

# Value Model-based Digital Transformation of Business Processes in Enterprises

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**Abstract.** In the process of digital transformation, the authors prioritize business engineering based on digital products realized by interaction among participants of a digital business ecosystem. Creating a business in a digital environment suggests compliance with the value parameters determined by the digital business model of the product in business processes. In designing and adjusting the business processes realizing digital business model, a targeted model of management should be formed, allowing consideration of the parameters of the digital business model values. Orientation on corporate values without considering the values of the digital business ecosystem participants is an essential disadvantage of the existing approaches to development of the digital model of business management. The study presents an approach to digital transformation of business processes based on a value model. The study method includes analysis of the role of the value-oriented approach in digital transformation of companies, selection of the ways of digital transformation of business processes of a business model, review of the methods and tools of value-oriented business management, and description of the approach to creating a targeted value-oriented business process management model. This model connects the value model and the targeted business process management model, allowing design and adjustment of business processes in accordance with the value parameters of a digital business model. The requirements for the value model are determined at the stage of designing a digital business model. These requirements should be used in developing a targeted model of managing a cross-organizational business process, arising in interaction of the participants forming the joint product in the digital business ecosystem. The proposed approach is now being tested in the enterprises, involved in digital transformation.

**Keywords:** business process, value-oriented business model, digital transformation.

## 1 Introduction

Formation and development of digital economy, the leading driver of the Fourth Industrial Revolution, based on the use of cyber-physical systems, is becoming an important

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strategic task for industrially developed countries. Transition to the digital economy, implying large-scale use of IT not only for data processing but also for managing enterprises is usually referred to as digital transformation (DT). The goal of DT is to raise the efficacy of companies, which will lead to improved competitiveness and adjustability to growth in a turbulent environment. One of the positive effects of DT is the possibility and necessity of existing under conditions of digital interaction among the participants of a business ecosystem (manufacturers, intermediaries, customers) based on the principles of value distribution, normally referred to as distributive economy, also called distributism.

The key idea underlying implementation of DT adopted by most approaches consists in development of a digital business model (DBM), which not only reflects the value proposition to the customer but also demonstrates the ways it is done and provided by digital technologies in the course of interaction among stakeholders.

Implementation of the DT processes generates, in our opinion, certain research challenges, namely:

- Underdevelopment of the methods of assessment and commensuration of values in the course of business simulation, which makes development of common DBM and distribution of values among the participants difficult;
- The absence of the methods of applying the value-oriented approach (VOA) to engineering of business processes (BP) in the digital environment, which complicates the perspective of DBM implementation;
- The absence of an approach to improvement of BPs in the enterprise and among its stakeholders under conditions of the DT based on a general structured model of values, which reduces promptness of changing the DBM under conditions of fast changes in the business environment.

The goal of the proposed study is to develop an approach to improvement of BPs of an enterprise under conditions of DT based on the model of product values. To this goal, the following problems have been solved: analysis of the role of the VOA in the process of DT of an enterprise and of the methods of DT of BPs considering the value-based parameters of the business model; the methods and tools of value-oriented management of BPs are reviewed; an approach is proposed to development of a targeted value-oriented model of BP management.

## **2 The Role of the Value-oriented Approach in the Process of Digital Transformation of Enterprises**

A digital economy is characterized by mutual dependence of businesses and the IT aspects of their activities. It is considered that business strategies are the most significant driver of changes for a traditional economy. For the digital economy, appearance of a new highly effective technology, opening up business development perspectives, may become such a driver [1]. A push-pull model, according to which business requirements pull the business, and IT push it, is characteristic of the digital economy.

Development of the technologies of social networks, the Internet of Things (IoT), cloud computing, mobile computers and big data, as well as emergence of devices allowing operation of these technologies, creates conditions for intense expansion of digital environment, which is understood as the totality of digital information, digital processes and digital infrastructure (digital devices and platforms), as well as actions relating to management of digital processes towards development of a digital economy.

Modern companies based on digital platforms use digital environment to form and develop their own digital business ecosystems (DBE), a network of sustainable interactions among an enterprise, its suppliers, partners and customers (organizations and individuals), in order to provide maximum value to all its participants. As a result of DBE development, the boundaries between a company and its environment fuse, leading to implementation of digital strategies based on transition to innovative DBM.

According to [2], a business model provides a competitive strength to a company by describing the critical success factors; therefore, it is a more significant element of business architecture than a company's mission, strategy and the cash flow plan. A DBM reflects the principles of doing business and considers such aspects as availability of a digital platform, digital content, digital interaction with customers and partners.

However, in a digital economy, a business model becomes not only an element of business planning but also a mechanism of managing an enterprise and the processes of its digitalization. In this regard, the radical shift of the paradigm of enterprise digitalization should be noted: whereas at the starting stage of the digitalization era, research based on an information model was the basic approach to development of information systems, followed by automation of BPs, now, at the time of movement towards the digital economy, design and realization of DBMs are viewed as the basic approach [3].

In developing a DBM, dynamic features of the DBE should be considered, which, according to [3], include the following: a short life of a business model due to fast changes in technologies; the necessity of orientation not on resources but on dynamic business opportunities; turbulence of business ecosystems, caused by complex interactions among their participants; the possibility of intra-industrial diversification and synchronized business behavior of its stakeholders. Hence, the key elements of analyzing a DBE are the following: digital platforms, social trends, practices and business opportunities of companies. It is important not only to examine the way a value is created but also the way it is used and distributed among the participants of a DBE. In this regard, a search for the balance of interests of different types of stakeholders on the basis of coordination and mutual alignment of values remains to be a complex theoretical issue [4]. To solve the problem in the framework of the VDEE (values-directed enterprise engineering) approach [4], the principle was determined and the method of delineating the environment of enterprise values was substantiated.

Relating to business models, the issues of values are considered in the course of designing a value proposition by comparing the factor of benefit for the customers to their needs and the necessity of fulfilling a task or solving a problem [2]. Hence, in the context of a business model, a value may be understood as the attitude of a customer to the proposed product, which should be expressed in the terms describing the customer's

needs. Then the customer, based on utility and price, will take a decision whether to buy the product having the given properties.

It is evident that the concept of the value is much deeper than the utility of products. One can identify cultural, ethical, aesthetical, economic, material, financial and other values. Being different in nature, values are united by a common property: they are used as principles in decision-making. Traditionally, in developing a DBM, economic values are primarily used. There are two approaches to their estimation: the user value (utility) and the exchanged value (cost, or commodity cost). However, due to the necessity of distributing values in the DBE and of maintaining the balance among stakeholders, the use of values in the DBM has not only the evaluating but also operational nature.

Now DBMs are used as an inseparable element of DT realization. In literature, certain frameworks are provided, describing the DT process in a DBE [1, 3, 5, 6]. Summing up these approaches, the following phases of the DT process may be identified: business design; organization design; modeling IT architecture; systemic prototyping; and business development. A DBM is developed in the phase of business design, which presupposes selection and testing of the business model, including analysis of distribution of values among participants of the value network, in which companies collaborate in manufacturing a complex product [7]. The process of designing the DBM for a value network, according to the e3value approach, proceeds as follows:

- Identifying technological business ideas;
- Determining priorities and choosing a technological business idea;
- Developing a hierarchy of values;
- Designing an elementary and/or multiple network of values;
- Assessing the economic sustainability of the network of values; providing economic assessment of each network participant.

For practical use of this approach, Internet engineering [7] is used, in which the exchanged value is used as a criterion of value.

### **3 Digital Transformation of Business Processes in the Framework of Implementing the Digital Strategies of Enterprises**

A business model is an idea to be implemented. According to [8], a business model is represented by BPs performing the role of a link between a business strategy, a business model and current operations. BPs are modeled in the course of DT in the phase of organization design.

The DT process produces certain requirements for design and management of BPs: targeted management, required to maintain the proportions of the value model under conditions of network interaction; promptness of deployment of making changes, attributed to the dynamic nature of business models in a DBE. These requirements may

be realized, based on the modern concept of BP management (BPM) and of the system of the BPMS class.

The key principle of the BPM concept is creating values for customers by forming customer-oriented BPs, the efficacy of which is evaluated on the basis of customer satisfaction using approved tools: a map of the value creating chain, ABC analysis, statistical control methods, etc. BPMS software complexes, automatically generating business applications based on an IT platform are an environment for promoting the BPM concept. Such powerful tools are a necessary condition for BPs in DT but it is not a sufficient condition, as implementation of BPs of the network business in a DBE has a number of features: distribution; dynamism, and the necessity of realizing the set parameters of network values. The status-quo requires application of an operation approach to value-oriented management of BPs, to ensure better control of delivering the value to the customers and of distributing the values in the network.

In this regard, the concept of the product value in relation to BP management should be specified. In the BPM-discourse, this concept is often misinterpreted, and a certain thing (for example, a commodity or material) is often identified with a value, which in fact is a “metaphysical” category, manifested in the attitude of an individual or a group to the product proposed to him/them. Hence, according to [9], a conclusion is made that a value may “flow” through a “value-creating chain” or a “value-creating flow”. In addition, statements can be found that a value is an imminent characteristic of a product or that a value may be added by a process action. In this context, such notions as a value-creating chain or a value-creating flow begin to be understood literally. As a matter of fact, a value, as a subjective attitude, is not an internal characteristic of a product, and, as it is not substantive, it cannot be transferred or provided, etc., it cannot be added to a product or service. On the other hand, each step of a process may improve perception of a product value by a customer.

These ideas should be considered, to ensure correct development of a targeted model of managing BPs, oriented on customer values and containing mechanisms of aligning the values and objectives of a BP. It is to be noted that the issue of building a targeted model of BP management corresponding to customer values is not sufficiently investigated. In particular, questions arise relating to the methods of selecting values, their assessment and co-measurement, the principles of establishing ties between values and objectives and determining the role of a value in assessing the efficacy of BPs in terms of the end result. In the context of enterprise engineering, these issues are investigated in [4], and the provided recommendations should be used for solving the problem.

#### **4 Methods and Tools of Value-oriented Business Process Management**

There are publications which contain recommendations on applying values to the management processes in finance, enterprise engineering, designing enterprise architecture and BP management. An important area of value-oriented management is taking managerial decisions, presupposing the choice of the best decision among many alternatives based on the value criterion.

Essential contribution to the theory of value-based decision-making was made by Ralph Keeney and Howard Raiffa, who developed the multi-attribute utility theory (MAUT) [10, pp, 5-7], in which they proposed a paradigm for analyzing decisions, consisting of five steps: preliminary analysis; structural analysis; uncertainty analysis, analysis of utility or value; the optimization procedure. In this, a decision-making tree is built, consisting of decision nodes and case nodes, for which probabilities are found. Then the decision-maker (DM) finds the numerical equivalents for utility (value) for the effects related to a certain decision and then finds an optimal decision by maximizing the expected utility. The authors of the theory proposed a paradigm of value-focused thinking (VFT), based on a value-based decision-making approach. This approach is compared to the commonly used approach of alternative-oriented decision-making [11]. In accordance with the VFT framework, the decision-making process should be started not by searching for alternatives but by building a decision-making model, based on values in choosing the objectives, thus essentially improving the process of searching for alternatives and the decision-making process.

In building a value-oriented model of decision-making (the value-oriented model), the following components are identified:

- Values of the DM, used as principles for choosing a set of objectives;
- Objectives, indicated in the context of strategic decisions and organized as a hierarchy;
- Goals oriented on achieving objectives and organized as a network;
- Alternatives from which a decision is selected;
- Attributes of goals, allowing quantitative estimation;
- Criteria allowing the degree of goal achievement to be assessed;
- Compromises allowing comparison of contradictory goals;
- Restrictions used for eliminating unacceptable alternatives.

This model allows decision-making focused on values. To consider the risks, interchangeability and multiple criteria, it is reasonable to apply the mathematical methods developed in the framework of the MAUT theory. The MAUT value model, unlike attributes, which provide a measure for achieving a specific objective, ensures a common structure for uniting various attributes. Depending on the situation, during decision-making a value model may be either a function of measured preference or a utility function.

The possibilities of applying the VOA to management of BPs are now actively discussed in literature. In [12], it is proposed to use the value framework for BPM, containing the following set of corporate values: quality, flexibility, efficacy, standardization and compliance with requirements, an external network, internal alignment, innovations, and preservation of traditions.

In [9], the use of VOA in BPM is investigated, offering an approach to value-based management of BPs and identifying “use value” and “exchange value”. The Ropt method, based on estimating the exchange value in terms of financial payback from design and reengineering of a BP, is recommended.

An approach to value-oriented BP engineering is proposed in [13]. Here an adapted VFT framework is used in relation to business processes of managing human resources.

Connection is indicated between the model of values based on the methods of the multi-attribute utility theory and BP models built according to EPC notation (event-driven process chain).

The above approaches are focused on achievement of corporate goals and do not directly take the values for customers and other participants of digital interaction into consideration. However, conceptual ideas obtained in these studies may be used in developing an approach to value-oriented targeted business management (VTBM) in digital business transformation.

## **5 An Approach to Improvement of Business Processes at an Enterprise under Conditions of Digital Transformation Based on the Value-focused Model**

Currently, significant expertise has been accumulated in the area of practical application of VOA, in particular, in the IT industry, where the use of VOA in BP management has become a norm, which is reflected in certain standards of IT management: Val IT Framework, The Open Group IT4IT™ Reference Architecture, and COBIT 5. In particular, the business model of COBIT 5 indicates that creating a business value for the customer based on adjustment of the stakeholder needs to the high-level objectives of an enterprise is one of the principles of applying this standard.

Another practical application of VOA is electronic business. In [1] different aspects of value distribution in e-business models are provided, and an approach to designing a networked e-business in a DBE is proposed, beginning with building a DBM up to developing an IT system prototype. The approach is illustrated by case studies.

Examples of practical application of VOA in the framework of the VDEE concept to realize the procedures of architectural analysis of DT options and of risk management are provided in [14]. In [15], the use of this concept for solving a practical task of building a competency environment, as well as for using the competency model as a value model, is described.

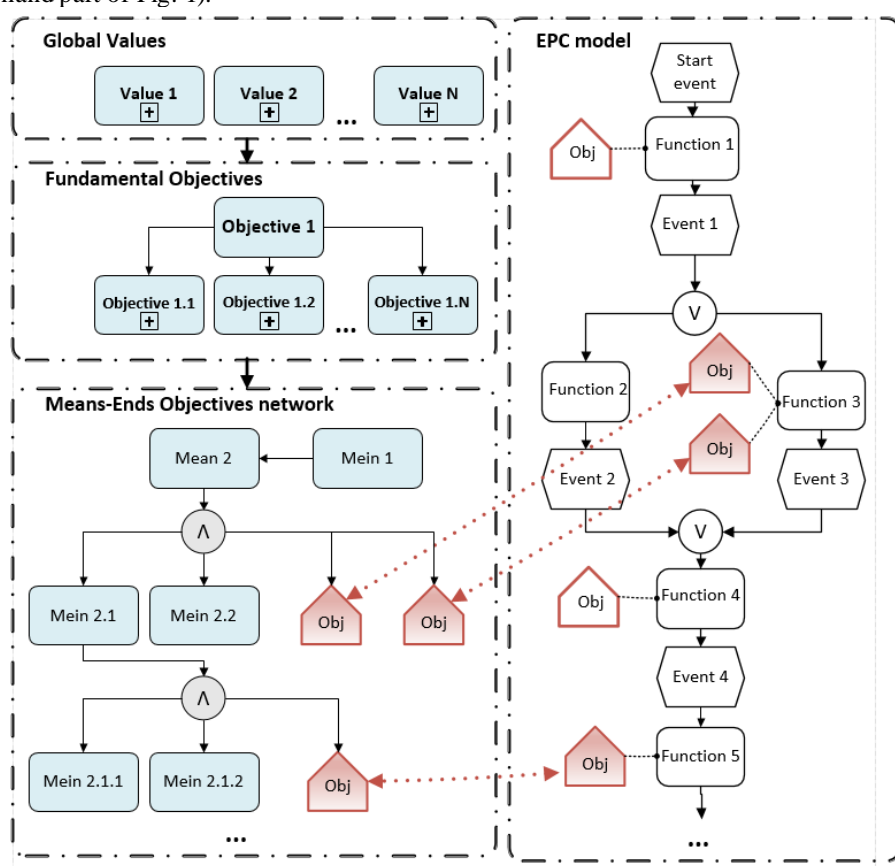
In [5], creating complex products in a distributed DBE is investigated. According to the proposed method, the use of stakeholders' value models is one of the key elements of the process of creating a business and its realization. A high-level model of objectives is developed at the starting stage, which is then adjusted to the requirements for the architecture of a decentralized ecosystem, and the roles of the participants and their values are described.

This confirms the necessity of applying VOA to creation of a networked e-business; however, the issues of using the value models are localized as part of designing and testing business models and are not brought to engineering of BPs realizing the business model. The latter essentially restricts the role of the value model in the process of e-business management.

To sum up, the value-oriented approaches of business management are actively developing in the framework of traditional business, where the value model is focused on

achievement of corporate goals. At the same time, in the framework of network e-business, the significance of the value model is recognized, though its use is restricted to designing business models.

In our opinion, the joint use of these concepts will allow implementation of an approach to DT of business processes in the framework of implementation of complex digital business models, ensuring compliance with the parameters of the stakeholders' values distributed in the network. In the process of DT, in designing a digital product, it is necessary to develop a VTBM, meant to ensure realization of a value concept and the possibility of making prompt changes considering the market behavior. The principle of creating a VTBM model is shown in Fig. 1 (with EPC-notation). VTBM (the left-hand part of Fig. 1) contains a model of values, management objectives and means-ends. The means-ends are adjusted to the functions of the business process model (the right-hand part of Fig. 1).



**Fig. 1.** The principle of creating a value-oriented targeted business management model with EPC-notation

Creation of such a model should proceed in the course of developing a digital product at the stages of designing the business model and of organizational design of the



digital product. The approach to creating a VTBM model in the context of developing a digital product proposed by us is shown in Table 1. The requirements for the value model are determined at the stage of designing a digital business model, containing requirements for the value proposition for the customer and economic value for the participants of creating the digital product.

These requirements should be used in developing a targeted model of managing a cross-organizational BP, arising in interaction of the participants forming the joint product in the digital business ecosystem.

**Table 1.** Description of development of a value-oriented targeted business management model in the context of designing a digital product

Designing a digital product	Developing a value-oriented targeted business management model
Designing the digital business model	
1. Revealing, prioritizing and selecting a technological business idea	Revealing customer needs, analyzing the potential of value creation
2. Analyzing business scenarios	Determining the aspects of creating a value proposition and of value objects, and determining the temporal value characteristics
3. Forming a value proposition	Developing a hierarchy of values
4. Designing a value creation network	Distributing values among the digital product participants
5. Testing the business model on the basis of modeling a revenue flow	Determining the economic values of the participants of network interaction
Organization design	
1. Developing the vision of the digital product	Developing a value model of a digital business ecosystem
2. Functional modeling of the digital product	Developing a value model
3. Modeling the cross-organizational BP	Developing a value-oriented targeted model for managing the main BP of the digital business ecosystem
4. Determining the requirements for the business services of the participants of the ecosystem	Developing the attributes of the objectives, criteria and restrictions for analyzing and evaluating the efficacy the cross-organizational BP of the digital business ecosystem

The advantage of using a VTBM model is the possibility of assessing the efficacy of a cross-organizational BP. For this purpose, such parameters as attributes, evaluation criteria and restrictions are to be studied.

## 6 Conclusion

The following conclusions are made: 1) Selection and testing of a DBM, which has to be analyzed in terms of distribution of values among the participants of digital collaboration, is becoming the key stage of planning in the process of DT of enterprises; 2) In designing and adjusting the BPs realizing DBM, a targeted model of management

should be formed, allowing consideration and control of the parameters of the DBM values; 3) Orientation on corporate values without considering the values of the DBE participants is an essential disadvantage of the existing approaches to development of the digital model of business management. Based on that, the authors propose an approach to develop a VTBM by identifying the connections between the functional goals of the business processes and the value model; the process of building a VTBM in the context of business design is described. The use of such a VTBM will allow control of compliance with the parameters of the DBM values and prompt adjustment of business processes to its changes. The proposed approach is now being tested in the enterprises of the air transportation industry and in the organizations of the financial and educational sectors involved in DT.

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