Advances in Economics, Business and Management Research, volume 156
2nd International Scientific and Practical Conference on Digital Economy (ISCDE 2020)

The Use of Digital Application MPI Supply Chain for Efficient Management of the Firm's Operating Activities

Gabdullin N.M.[1,*] Izmailov A.E.[2], Kirshin I.A.[1]

[1]*Kazan Federal University, Kazan, Russia*
[2]*BPM Research and Practice LLC, Kazan, Russia*
[*]*Corresponding author. Email: nail56@yandex.ru*

ABSTRACT
The aim of the research is an elaboration and use of digital applications for efficient management of the firm's operating activities. The use of digital applications makes it possible to improve the operational management system based on the "Value Chain" model, to quickly identify potential risks and possible losses in the simulated value chain. The authors proposed a classification of firms in accordance with the maturity levels of the firm's business operations. to bring the company to a new level of maturity. It is substantiated that through the introduction of digital applications, firms form standards for process execution (maturity level 2) and set targets along the entire value chain (maturity level 3). through small improvements (maturity level 4). The article reveals typical constraints in improving operating activities of Russian firms, consisting of inaccurate indicators at cost, impossibility of getting the needed quality the first time, irrelevant methods for assessing staff performance, lack of measures to improve the value chain. The functional of digital applications for managing the company's operating activities has been determined, including: collection and processing of Big Data, stakeholders adopting the “mobility” standard in their activities, logistic optimization, monitoring and control of processes in real time. A business case of Digital Applications has been developed that implements fixing along the value chain in the framework of maintenance of transformer substations. The processes along the value chain presented in the digital application covers, firstly, the full cycle of digitalization of assets and operations. Second, it identifies the links between non-financial and financial metrics of operational management. And, thirdly, it provides an assessment of the influence of operating factors on the achievement of strategic goals and the value of the firm.
Keywords: *Value chain, digital transformation of the economy, digital application, operational activities, maturity levels of the firm's business operations*

1. INTRODUCTION

The digital transformation of the economy, functioning as a metatrend of sustainable development, can significantly improve the potential of firms' management systems through digital reformatting of operating and management activities. Digitalization optimizes the process of creating value, generates new ways of interacting with customers, increases the efficiency of business processes, develops the capabilities of employees, creates new products while simultaneously generating new risks and threats.

The use of digital technologies does not mean a decrease in the contribution of a person's professional experience and competencies to the production of economic benefits. On the contrary, the importance of qualifications, education, human digital skills and, therefore, human capital is ever increasing. Digital models of professions appear. For example, in the OAO Setevaya Kompaniya (Grid Company) of the Republic of Tatarstan, one of the modules of the Smart RES project is the “digital electrician”. “The outfit of the digital electrician” is designed to include a digital modular helmet; a tablet PC and sensors on the overalls”[7]. This project increases the safety of employees during work and simplifies the process of maintaining networks and equipment.

2. METHODS

The goal of digital transformation is to change the logic of processes and move the company's operations to a new level of maturity. In accordance of methodological principles, firms can be divided into 4 groups according to their maturity levels (Figure 1).

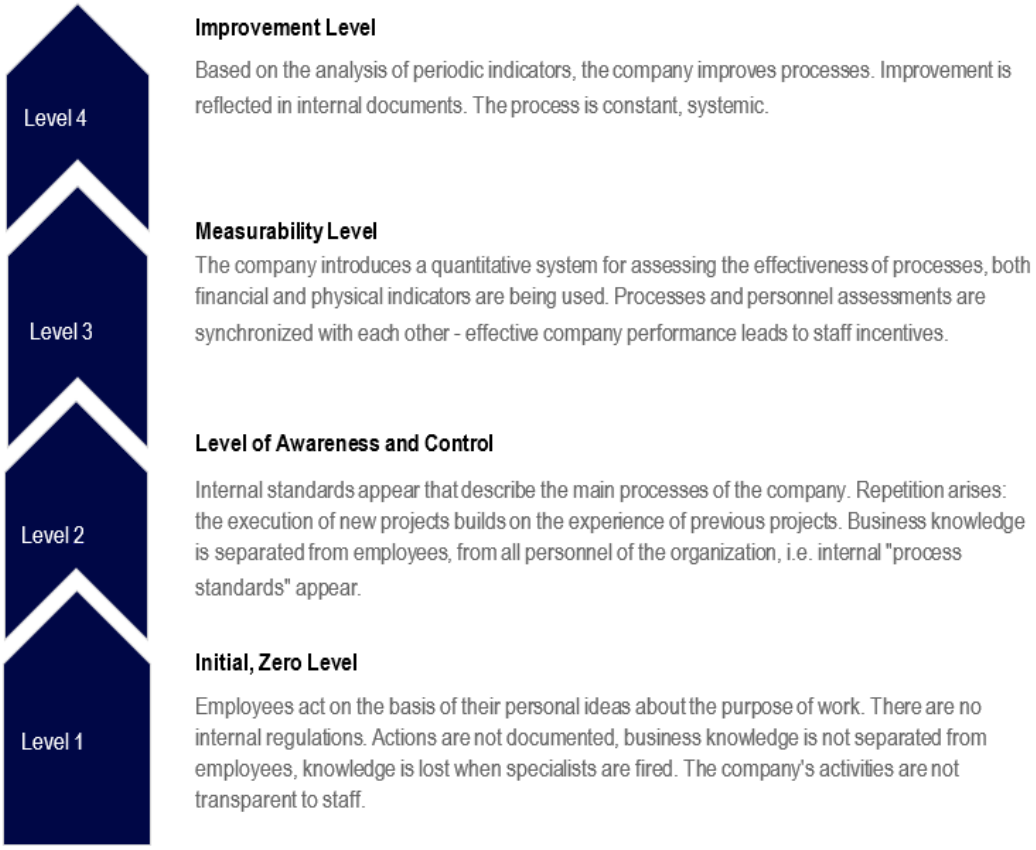

Figure 1 Maturity Levels of the Company's Business Operations

The transition of Russian firms to new levels of operational maturity depends on a number of typical constraints (Figure 2).

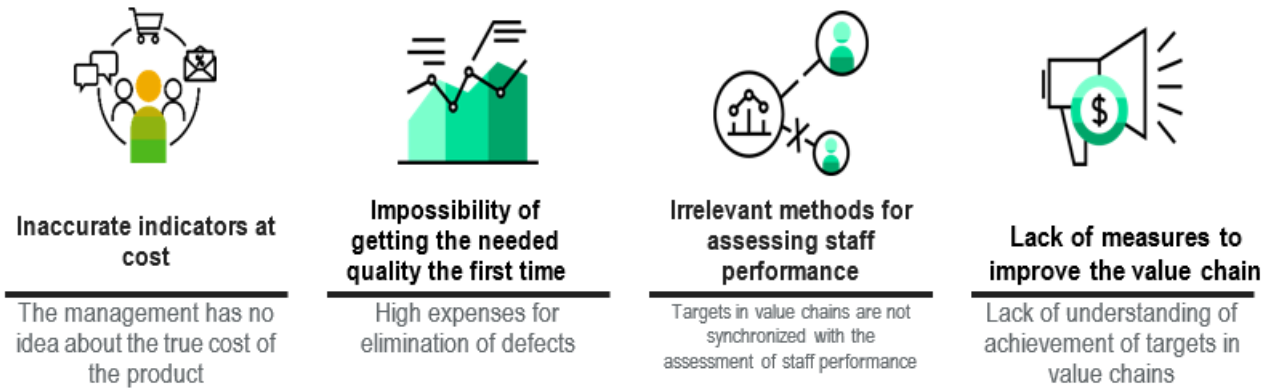

Figure 2 Typical constraints in improving operating activities of Russian firms

According to Gartner research methodology, firm, being competitive is getting harder. Industry leaders have 20-50% lower supply chain costs than their competitors. In companies with a weak culture of quality, employees make 85% more mistakes on average than in companies with a strong culture of quality[4].

In order to address these challenges and move to a new operational level, beginning with warehouses and factories and ending with the administrative office, firms are implementing operations management systems based on the Value Chain model[3,12]. Firms use these information systems to form process performance standards (maturity level 2) and set targets throughout the value chain (maturity level 3). Process targets are further continuously improved by making minor upgrades, rather than large-scale innovations (Kaizen method). Calculation of costs according to the Kaizen method is a planning method applied at the stage of performing the operational tasks of

the firm and focused on reducing variable costs in the planning period below the level of costs of the previous period. The target cost reduction ratio is calculated as the ratio of the target cost reduction to the baseline cost.
Following this logic, the firm must continually strive for excellence, so it is necessary to always set a benchmark for improving existing methods and procedures. The search for ways to improve should be continuous. After implementation, such systems deliver:

– reduction of operating costs by more than 15%,
– reducing the time to complete warehouse, production and corporate tasks by 10-30%,
– reducing the level of spoilage during production and acceptance at the warehouse up to 25%,
– reduction of labor costs for assessment and improvement of activities up to 88%[9].

3. RESULTS AND DISCUSSIONS

The main feature set of digital applications for managing the operating activities of a firm, in our opinion, is (Figure 3):

– Collection and processing of Big Data, allowing to increase the efficiency of generating added value and optimize the processes of storing and processing data. Modern digital technologies for machine processing of the Big Data make it possible to measure the actual costs of the implementation of any business process or production of a product.
– Stakeholders adopting the “mobility” standard in their activities. Owners and managers get the opportunity to switch from their stationary computers and not always convenient laptops to mobile software and hardware systems. However, to implement the “mobility” standard, first of all, it is necessary to train employees in digital competencies.
– Logistic optimization. Increasing the efficiency of logistics and production requires efficiency and transparency of procurement, fair competition among suppliers, and long-term relationships with strategic partners. E-procurement systems are increasingly the only way to achieve these goals.
– Monitoring and control of processes in real time. Real-time technologies are focused on collecting and presenting operational information about the status of tasks, quality control processes and the actual cost of products or services. This information is particularly used to compare actual results with benchmarks, and to identify and analyse variances that affect value creation. Thanks to the greater transparency of the supply chain, managers can track the execution of business processes at any time, from procurement of raw materials to sales.

Digital applications to improve operating activities are fundamentally changing the firm's development strategy based on the digitalization of the value chain[5,6]. A value chain operating model is a system for transforming a firm's capital to create value. Implementing an end-user model transforms management approaches to value chain organization. Within this approach, it is possible to assess the contribution of individual operations to creating value for the customer. Digital applications aim to transform the value chain to increase the return on investment of the firm. Investments in digital technologies affect the internal structure. In many industries, digital application adoption is seen as an indicator of progress towards the corporate mission[8,10,11]. Indicative in this respect is the practice of digitalization of the electric power industry, which permeates the entire energy conversion chain from generation to transmission and distribution to the consumer and changes the very nature of the existing energy infrastructure. Digitization serves as the foundation for creating new business models and revenues in the power industry and provides benefits in three key areas: reliability, efficiency and affordability. The use of digital applications enables the firm to better meet the needs of its customers. For example, the introduction of an intelligent electricity metering system by a grid company and the transition to the use of smart meters provides a convenient user interface and active involvement of consumers in the energy management process. Smart meters provide the ability to automatically process and store Big Data.

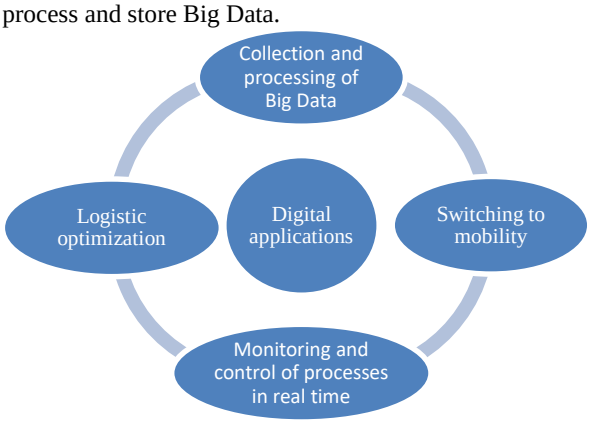

Figure 3 The main functions of digital applications for managing operating activities of a firm

Accordingly, OJSC «Setevaya Kompaniya», while simulating the value chain, makes a grouping of resources and results by the following capitals: financial, production, human, intellectual, natural and social and reputation. “As a result of the company's activities, capital is being transformed and value is being created for external and internal stakeholders. Each capital is expressed in a set of indicators that reflect the contribution to the implementation of the Company's strategic goals and the UN Sustainable Development Goals”[7].
The main digital applications for managing the components of intangible capital are presented in Table 1.
Innovative digital solutions help reduce costs and increase added value at every stage of the value chain. The fourth industrial revolution merges classical production and management methods with cyber-physical production systems (CPPS). This horizontal integration of smart products and networks into new (predominantly non-linear) value chains will lead to profound changes in innovation

cycles and maximize market impact. Consumer capital digital applications are effective communication tools as they enable brands to achieve their overall communication goals through interactions with large numbers of Internet users.

Table 1 The main digital applications for managing the components of intangible capital

Types of Capital	Digital Applications
Human Capital	Digital Human Capital Management, HCM Human Capital Analytics, HCA
Organizational Capital	Brand awareness digital applications are aimed at attracting a large number of users. Managing company data and resources is more systematic and easily accessible in the digital environment eKanban planning system for lean and on-time production: providing real-time monitoring of all production processes Radio frequency identification (RFID) Enterprise resource planning (ERP systems)
Consumer Capital	CRM-system is a customer relationship management system BPM-system is a system for managing business processes for customer service, implemented to improve the efficiency of the Company Creation of mobile applications and personal user account

There are various types of CRM software. Most of them are capable of performing the key functions of CRM - storing, tracking and sharing your customers' data. However, many software solutions can also support operations. For example: an operational CRM can improve the management efficiency of all activities that make up the value chain, including marketing, sales and customer service. Analytical CRM can help track customer interactions or improve customer acquisition and retention processes. In-house CRM can leverage interactions between different departments, suppliers, or stakeholders.

Electronic Kanban (E-Kanban) ensures the maintenance of stocks at a standard level, the delivery of goods and equipment at specified time intervals. E-Kanban is currently using the Internet as a method for routing messages to external vendors to provide real-time control of the entire supply chain. E-Kanban has a number of competitive advantages, including lower inventory levels, lower storage and transportation costs, reduced working capital, and increased liquidity.

Oftentimes, the impossibility to find a critical component in stock can jeopardize the entire value chain. The use of RFID technology removes these risks. As part of the new digital solutions, ultra-high frequency (UHF) RFID tags are encoded, printed and attached to inspection objects. This procedure allows each object to be identified in all business processes, which increases the transparency of the value chain [2]. While some digital applications, such as eFreight or eMaintenance, are tied to specific stages of the value chain, most applications can be applied individually or in a networked manner to enhance the impact of different stages of the value chain.

4. FINDINGS AND CONCLUSIONS

Let us consider the case of fixing operational processes along the value chain within the software of transformer substations (figure 4a and figure 4b).

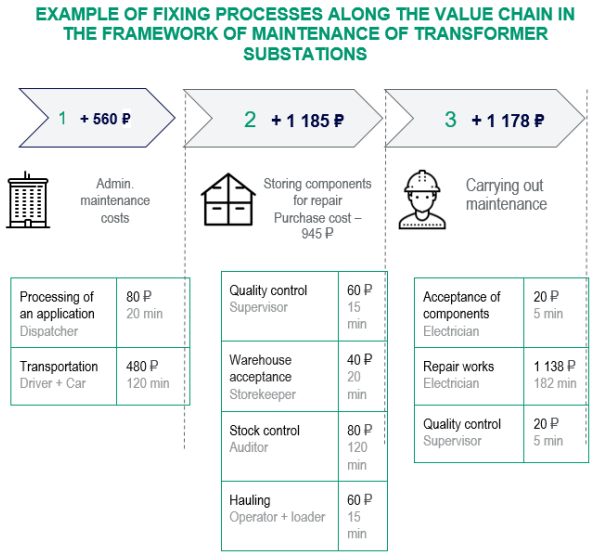

Figure 4a How the software works

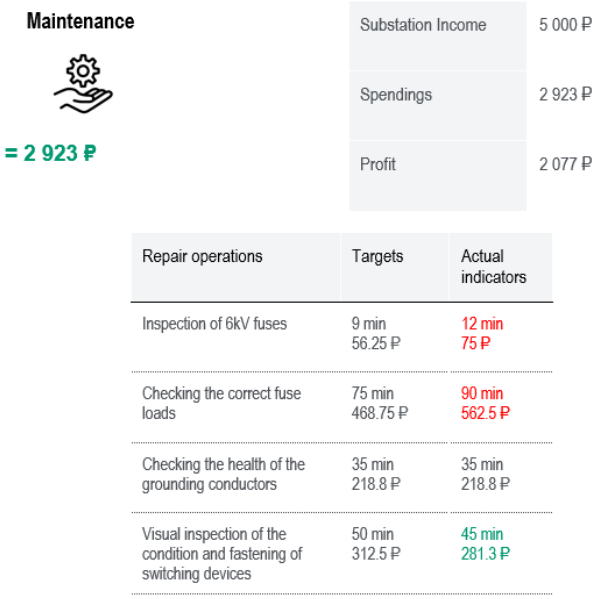

Figure 4b How the software works

Description of the technologies used

1. RTLS Technology
   – Employees are equipped with Bluetooth® (BLE) badges
   – BLE beacons are installed on vehicles
   – BLE bridges are installed at the substation
2. RFID Technology[1]
   – The warehouse is equipped with RFID antennas
   – Printer for printing RFID tags
   – RFID tags for consumables
3. QR coding Technology
   – Mobile computers
   – Mobile printers

Description of business processes

1. In the information system, the dispatcher creates tasks for the substation maintenance. The system records the time spent on application processing by employees and includes the maintenance cost.
2. RFID antenna automatically detects the shipment of consumables from the warehouse. RFID technologies make it possible to reduce the cost of such warehouse operations as: stock control, hauling, picking and shipping. Upon receipt at the warehouse, consumables are marked using RFID printers.
3. The electrician receives consumables and a work order.
4. At the moment of departure, the driver scans the QR code of the badge via a mobile computer and records himself, the electricians and vehicles in the information system. The time spent by resources for transportation is included in the cost of maintenance.
5. Bluetooth® bridge detects the arrival of a vehicle at its destination.
6. The electrician using a mobile computer takes consumables to an abstract warehouse of the Substation.
7. The electrician, via a mobile computer, scans the QR code of the work order. In the mobile computer, he fixes mechanisms, consumables and himself for a task, after which he starts repair work. The system records the time spent by resources for repairs and includes maintenance costs.
8. Meanwhile, Bluetooth® bridges record all movements of employees inside the substation.
9. The electrician completes the repair work and sends a request to print a tag with a QR code via a mobile computer. The QR code tag includes all service information and is glued in a specially designated place. The team that arrives for the next service will be able to scan it and see what was done last.
10. The senior foreman (supervisor) scans the QR code of the order and approves the quality of the work performed. The time spent on quality control is also included in the maintenance cost.

Comprehensive, integrated digital solutions are critical to the efficient implementation of smart products and networks in value chains. In our opinion, it is only through the implementation of such integrated digital solutions that it is possible to develop intelligent business models that provide competitive advantages and consumer demand.

ACKNOWLEDGMENTS

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

REFERENCES

[1] J. Curtin, R. Kauffman, F. Riggins, Making the 'MOST' out of RFID technology: A research agenda for the study of the adoption, usage and impact of RFID, Information Technology and Management, 8 (2007) 87-110. DOI: 10.1007/s10799-007-0010-1.

[2] Digitizing the Value Chain for High Performance. https://www.accenture.com/us-en/~/media/accenture/conversion-assets/dotcom/documents/global/pdf/strategy_3/accenture-digitizing-the-value-chain-for-high-performance.pdf

[3] A. Fearne, M.G. Martinez, B. Dent, Dimensions of sustainable value chains: implications for value chain analysis, Supply Chain Management, 17(6) (2012) 575-581.

[4] Gartner: 10 Business Cost Optimization Ideas, 2019. https://www.gartner.com/smarterwithgartner/ten-business-cost-optimization-ideas

[5] M. Hansen, J. Birkinshaw, The Innovation Value Chain, Harvard business review, 85 (2007) 121-130.

[6] P. Hines, N. Rich, The seven value stream mapping tools, Int. J. of Operations & Production Management, 17 (1997) 46-64. 10.1108/01443579710157989.

[7] Integrated Annual Report of OJSC Setevaya Kompaniya for 2019. http://gridcom-rt.ru/upload/content/aktsioneram-i-investoram/obyazatelnoe-raskrytie-informatsii-emitentami/godovye-otchety/GO_2019.pdf

[8] W. Klibi, A. Martel, A. Guitouni, The Design of Robust Value-Creating Supply Chain Networks, European Journal of Operational Research, 35 (2010) 283-293. DOI: 10.1016/j.ejor.2009.06.011.

[9] Production and Operations Management. https://mpicloud.com/ru/product/upravlenie-proizvodstvom/

[10] M. Subramaniam, Digital ecosystems and their implications for competitive strategy, J. of Organization Design, 9 (2020) 12. DOI: 10.1186/s41469-020-00073-0

[11] P. Tallon, K. Kraemer, V. Gurbaxani, Executives' Perceptions of the Business Value of Information Technology: A Process-Oriented Approach, J. of Management Information Systems, 16 (2000) 145-174. DOI: 10.1080/07421222.2000.11518269.

[12] E.A. Zamora, Value Chain Analysis: A Brief Review, Asian J. of Innovation and Policy, 5(2) (2016) 116-128. DOI: 10.7545/ajip.2016.5.2.116.