

The Role of Business Processes in Digital Transformation of the Organization

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Abstract - Business processes reflect the nature and the reason of existence of the organization. They determine the structure of information system that supports them. There from comes the importance of business processes, as well as culture and technology within the organization. Nowadays, when organizations are under great pressure from competitive market and changes in the environment, the capability of changing its own processes through digital transformation paradigm will play the main role in sustaining the organization's position on the market. Although digital transformation is a contemporary term, it covers the usage of existing methods from different areas like business processes, management by measurement, organizational culture etc. The way we see business processes is usually through process models. Regardless the notification we use, these models help in understanding the way organization does its business and are the basis for the work optimization/redesign, activity-based costing analysis, or the development of information system's architecture. This paper proposes a set of methods related to business processes that can be used in digital transformation of the organization itself or digital transformation of virtual organization encompassing all the members of industry product or service value chain.

Keywords – business process, digital transformation, virtual organization

I. INTRODUCTION

After human civilization had moved from industrial into information age, information was recognized as a commodity with its own value. The rate of change within the environment of an organization is increasing daily and hence is the inner entropy within the organization. In trying to reduce this entropy numerous approaches have been introduced, the latest one, being the umbrella term, is digital transformation (DT). The idea appeared in late 1990s, and again in 2000s. A huge research has been done in this area lately which proves its significance [1]. Digital transformation is more likely to be a framework than a strict methodology, or set of methods for improving the business processes, organizational structure or the entire product or service value chain. Given the modern IT technology, this framework encompasses all the efforts in developing the solid business models, optimized processes, proper organizational structure, and adapted management skills.

Regardless of organization's mission or product or service orientation, digital transformation framework has the common elements: use of technologies, changes in value creation, structural changes, and financial aspects

[2]. While considering the digital transformation as a contemporary concept, the methods used in its different areas are already known, except for new technologies. The way and the order in which these methods are implemented is something new. If we compare business processes reengineering (BPR) as an approach, with digital transformation, certain similarities can be found. The famous quotation "do not automate, obliterate" represents the essence of BPR [3]. The idea was to have a new start, because just trying to speed up processes as they are, by implementing computers and software, no mayor success can be expected. Although it has been proven to be the truth, this approach alone, without considering organizational strategies, value chain, management or customer orientation is not sufficient nowadays.

The further development towards digital transformation was in a form of strategic planning of information systems [4]. The idea was to come up with an information systems development methodology as a set of different methods to increase the importance of information systems and to bring it up to the top management level. The architecture of the future information system (IS) was supposed to be aligned with business strategy whereby business architecture contribute to clarify the complexity within an organization. This forms a useful starting point for development of subsequent functional, information, process and application architectures which contribute to an adequate ICT-governance and orchestrate the resources for critical business activities for e-business efficiently [5].

Another crucial concept in digital transformation is organization's value chain. The application of value chain model results in rough architectures of business processes and information system. The interrelation between organizations value chain and its information system has been well stated in [6] as one of five critical factors for managerial consideration for an effective business value chain. If the value chain extends to all participants in product/service life cycle, then we come to virtual organization. In its very nature, virtual organization is about information integration and business processes alignment and integration of all participants in product/service life cycle, from suppliers to customers [7].

This paper proposes a set of methods that can be useful within the framework of digital transformation and are related to value chain, business processes and virtual organizations.

II. VALUE CHAIN

The value chain concept was completely perceived by Michael Porter. He introduced this term in his book *Competitive Advantage* in 1985. It is basically believed that each organization consists of a set of processes/activities performed within the framework of specific functions for the purpose of engineering, production, marketing, delivery, and maintenance of organization products/services. Information technology used to support the value chain processes is usually in a form of enterprise resource planning (ERP) systems. These systems equipped with modern technologies like

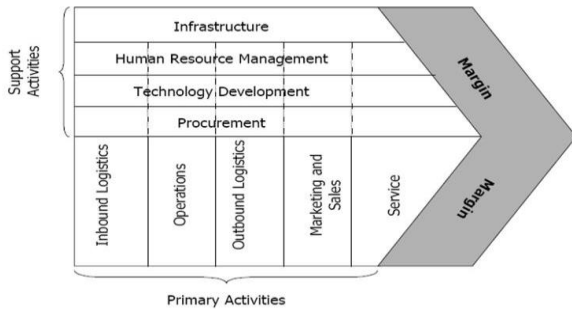


Figure 1. Organizational value chain, source: M.Porter, 1985

cloud computing, mobile technologies and internet of things, can significantly contribute to digital transformation of the organization [8]. The cloud computing role in digital transformation is deliberately analysed in [10]. All the processes may be represented in the form of a value chain (Figure 1). By sequential performance of processes represented in the value chain, a private organization increases its profits, and a public sector organization fulfils its mission.

In general, all organizational functions (and appertaining processes) can be divided into two groups:

a) Primary functions, whose processes form a linear course from suppliers, through business processes to buyers. These are the functions/processes that the organization needs to perform in order to survive (core business). In the performance of these functions/processes direct value is added to the final product/service.

b) Support functions which spread through the entire value chain and do not represent “core business” of an organization. However, without these functions/processes the organization could not perform as a uniform unit and the synergy effect of primary functions would be unreachable.

As value chain model of an organization is one of the analysis forms of business activities, it is crucial for digital transformation. The objective of this analysis is determination of the organizational structure and development of related information system architecture [9]. The value chain model is an important part of digital transformation for the following reasons:

- It separates primary from support business technology functions (processes).

- It is focused on finding an answer to the question: “How does business technology add value (mission or profit) to meet the users’ needs?”

- It enables combining business units’ approach with other approaches in strategic considerations on organization development.

- While performed, it is independent from the organization structure. Furthermore, it suggests a natural organization structure for defined business processes.

- Sequential running of the primary functions process leads to the product/service life cycle. This life cycle can be used in business technology matrix analysis for defining the architecture of the organization’s information system.

- If an organization produces several products/services, the life cycle of each can be determined individually.

All these features make the value chain a useful tool for digital transformation, especially in analysing the impact of modern technology on the improvement of business strategies and the improvement of management supervision of business operations. The value chain of an organization does not exist on its own, isolated. It is a part of a wider value system, the so-called industrial value chain. The industrial value chain completely connects all value chains on the “way” from raw materials to the consumption of the final product. According to [11], value chain analysis is equally applicable to vertically integrated organizations as it is to virtual organizations and allows the identification of value-added flows through the value creation process within both the industry and the firm. The analysis of the industrial value chain creates prerequisites for the application of modern technology in a virtual information system consolidating all members of product/service life cycle.

III. BUSINESS PROCESSES

In observing the dependence of business operations of certain organization parts on ICT on one hand, and possible savings resulting from the application of ICT in those organization parts on the other, we come up with two-dimensional space, which represents the transformed

| | | | |
|--|------|--|---|
| Process dependence on ICT support | High | 2. OPERATIONAL PROCESSES - Ordering materials or services - Accrued business operations | 4. STRATEGIC PROCESSES - Plan catering - Offer catering services - Offer accommodation services |
| | Low | 1. SUPPORT PROCESSES - Equipment maintenance - Personnel tasks | 3. POTENTIAL PROCESSES - Documents management |
| | | Low | High |
| Expected value effect of application of contemporary ICT | | | |

Figure 2. Significance of ICT application in supporting business processes within the digital transformation framework, source: author

McFarlan development matrix (also known as the “Boston Square”) [20]. The matrix with examples of analysed processes of an imaginary hotel organization is show in Figure 2.

Business processes are viewed considering the use of information technology according to two criteria: (1) what are the expected savings which can result from the application of new ICT and (2) to what extent is the good execution of processes conditioned by the application of modern ICT. If these criteria are viewed as two independent variables and are placed on the axes of a two-dimensional coordinate system, a minimum of two discreet values on each axis determined (the contribution of new ICT to the reduction of system functioning costs, i.e. savings: high-low, the dependence of good execution of processes (efficiency and efficacy) on contemporary ICT, i.e. conditioning: high-low), a matrix with four fields is obtained. The key is to understand that the existing, planned, and potential ICT applications for supporting organization’s business processes are analysed. If the utilization of ICT in specific business processes is called application, then the matrix shows applications and the entire matrix is known as application portfolio. This method if used, could improve the digital maturity of the organization according to guidelines for reaching the digital maturity in ICT and process infrastructure part [8]. If exploratory digital transformation maturity model is considered [13], the above method is useful for its operations part especially in determining the DT business processes priorities

IV. DT FRAMEWORK: BUSINESS PROCESSES REDESIGN

The significance of business processes within the framework of DT is not up to debate at all. An analysis of different DT maturity models has shown that almost every model contains processes as a part of maturity assessment [13]. In some cases that part is named “operations” and in others “processes” or “process digitization”. Process digitization is not just implementing new technology on existing processes, but more likely preparing and optimizing processes for taking benefits of new technology, like mobile or cloud applications are. The idea of preparing the processes prior to implementation of new technology is not a novel one. It started with James Martin [19], as information engineering in 1989. and spread out through the concept of strategic information planning methodologies [20]. Later on it has focused to process reengineering [3]. The idea of designing business processes (models) in relation with organization mission and strategic vision is in very essence of DT [2].

The value chain analysis, as well as the BCG matrix analysis, provides enough elements for strategic consideration of business process reengineering. Determining business processes and their sequence according to the product’s/service’s life cycle (Value Chain), as well as determining the influence of ICT application to business operations of an organization (BCG matrix) are prerequisites for quality business process reengineering. That is the starting point in

increasing the organization’s efficiency and implementing new technologies through DT.

Business process reengineering represents fundamental consideration and a radical modification of business processes for the purpose of achieving dramatic improvements in critical, contemporary measures of organization performance, such as costs, quality, service, and speed. The important term here is business process. At the same time, redesigning the processes creates the most complex difficulty to modern management. Most businessmen are still not “process oriented”, but rather oriented towards terms such as work, task, staff, organization structure etc. Although information technology plays a large role in designing processes, it should be made clear that designing the processes in its nature, is not ultimately the automation.

Researches still show that requirements engineering approaches for implementing new technologies do not encompass business strategy, although digital transformation framework requires it.

One of the methods to be used in planning business process reengineering, is business technology matrix [20]. In its very essence this is processes/data classes matrix. This simple method belongs to a group of low-resolution methods, as processes and data classes are the ones analysed in the matrix, and not detailed activities and elementary data (Figure 3).

| | dc1 | dc2 | dc3 | dc4 |
|----|-----|-----|-----|-----|
| P1 | R | | C | |
| P2 | | C | R | R |
| P3 | R | R | R | |
| P4 | | | R | C |
| P5 | C | R | | R |
| P6 | | R | | R |

Figure 3. Business technology matrix, source: author

Processes (P) are presented as rows and data classes (dc) as columns of the matrix. The content of rows depicts input data classes (**R**ead) and output data classes (**C**reate) that each process read and create, respectively.

By aligning matrix business processes according to product/service life cycle, natural business units of an organization are obtained, as well as the architecture of the organization’s information system. Thus, processes are clustered according to the life cycle of the product/service that the organization is producing. The result of the application of this method is two-fold: (1) the organization is naturally structured according to its business units, regardless of current organization structure and (2) the architecture of a single information system is determined. The resulting business units must meet some requirements:

- the boundaries of business units must be clear
- business units must be small enough to enable direct further analysis

- business units must be large enough to use the advantages of sharing the data basis
- business units must not overlap with another business unit
- generally speaking, the data from one business unit should not be updated by another business unit.

Using this method two dimensions of DT maturity models could be analysed: organization and processes/operations [13].

Unlike clustering processes according to life cycles, there is a method of process clustering according to affinities. This method is based on the same business technology matrix. (Figure 4).

| | dc1 | dc2 | dc3 | dc4 |
|----|-----|-----|-----|-----|
| P1 | R | | C | |
| P2 | | C | R | R |
| P3 | R | R | R | |
| P4 | | | R | C |
| P5 | C | R | | R |
| P6 | | R | | R |

$dc(P_i) \dots$ number of dcs used by P_i
 $dc(P_i, P_j) \dots$ number of dcs used by P_i and P_j simultaneously
 Affinity from P_i to $P_j = \frac{dc(P_i, P_j)}{dc(P_i)}$

Figure 4. Business processes affinities, source: author

Matrix in the Figure 4 represents the relationship between processes and data classes and is read, for example, “process P1 operates with data classes dc1 and dc3, regardless of type of operation (read or create). By calculating the affinity between processes using expressions in Figure 4, the matrix in Figure 5 is obtained. By selecting the largest affinities, the grouping of processes into clusters (potential organizational units) begins.

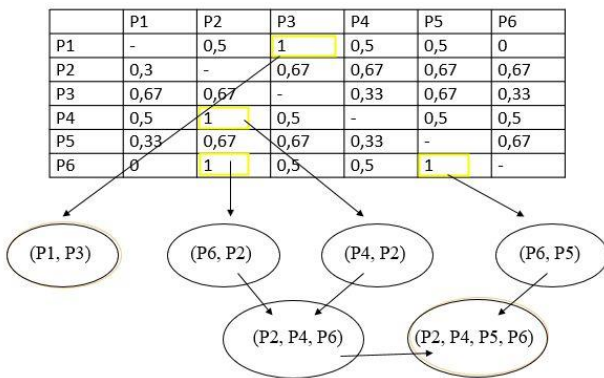


Figure 5. Business processes affinities, source: author

The affinity grouping method has a two-fold role:

1. Processes are grouped into cores (clusters, organizational units) of a future optimized organizational architecture.
2. On the other hand, if data classes are grouped instead of processes (Figure 4), the basic structure of future database is obtained. Affinities between data classes direct towards the process responsibilities for data groups.

While the second case is related to data base planning, i.e. the organization’s information system, the first case is related to grouping business operations into organization units (divisions). This once again confirms that, in this digital transformation age, organization development methods and information systems development methods are closely linked and point to the possibility of existence of common methods, or a common meta language for the development of organizational and information systems. Thus the importance of these methods is spread not just to organization and processes dimensions of DT framework, but to software technology dimension, too [23].

Different researches show that the overall effort in business process redesign cannot be defined in the form of a “standard operating procedure”. Therefore, no recipe exists which could be used for preparing business processes in a frame of digital transformation. It would be much more precise to state that a framework for successful implementation of digital transformation in processes and organization dimensions contain a number of methods, while the choice and the order of application of specific methods depend on the organization. A possible scenario of preparing business processes for digital transformation, could be as follows:

- a) Modelling existing business processes of an organization (BPMN diagram); Result: overview of existing processes and exchange of information/material flows among them.
- b) Analysis of the organization’s business processes (value chain). Result: understanding the nature of the organization, separating primary from support processes, rough indication of business units and possible information system units.
- c) Analysis of the organization’s business processes (BCG matrix). Result: Development priorities for information system application groups, according the dependence of business processes on ICT and potential savings in applying ICT to those processes.
- d) Analysis of the organization’s business technology (business processes) by applying the business technology matrix. Result: Future architecture of the organization’s information system, with all its subsystems; optimum organization structure with business units.
- e) Analysis of affinities among activities and entities. Result: for each business unit obtained under d) – clustering entities into data base cores and grouping activities into organization units.
- f) Development of dataflow diagrams. Result: the structure of the future application solution and application modules logic.
- g) Development of a new business data model (entity relationship diagram). Result: proposal of the future application data base structure.

V. VIRTUAL ORGANIZATIONS

Nowadays, organizations cannot be viewed on their own, but within the framework of the environment they

operate in (industrial value chain). Therefore, every digital transformation effort not taking the organization environment into account would, at the very least, be condemned to uncertainty. Furthermore, fast development of new technologies, like mobile or cloud-based solutions, would make it more difficult to succeed in DT projects, if organization environment was not taken into account [16].

With meeting legal requirements, developed Intranet infrastructure enables the development of extranets, i.e. virtual information systems whose subsystems are information systems of individual participants within the life cycle of the product/service. A new wave of business processes redesign, using contemporary information technology, breaks the “walls” which separate individual organizations from one another. Business processes do not stop at the gate of organizations but form a new alliance called virtual organization. A virtual organization can be defined as an alliance of enterprises that come together to share skills and resources, in order to better respond to business opportunities and are enterprises whose cooperation is supported by information technology [18].

The development of products, planning, distribution, and numerous other business processes are inter-organizational in their nature, thus linking the entire chain, from suppliers to end buyers. Each organization involved in the life cycle of the product/service thus becomes a single wheel in a complex mechanism. In order for this mechanism to operate as a whole, and to utilize the synergetic effect of all organizations in the mechanism, it becomes a single virtual organization, with a single information system. Although each organization retains privacy of a larger part of its data, interfaces among organization’s information system (mechanism parts) must remain transparent.

When analysing the influence of electronic commerce on an organization, the possibilities for the buy-side and the sell-side of e-transactions should be identified, since information systems with different functionalities must be developed within the organization – one is the buy-side functionality and the other the sell-side functionality. The possibility for the organization’s information systems on the buy-side and the sell-side to be technologically supportive is very scarce. The buy-side e-commerce refers to transactions ensuring the resources that the organization needs from the suppliers. The sell-side e-commerce refers to transactions included in the selling of products/services to the organization’s buyers.

In distinguishing the buy-side and the sell-side of e-commerce, different aspects of management of the organization’s supply chain are observed [17]. Supply Chain Management represents the coordination of all supply activities within the organization, from suppliers to the delivery of products/services to users. The possibilities of using e-commerce in directing and reengineering the supply chain are numerous.

The value chain enables finding ways in which supply chain activities can add value to products and services delivered to customers. An internal value chain exists, which refers to supply activities in the organization itself, and the external value chain, where supply activities are performed by partners.

The development of an information system which would support the entire supply chain, i.e. support all business processes founded along the life cycle of the product/service, should be planned, and developed within the processes redesign effort. This effort would be unique to all organizations forming the supply chain, or whose processes are performed along the life cycle of the product/service. The overall effort in redesigning the processes of all members in supply chain is shown in Figure 6.

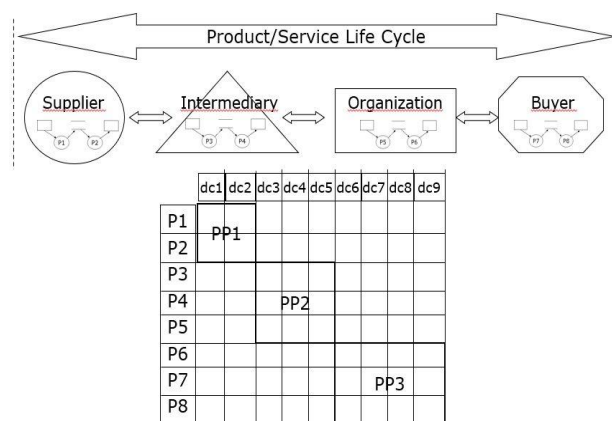


Figure 6. Analysis of supply chain processes, source: author

Processes of supplier (P1, P2), intermediary (P3, P4), Organization (P5, P6), and Buyer (P7, P8) are considered simultaneously as a whole along with the data classes they read or create. Affinity analysis will group all these processes into semantic classes which form the architecture of virtual organization that encompasses all the supply chain members. This represents the process dimension of supply chain digital transformation.

One possible scenario for building such virtual enterprise architecture would be as follows:

- a) Modelling the existing business processes of all supply chain participants (supplier, intermediary, organization, buyer). Result: overview of existing processes of product/service life cycle and exchange of information/material flow between them.
- b) Analysis of business processes of all supply chain participants (value chain). Result: value chains of all supply chain participants.
- c) Analysis of business processes (value chain). Result: forming a single value chain (industrial value chain) on which all product/service life-cycle processes lie. In other words, forming a value chain of a virtual organization which includes all supply chain participants.
- d) Analysis of the virtual organization’s business processes (BCG matrix). Result: Development priorities of application groups of virtual organization’s information system, according the dependence of appropriate business processes on ICT and potential savings in applying ICT to those processes.
- e) Analysis of the virtual organization’s business technology (business processes) by applying business

technology matrix. Result: Future architecture of the virtual organization's unique information system, with all its subsystems; defining virtual business units.

f) Development of dataflow diagram of a virtual organization. Result: the structure of the future application solution and the logic of application modules to be used for drawing up interface applications among supply chain participants.

g) Development of a new business data model (entity relationship diagram). Result: proposal for the structure of the future single data base of the virtual organization.

VI. CONCLUSION

Digital transformation is a multilayer and multidimensional effort for changing the organization while anticipating the role of contemporary information and communication technology. It is a multilayer and multidimensional process encompassing organizational culture, role of C-level management, organization, processes and modern technologies like mobile or cloud solutions. Business processes are to be prepared and optimized if digital transformation is to be successful. Although digital transformation is widely accepted paradigm nowadays, redesigning business processes and creating new business models rely upon methods that have already been in use for some time.

Value chain analysis, business processes redesign, BCG matrices, affinity analysis and virtual organization concept, if properly applied, are useful tools for organization and processes dimension of digital transformation. Using this methods, higher levels of digital transformation maturity could be achieved.

Holistic approach in digital transformation, encompassing all its dimensions, would require new paradigms that are beyond existing methods. Three areas of expertise are promising for future research: (1) methods engineering for development of new possible methods, (2) metamodeling for defining the digital transformation repository gathering all the concepts of digital transformation under one umbrella, and (3) creating new ontologies as a set of concepts and categories in a digital transformation area or domain that shows their properties and the relations between them.

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