The Impact of Digital Transformation on Economic of BRICS Countries

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Abstract. Developing countries face an acute problem of economic growth. In situations of limited labor resources growth, the main factor of an increase in the capacity of an economy to produce goods and services is the intensification in labor productivity. Aggressive marketing claims that the digital transformation is the introduction of new breakthrough information and communication technologies automatically ensure the explosive growth of the economy [1]. However, it is wrong to assume that economic growth takes place on its own, without the participation of other factors. Integrated planning is about different actors working together to re-align individual strategies to produce a commonly-defined objectives. We hypothesize that breakthrough technologies open up new business opportunities, they can be considered a prerequisite for progress, but their introduction is not sufficient to increase business efficiency, because technology ensures success only in conjunction with serious changes in the company's activities. Integrated planning can improve coordination between diverse actors by harmonizing uncoordinated strategies to obtain concrete achievements [2].

Keywords: Digital Transformation; integrated planning; productivity paradox, process oriented IT systems; business process management.

1 Introduction

Information technology is considered to be an important factor of sustainable economic and social development. The Communiqué of the BRICS ICT ministers meeting says that «The Parties acknowledged that Information and Communication Technologies (ICTs) have become a key factor for sustainable economic and social growth and development. ICTs are of increasing importance in governance, business, and social activities and their impact will increase in the future. There is a common agreement on the importance of ICTs as essential tools for the growth and advancement of developing countries» [1]. In this paper we discuss a hypostasis that to be successful the implementation of IT must be accomplished by a tremendous changes

[1] The study is funded by RFBR and NRF according to the research project № 19-57-60004/19 and RFBR research project № 19-07-01137 A

Proceedings of the XXII International Conference "Enterprise Engineering and Knowledge Management" April 25-26, 2019, Moscow, Russia

within organization. Thus, concentrating on technology exclusively and ignoring the organizational aspects of production makes digital transformation useless.

A term digital transformation is considered as a new stage of embracing informational technologies (IT) to get their accelerating impact across business and society. However, nobody canceled the productivity paradox posed by R. Solow, postulating that it is impossible convincingly demonstrate the connection of IT investments with measurable results in labor productivity growth [3]. As noted M. Spence, over the years enterprises have invested billions of dollars in high technology, but the growth of labor productivity in the world is almost imperceptible [4]. According to the theory of complementary assets by P. Milgrom and D. Roberts, a modern enterprise should be considered as a complex of interrelated assets, so an increase in any of them contributes to the profitability growth of the others [5]. One of the essential complementary assets is the organizational capital; it includes a set of practices in organization of production, of work and managements, adopted at the enterprise [6]. Thus, the growth of labor productivity in the introduction of new technologies does not occur directly, but through a change in organizational assets. E. Brinjolfson, L. Hitt and S. Yang proved that the combination of IT and certain organizational practices creates more value than each of them separately [7] [8]. They consider the consistent creation and development of complementary practices as a prerequisite for the enterprise effective development [7]. Similar studies on the analysis of the impact of investments in IT on the economic results of Russian companies carried out by V.I. Ananin, K.V. Zimin, M.I. Lugachev, K.G. Skripkin [9], [10], confirmed named results.

Publications on the transition to the digital business usually distinguish: digitization of analog information; digital information processing and digital transformation of the enterprise [11]. The first two facets of the digital transformation are quite fully covered in the literature, while the third is less evaluated. As part of this work, we propose to separate the external and internal aspects of the digital transformation. The external aspect is associated with a change in the business model and ways of doing business [12]. As an internal aspect we propose to consider the transformation of organizational capital. In our opinion a success of IT implementation critically depends on enterprise transformation, otherwise, an economic impact will not be obtained due to productivity paradox. Thus without enterprise transformation a digital transformation will become yet another IT automation that locally influence few operations but have poor overall impact on economics of an enterprise.

In this paper we consider as an example Business Process Management (BPM). According to Gartner, BPM is an innovative IT approach, as well as a management initiative [13]. We analyze a change in organizational and economic relations between workers, participating in a fabrication of a product or a service, and hypothesize that enterprise transformation is a complex arrangement, which includes modification of all aspects of business at the enterprise. The approach of this research is based on works of H. Minzberg [14], who studied the forms of coordination among the work group; J. Galbreith [15], who considered an information management to be a major factor of labor productivity; and M. Hammer [16] who developed a concept of a process management. The goal of this study is a development of principles of a complex transformation accompanying an implementation of Business Process Management (BPM) system.

2 Functional Approach To Enterprise Operation

We talk a lot about the deficiencies of functional management and call on switch to a process management, however, nobody has yet defined the notion of functional management. We guess that functional management can be understood as a combination of several concepts: division of organization into functional units and a bureaucratic behavior. H. Mintzberg defines organizational «as the sum total of the ways in which it divides its labor into distinct tasks and then achieves coordination among them» [14]. The division of an organization into functional units involves grouping of employees performing cognate operations within one business unit. The concept of rational bureaucracy was defined by M. Weber [17]. A bureaucratic organization imply a hierarchy of authority, where an employee gets all the instructions from his direct-line manager, and if the instructions are given behind the manager's back, the latter will not be able to monitor its performance and will not be responsible for a result. H. Mintzberg calls this way of coordination a direct supervision [14]. Consequently, if the employee wishes to hand-off his result to the next participant, he exercises it through his direct supervisor. But if the next participant is located in a different business unit, the task has to climb up to the hierarchy level, where both units have a common manager. Consequently, several additional steps are being taken: a task move upwards – escalation and downwards – delegation. These additional steps do not increase the value but add to the cost, therefore they can be eliminated. Since the manager assigns the work to his subordinate and supervises the performance, he is a consumer of a result. As pointed out by M. Hammer and J. Champy, manager see the result basing on his interests, not on the interests of the client, who pays for the goods or services [16].

We can make the following conclusions. The managerial method, which we got used to refer to as «functional management», is in fact a combination of the functional structuring a company into business units and the bureaucratic method of organization behavior. Both methods are foundational for modern institution development. The result of this combination is numerous overabundant information flows up and down the company hierarchy. Evidently, the efforts spent to support those flows increase the cost but not the value, therefore overabundant flows should be eliminated.

3 Labor Productivity: the Information Processing Perspective

J. Galbraith associated enterprise labor productivity with its capability to process internal information flows [15]. He states that in order to increase labor productivity it is necessary to strain for the reduction of internal information flows and enhance the employees' ability to process this flows. He demonstrate that the better the production task is formulated, the less time is spent on its execution, whereby labor productivity increases. We use this approach to reveal the factors of labor productivity increase from the information management perspective. Let us consider a modification of internal information flows as a result of a switch to process-based management.

According to J. Galbraith there are several approaches targeted at helping a functional organization manage the information flows. In order to reduce internal

information flows he suggested using slack resource and self-contained tasks; enhance lateral relations between the actors at the similar hierarchical level. To increase the enterprise ability to process information he suggest so-called «vertical information systems», automatizing information exchange between the employees at different levels of organizational hierarchy [15]. Let us deal with these suggestions in detail.

Slack resource implies the use of greater amount of resources (human, production and financial) than it is required for standard production. It is used to overcome unanticipated overload or in case of changes in existing situations [18]. Slack resource may be immediately available for use (e.g., employees on standby), recoverable (e.g., overheads) or potential (e.g., a capability to borrow funds for development). The impact of slack resources on the company efficiency is the subject of scientific disputes [19]. On the one hand, slack resources can be considered as redundant, increasing costs and reducing the enterprise efficiency. On the other hand, a slack resource provides the enterprise with a potential for immediate response to changes in business situation. As provided by the neoclassical microeconomic theory the company's goal is to maximize the profit, so the managers acting to the benefit of the owners should strive to reduce costs. Bearing this goal in mind an enterprise should minimize slack resources to operate with maximum efficiency. According to this approach slack is synonymic to prodigality and thus is inadmissible. However, it is acknowledged that most organizations keep a certain reserve of non-used or underemployed resources, which means that for some reason these organizations do not operate with maximum efficiency and the backup level is approximately the same in different countries and different industries [20]. Modern economic science acknowledges existence of slack resources. As demonstrated by H. Leibenstein, companies do not aspire to be efficient to the maximum possible degree except for some highly competitive markets [21], thus backup of resources is acknowledged to be standard behavior. At the same time, the issue of choosing the necessary extent of slack resources remains open.

Self-contained task implies that everything required for job execution is immediately available: raw materials and components, tools and accessories, knowledge how to perform this work. J. Galbraith addresses two ways to increase task independence. First, the task should be fully understood by the worker, otherwise its fulfillment will require studying and mastering of new practices. For this purpose production tasks are supposed to be divided into standard, well-formalized jobs, and non-standard assignments, the number of which should be minimal. Second, he suggests regrouping company employees by products or services instead of by functions, so that each group has its own set of required resources. This, in his opinion, reduces redundant information flows. Vertical information systems connect the workers at different levels of management hierarchy, help collecting information from lower levels, accumulate and process it in order to facilitate managerial decision- at the upper level. They serve to inform the management of all the exceptions happening during production task execution. Lateral relations happen between allied workers, performing interrelated tasks. Since such employees belong to different departments, which are traditionally viewed as functionally isolated business units each having its own local interests, it is common practice to introduce the so-called coordinating or liaising positions. The coordinator's role consists in supervising the progress of the production task in order to promptly identify all deviations during its execution and immediately inform all stakeholders. Notice that the coordinating position is not

authorized to solve the conflicts, only to escalate the problem to the functional managers in charge, so the amount of information flows does not decrease.

Reengineering critics note that the division of labor and narrow specialization of the workers lead to a decrease of each production task in the size and result in an increase in the number of performers. That, in turn, increases the demand for coordination. As noted by M. Zheleny, the special class of employees who are not engaged in production but are meant to coordinate the work emerges, the cost of coordinating increases [22]. That is why M. Zeleny thinks that reengineering means "partly spontaneous response to the extremes of labor specialization and differentiation". In his opinion, reengineering equals reintegration and should go in three main directions: reintegration of work into bigger combined units; reintegration of workforce enables the workers to perform and coordinate bigger tasks; reintegration of knowledge – refusal from narrow specialization in favor of specialists of a wide profile.

As noted by H. Mintzberg the method of work coordination influences the controllability and the size of a business unit [3]. Since it is difficult to monitor execution of complex tasks, direct supervision is frequently replaced with mutual coordination. In this case the employees have to be in close communication, which can be effective only in a small business unit. In cases when the enterprise substitutes standardization for direct supervision controllability increases, which is confirmed by examples of industrial enterprises, where the managers are capable to supervise big production sites. Industrial enterprises started with standardization of work, set out strict requirements to results, which required standardization of workers' qualifications, so they finally came to the standardization of workflows. The switch to process management implies the use of the same forms of standardization and abandoning direct supervision.

4 Process Management

Business processes consist of a sequence of well-formalized tasks, so the execution logics of each of them may be easily understood by all the employees. In order to eliminate redundant information flows up and down the management hierarchy a set of conditions should be established, by fulfilling which an employee can transfer the production task directly to his allied employee along the production line without agreement with the direct supervisor. The «virtual» channel, linking the allied employees in the execution of a common production task, will be called a business process. Thus, standardization of work processes makes it possible to reduce the need for direct supervision and increase the controllability. However, only those tasks, which meet clearly defined requirements, will be transferred this way, while other task that does not comply with the established standards it will be transferred in a traditional way, including all escalations and delegations. With this method of performing work, the manager does not lose control levers, since he is sure that he will be promptly and timely informed about all situations when the process deviated from the standards.

However, interpretation of process management as pure process model re-design, limit our capability to control a process. Model modification is an essential but not the

only way of process management. We suggest distinguishing between management of an enterprise with the use of business processes and the process controlling. The first is a holistic management approach focused on aligning all aspects of an organization with the wants and needs of clients. The second is an effort to maintain normal operation of the process. We allot three levels of process controlling. The level of operational control implements the concept of proactive BPM. Its main idea is to exclude managers from the routine duties to manage the process instances. Their involvement happens only in cases where it is really necessary. The level of a tactical controlling is carried out through the manipulation of additional layers and aspects of the process models that are not covered by the process map. Thus it is possible to achieve, for example, the optimal allocation of human resources involved in the process. Finally, a strategic management involves improvement of the process model and is applicable only if the first two levels are no longer able to achieve their goals.

5 A Transformation of Organizational Structure

Let us suppose that the switch to process management is not limited to modification of organizational relations between the immediate participants, but requires drastic modification of the entire company management structure.

Transformation of management structure may follow several directions. First, the company may focus its attention on standardization and formalization of production tasks, introduce task execution standards. However standardization does not guarantee that the tasks are completed in full and in due time, therefore the company strengthens horizontal relations between actors, introduces the roles of process owner and process coordinator. This form is called the functional management structure with a horizontal annexe. Notably the process owner cannot contact an actor directly, but via respective functional manager only, which significantly embarrasses supervision and increases overheads. Also, the owner does not manage resources, he cannot take an independent decision with regard to the actor, only through his functional manager. The owner's role becomes degenerated and is reduced to coordination, he does not have any real leverage over the actor. Since communication through functional hierarchy is not sufficiently effective, the company switches to the matrix organizational structure.

In the matrix organization a worker finds himself in dual subordination, first, he reports on all the current issues of business activity within a process framework directly to the process owner, second, he is accountable for all the other issues to his direct supervisor. The process owner is entitles to reward and punish the executor, therefore he has leverages over the process. Here it is important to strike the balance between the two branches of power. It is usual to differentiate the relations of subordination and those of coordination. In the matrix structure the employee is subordinate to the functional manager and coordinates its work with the process owner, that's what underlies deficiencies of the matrix management system.

Processes are most often differentiated by the output goods, therefore horizontal working groups are usually based on the product principle. At the same time an organization can use the territorial principle of differentiating its activities, in this case the matrix structure becomes three-dimensional and more difficult to create and

control. The drawbacks of this system are the difficulty of differentiating authorities between the two branches of power and consequently potential conflicts.

In order to get rid of dual subordination companies switch to process-based organizational structure. In the process-based structure all the activities are hinged on the company business processes. First, main processes are singled out with a dedicated owner assigned to each of them, who has sufficient resources at his disposal to manage all the workers. All the workers are directly subordinate to him thus eliminating any ambiguity in relations. In order to unite individual processes into a single system the company establishes a process committee consisting of the owners of individual processes, they are responsible for the coordination of execution of individual processes. Each process is linked to a competence center, whose tasks are: continuous improvement of processes and formalization of working methods. For example, if the enterprise faces the necessity to solve a new task for the first time, a new process may be required to be developed. The company may keep functional support units but only for the purpose of solving corporate-wide tasks, e.g. for personnel management, calculation of wages, provision of IT services, the latter are considered as services rendered to business units.

Let us have a closer look at a process-based organization. Its overall activity is divided into different areas, with main productions processes distinguished for each area. To align main processes the company needs a process committee uniting the owners of all processes. Modifications of processes and their interaction are carried out with participation of company process architect. For each area of activity there is a special process competence center, which, along with the process owner, includes: a process engineer, who is responsible for correct execution of production process, an analyst, who is responsible for process modeling and project executors. The downside of exclusively process-based organizational structure is the loss of communication between the employees exercising similar functions in different company units. Therefore, it is possible to make provision for a functional manager role, coordinating the work of specialists with similar functions in different enterprise processes. This structure is called process-based organization structure with a functional overhead.

6 Conclusions

The analysis demonstrates that a new IT implementation require a complex transformation of business relations in the enterprise as the essential prerequisite for labor productivity growth. Reengineering and improvement of the business process are essential but insufficient conditions for a transition to process-based management. To exercise BPM advantages it is necessary to switch to a continuous-flow production methods and modify a management structure. Within a functional organization process-based management is constrained due to the conflict of interests of different business units and impossibility for the process owner handle required resources directly, which is a possible cause of reengineering project failures. The organizational structure should be transformed in such a way that it honestly reflects managerial relations evolving within this production system. It can be noted that there is a demand for new up-to-date IT instruments connecting the employees at the same hierarchy level, ensuring managerial supervision over the progress of production tasks. To

support process-based management at an enterprise we argue a new class of «horizontal» information systems which perform the transportation and coordination functions: they transfer tasks between the participants in strict compliance with the set up procedure, notifying the management of all violations, deviations and emergencies.

We conclude that a digital transformation to be successful must be attended by a complex enterprise transformation. We considered a case of BPM system implementation and explore that a process transformation requires a cohesive approach to reorganization of the entire complex of business relations, including a switch to mass production methods, structuring of activities around their business processes, an implementation of process controlling at three levels, restructuring of management structure in accordance with the chosen forms of labor organization at a particular enterprise, implementation of new information systems aimed at supporting lateral relations.

Thus, one should not deem a digital transformation unilaterally, as a global computerization using modern IT, rather as a profound change affecting the basic principles of doing business. A new IT initiative will doomed to failure if it is not supported by effective changes in the organizational and economic relations existing at the enterprise.

The results of this study are important for the BRICS countries, which, aimed at developing their economic potential, heavily invest in IT, but at the same time are not satisfied with the achieved results of growth. It can be argued that the reason lies in the lack of attention to the organizational changes that occur within enterprises implementing IT [23]. The obtained results not only explains the cause of the of productivity growth problem, but allow to outline a set of organizational measures aimed at overcoming the described limitations.

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