systems company is used. No deep data analysis. The frequency of analysis is consistent with the corporate planning regulations.	Both inhouse data and arbitrary structure data from external sources (social networks, partners and digital channels) are used. Advanced analytics of large data is part of the digital business processes.
8	Digital competence of personnel	Efforts are made to provide digital management to the personnel responsible for traditional business processes with no digital competencies	Established digital competencies in the field of adaptive planning, forecasting, advanced analytics, work with Big data

As can be seen from Table 1, major barriers to the DX lie in the management, methodological and information fields. Strategic, managerial and methodological aspects of the DX are reflected in the works of researchers, analysts, and consultants from McKinsey & Co (Willmott 2013), IDC (Greene, Parker and Perry, 2017), MIT and Capgemini Consulting (Westerman, Bonnet, and McAfee, 2014b) Forrester and Accenture (Digital transformation in the Age of the Customer, 2015) and others. A huge practical contribution to DX is made by the leaders of the global IT industry (Google, IBM, SAP, etc.), implementing their global projects in the field of business digitalization. Although it is already possible to speak confidently about the general laws, the key principles of the DX and success factors of digital leaders, it is premature to state that there is a deep-designed universal paradigm of transition from classical to the digital corporation (Thalassinos *et al.*, 2012a; 2012b; 2013; Sibirskava *et al.*, 2016; Pociovalisteanu *et al.*, 2010).

It is possible that the very ideas of creating such a transition based on various road maps, frameworks, digital reengineering plans, are contradictory (Westerman, Bonnet and McAfee 2014b; IDC Future Scape, 2015; Greene, Parker and Perry 2017), since they bring pre-digital approaches to the corporate development. We believe that diversity and ambiguity of digitalization, uneven development of industries, social institutions, participants of digital ecosystem, uncertainties and the high dynamics of global changes in the macroenvironment allow to assert, that the

DX process will develop flexibly in an evolutionary way, improving and changing the "original channel" as the market, state and society matures. The present article analyzes evolutionary approaches to the construction of digital performance management based on the advanced business analytics and proposes the functional architecture of the information system of digital corporate management. The proposed information models are based on the authors' project experience in real economy, as well as studies conducted by the Academic Competence Center of IBM "Reasonable Commerce" (located in Plekhanov Russian University of Economics) and outlined the prospects for further research.

2. Methods

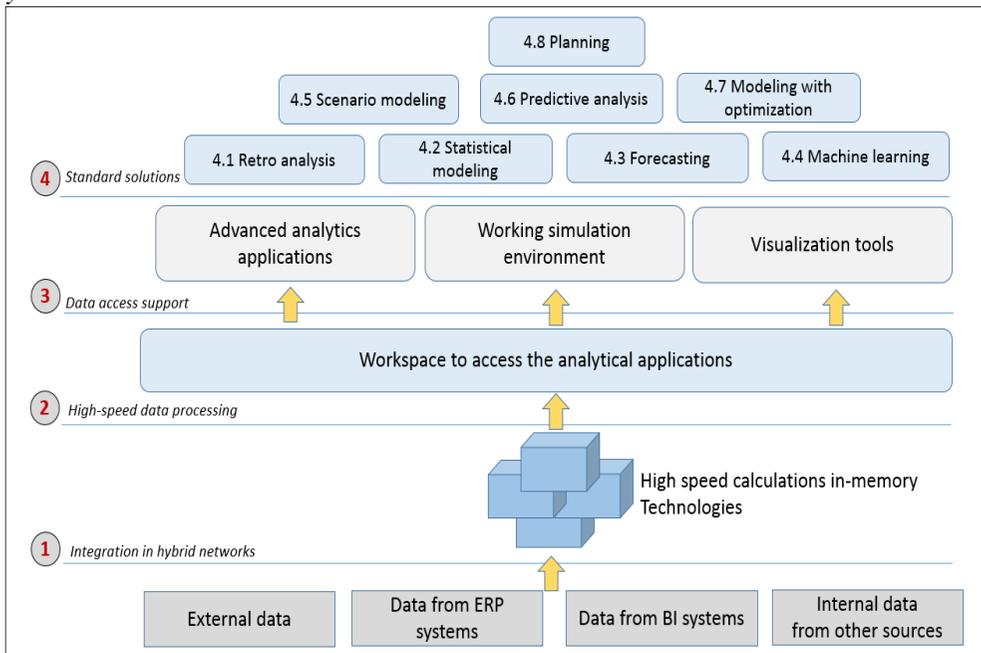
In the predigital era, the concept of CPM (Corporate performance management) by Howard Dresner was one of the most successful for corporate management (Howard 2007) – based on continuous inhouse management of KPIs with feedback control (Howard 2007; (Howard 2009), which was thoroughly analyzed by the authors of this article (Abdikeyev, Bruskin and Danko 2015, Bruskin 2015). To overcome the above contradictions between the information capabilities of the classical management pyramid and the DX requirements (Table 1) the authors considered an evolutionary approach to the design of an information-analytical management system for a digital corporation, which was reflected in Figure 1. Based on the evolutionary planning approach, a 4-level functional architecture of the corporate digital management information system was proposed (Bruskin and Kitova 2016; Bruskin 2016a), in which every control level was digital (Figure 1).

The scheme of Figure 1 fits in well with the conceptual framework of digital transformation described earlier (Westerman, Bonnet and McAfee, 2014a; Olanrewaju, Smaje and Willmott 2014).

As can be seen from the presented architecture, technological innovations have touched all the levels of the system architecture:

1. The level of integration in hybrid networks distinguishes new opportunities for processing external data, which may include Big data (this primarily refers to unstructured data from social networks);
 2. The level of high-speed data processing based on new computing technologies (such as the use of In Memory technologies, column databases, parallel computations, etc.);
 3. Access to data is provided based on multiagent systems and technologies for extracting and cleaning data from specialized storage facilities;
- In the coming years typical solutions of advanced analytics, that include not only statistical and scenario modeling tools, but also cognitive technologies of business analytics built on the predictive modeling described above, will be offered to the market along with optimization tools.

Figure 1. Functional architecture of the corporate digital management information system.



Therefore, although the above functional architecture is not final, it may serve as the basis of information and analytical support for a digital corporation (Table 2).

Table 2. Information and analytical support of a digital corporation

	Requirements for DX information management	Information paradigm of a digital corporation
1	Digital analysis	Provided due to evolutionary development of the expanded analytics based on digital technologies
2	Digital processes	Completely integrated with the digital technologies being their integral part
3	Digital products	Supported by digital processes and developed within the digital strategy
4	Digital communication	Provided with the digital infrastructure and developed considering the evolution of the digital ecosystem

However, the uneven development of the digital components of the architecture, as well as the digital components of the business model, is not an obstacle to the evolutionary processes of the digital corporation development.

3. Results

The proposed approach to the design of information-analytical corporate digital control system has enabled the authors to test digital components of architecture in

real consulting and research projects, as reflected in publications (Bruskin, 2014; Bruskin, 2016b; Kitova, Nefedov and Starovoitov, 2015; Kitova, Kolmakov, Dyakonova, Grishina, Danko and Sekerin, 2016; Belousov, Shelukhina, Rumachik and Shchemelev, 2017; Dzhukha, Kokin, Li and Sinyuk, 2017). From these, the modeling results of the digital analytical models relating to levels 3-4 of the functional architecture described above are of most practical interest. The models were implemented on the IBM Cognos TM1 platform during "Smart Marketing and Commerce" research project (IBM Shared University program). The results are used in the work of the Academic Competence Center of IBM "Reasonable Commerce" located in the Plekhanov Russian University of Economics.

Example 1: The authors have developed a retail network simulator on the IBM Cognos TM1 platform, designed for research and development of decision support systems. The simulation model of the retail market was part of this simulator. The simulation was performed for a system consisting of an arbitrary number of regions, retail chains presented in all regions, three store formats varying in size and range and three groups of goods. The demand model developed by Gold and Pray allowed us to simulate decision-making on the number of opened stores in different regions and on trade margin, depending on the assumptions about the competitiveness of stores in a simulated trading network. The parametric model considered the dynamics of demand, prices and marketing costs, and produced significant results with a wide range of input data due to the use of the principles of system dynamics, sigmoid-like market response functions and several additional heuristics described in the article (Kitova, Nefedov and Starovoitov, 2015; Alukhanyan, Andreeva and Andreeva, 2017; Charupongsopon and Puriwat, 2017).

Example 2: The authors have participated in the development of several multidimensional information models on the IBM Cognos TM1 and IBM Cognos BI platforms for the trade and service corporation. The complex provides short-term planning of sales activity of a large company based on sliding forecasting of financial sales figures in real time. Regarding sales planning, the development of H. Dresner's concept (Howard, 2007; 2009) is to consider corporate planning as a two-loop feedback system, in which the allocated internal contour provides forecasting of sales indicators in real-time mode, and external-financial planning and updating of monthly plans. The supported algorithms incorporate functionality sliding of the adaptive planning of daily revenue that can significantly reduce the information gap between strategic and operational corporate management levels (Bruskin, 2014; Bruskin, 2016b; Tcvetkov *et al.*, 2015). The results of modeling the forecast sales activity indicators confirmed the advantages of the proposed approach: the mean absolute percentage error (MAPE) was less than 5% compared to 15% for analogs in the forecasting step of 1 day, while the calculation time for the entire forecast reduced from 5 days to 40 minutes.

The authors have participated in several other consulting and research projects with the authors' participation – their business results are shown in Table 3.

Table 3. *The results of digital management introduction in the real sector of the Russian economy*

	Company profile	Business effects	Indicators of corporate governance quality
1	Large automaker	<ul style="list-style-type: none"> • Reduced planning costs • Transition to digital control functions 	<ul style="list-style-type: none"> • Financial planning reduced from 5 days to 0.5 days • Planning error decreased from 25% to 12%
2	Large pharmaceutical distributor	<ul style="list-style-type: none"> • Reduced planning costs • Transition to digital control functions 	<ul style="list-style-type: none"> • Financial planning reduced from 10 to 2 days • Planning error decreased from 23% to 8%
3	Trade holding in the market of sports goods	<ul style="list-style-type: none"> • Reduced planning costs • Transition to digital control functions 	<ul style="list-style-type: none"> • Financial planning reduced from 12 to 1 day • Planning error decreased from 17% to 8%

Thus, the digital components of information-analytical systems, presented at 3rd-4th levels of functional architecture (Figure 1), have already been successfully tested in large companies of the corporate sector of the Russian economy, even though these companies are just starting their way towards DX. We assume that further development of the digital performance management system will take place as the digital ecosystem, digital strategy, digital processes and their information support get ready, including the digital components considered at levels 1-2 (Figure 1).

4. Discussion

The proposed evolutionary approach, information-analytical models and systems of digital performance management with the use of advanced business analytics allow to design and implement business systems to support the digital management of the corporation. Due to the projected dynamics of digitalization of business, as well as the state level study of targeted programs for the development of the digital economy of the Russian Federation, the above results can be applied in corporate and public sectors of the Russian economy.

Advantages of the discussed approach to information support for corporate DX are the following: it does not require immediate digital reengineering, is evolutionary in nature and provides measurable business effects in a reasonable time frame.

As part of development and practical implementation of the digital corporation paradigm, in accordance with the functional architecture at levels 1-4, a lot needs to be done to ensure functioning of the reviewed systems in real-time, development of SMM (Social media marketing) analytics and its integration with social networks, design of an intelligent CPM-system based on predictive modeling. On the 4th level, it seems advisable to develop recommendation systems based on business intelligence and machine learning based on cloud platforms.

5. Conclusion

The proposed paradigm of the evolutionary development of a digital corporation based on a 4-level information architecture with the use of information-analytical performance management system and advanced analytics allows providing flexible development of DX based on available digital technologies and considering the existing level of digital maturity for both specific enterprises and the entire ecosystem for their development.

These discussed models and approaches make it possible to take advantage of digital technology and advanced business intelligence in partial readiness for DX.

Based on the Academic Competence Center of IBM "Reasonable Commerce" (located in Plekhanov Russian University of Economics), information and analytical models and complexes were created, and a large-scale computer modeling for solving several analytical problems in the field of digital marketing, finance and sales management was also held, which confirmed consistency of the developed models and algorithms.

Moreover, several scientific and consulting projects were successfully implemented in the real sector of the economy, which confirmed the feasibility of the evolutionary business digitization. Almost all the market participants are interested in the development of the proposed models and approaches, but primarily large corporations.

However, it is necessary to pay attention to the following requirements when preparing similar projects. Each project to create an information management system for a digital corporation requires a deep survey of the organization, allocation of digital circuits and development priorities, overcoming the barriers of an organizational and business nature, mentioned in the beginning of the present article (Table 1).

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