

# Ontology engineering of network companies<sup>1</sup>

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**Abstract.** The dynamic interaction of stakeholders of network enterprises necessitates the development and usage of an ontology, based on which information is exchanged between the agents of the company in the process of creating and implementing joint projects of innovative products and services. The article presents methods of ontological modeling of core competencies in business models as models of values, capabilities, business processes, resources and technologies, the stakeholders of joint activity.

**Keywords:** 'ontology' 'interaction' 'agent' 'network companies' 'business model' 'ontology engineering'

## 1 Introduction

In modern conditions the engagement and cooperative participation of different innovation, production, logistics and distribution companies in the development, creation and distribution of new competitive products with a maximum reduction of its life cycle represents the increasing value. The complexity of relationships between business partners leads to the formation of various organizational alliances or a network of enterprises, which form not just of value chain and value network with nonlinear nature of the interaction, to implement continuous innovation. For the implementation of inter-organizational interactions in such enterprises requires the development of mechanisms of continuous engineering enterprises based on the sharing and joint management of the knowledge by all participants in the related business processes within an integrated information space.

The characteristics of the network enterprise [3] are flexibility, intelligence, learning, ability to carry out future transformation, which provide:

- the collective nature of intellectual work, involving the cooperation of all stakeholder;
- formation of a horizontal, flexible organizational structures aimed at fast and effective implementation of projects and processes;

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- in operation networking structures as self-organizing and self-learning organizations, adapting the strategy and tactics of behavior in accordance with changing conditions;
- implementation of the needs and opportunities in the continuous carrying out of innovation.

A significant role in the development of the concept of a flexible engineering network of the company plays ontology engineering, which provides the unity of view of the enterprise at different levels of management positions integration of all components of a complex system. The concept of ontological engineering enterprises considering the enterprise as a holistic socio-economic and organizational-technical system, providing a focused and coordinated development of all components [4]. Conduct ontological engineering of enterprises involves the consideration of the enterprise as object of system engineering with a clearly defined life cycle of all its components. The company is the system able to transform in all aspects and relationships.

## **2 The ontological representation of the architecture of the network enterprise**

The approach to ontology engineering network of the enterprise based on the principle of adequate representation of enterprise architecture [1] of a flexible and adequate model-building enterprise at the strategic, tactical and operational level and rapid transitions between them.

For the organization of the information space of the interacting agents network enterprise proposes the creation of a coherent system of ontologies, which should include:

- Ontology of business strategy, reflecting the objectives, critical success factors, core competencies and their combinations, key performance indicators and requirements to the business model.
- Ontology tactical business models for the implementation of the key competencies and the formation of core values produced by the enterprises. The ontology of the business model considers the interrelation of all its components: values, capabilities, resources, processes, technologies, organizational structures.
- An ontology of activities, reflecting the peculiarities of implementation of business-processes in a specific area of activity of the enterprise taking into account the distribution of roles of interacting agents activities.

## **3 Ontology of enterprise strategy**

Enterprise strategy defines a set of fundamental statements, in accordance with which the lining up of the business model of the company and detailing their business processes. Development of strategy allows you to move from management of the organization, depending on the impact of randomly occurring external and internal factors to

the systematic activities to achieve the objectives and can assess their reachability by certain critical success factors and key performance indicators.

At the strategic level it is expected to identify the key competencies of enterprises have a significant impact on its market position. In the long-term competitiveness of the enterprise depends on the ability to implement with lower costs and faster key competences on the basis of which originate value for customers in turn implemented in the form of innovative products and services. Under core competencies in accordance with K. Prahalad and G. Chamelon will understand the result of collective learning in the Corporation, integrating production skills of the employees and a variety of technologies [7]. The core competence lies in the ability to coordinate the use of different production technologies, organization of business processes for interaction with partners and consumers. Key competencies are complex enough to mimic competitors. Usually the company owns 5-6 key competencies that define the combinations of key activities.

Based on the key competencies formed the mission of the company, an ontological definition which should include:

1. A description of the nature and purpose of the enterprise, determine the causes and the meaning of existence.
2. The definition of the perspective of enterprise, which characterizes the types of activities in the long term.
3. The formulation of the business idea, defining a group of buyers, their needs, their technological and functional performance of products and services.
4. The disclosure of the system of values adopted by the management and staff of the enterprise.
5. The definition of political units of the company in cooperation with the state and society.

The mission of the company takes place in the system of strategic goals. Strategic objectives can be organized according to the four layers of the balanced system of indicators forming financial, marketing, process and resource and technology sectors of performance [5]. The mission of the company takes place in the system of strategic goals. Strategic objectives can be organized according to the four layers of the balanced system of indicators forming financial, marketing, process and resource and technology sectors of performance [5].

Each strategic objective is further specified by a set of critical success factors selected by one of the methods of strategic planning, for example, in accordance with the SWOT analysis [2]: define the advantages and limitations of internal resources (based on General analysis of the status of resources and technology) and opportunities and threats in the external environment. In the future, these critical success factors will be considered in the analysis of specific business models aimed at achieving the goals. Critical factors in turn affect the formulation of the boundary values of key performance indicators, which must strive for enterprise-level business models and business processes.

## 4 Ontology of business model

In modern conditions the strategy of the enterprise must quickly adapt to technological and market changes by selecting the adequate business model of the enterprise. Under the business model we understand a set are interconnected in some way and organized the business processes that implement the method of obtaining income businesses through effective use of internal and external resources and technologies. The business model of the enterprise is characterized by the combining of business processes at a system level. The business model takes on a synergistic quality that is not characteristic of the individual business processes individually.

The ontology of the business model has the following purpose:

- Knowledge representation for the design of new activities. Used by system analysts, architects, businesses, developers, project managers.
- Knowledge representation for decision-making on the establishment or transformation of activities in accordance with the business model. Used top-level managers in the decision-making process.
- Knowledge representation for stakeholders to inform about new projects and opportunities create a network of alliances.

In accordance with the ontological model of A. Osterwalder [6] the main components of a business model should answer the questions:

- • What to produce – feature suggestions are of value (products and services);
- • For whom to produce – characteristics of consumer segments of the market;
- • How to produce – characteristics of value chains;
- • As to income – characteristics of the model to generate income.

The relationship ontology the business model ontology the enterprise strategy is implemented by establishing the linkages of the proposal values with the core competencies of the enterprise (Fig.1).

## 5 Ontology of activities

For the implementation of specific proposals of the values to build the chain of its creation, which defines the possibility of implementing certain parts in-house or with outsource. Each link is supposed to perform a certain activity, requiring a certain number of resources. Ontology of activity reflects the interaction of agents in implementing business processes. The agents are either performing or coordinating roles [4].

Evaluation of the necessity of performing activity in-house or with outsourcing can be obtained based on the comparison of integrated capabilities of various variants of the organization of the value chain.

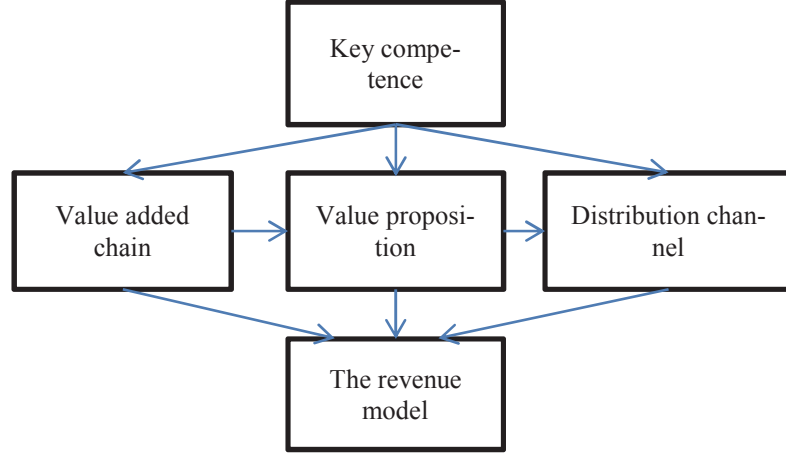


Fig. 1. Ontology of Business Model

Integrated assessment of the value proposition ( $\hat{V}$ ) is determined based on additive assessment of the level of provided abilities of progress of activities ( $\hat{C}_u$ ),  $U$  – the number of activities:

$$\hat{V} = \bigoplus_{u=1}^U \hat{C}_u, \quad \text{where} \quad (1)$$

$\bigoplus$  – the addition of fuzzy numbers.

Assessment of the level of ability of an individual activity  $\hat{C}_u$  is determined by a multiplicative estimate of the deviation of the level of requirements ( $T_i$ ) and provided resource capacity ( $R_i$ ),  $i = 1..N$  – The number of resources:

$$\hat{C}_u = \bigotimes_{i=1}^N \varphi(T_i - R_i), \quad \text{where} \quad (2)$$

$\varphi$  – fuzzy function (0,1),

$\bigotimes$  –multiplication of fuzzy numbers.

## 6 Conclusion

The proposed system ontology network operators provide a link between the three levels of enterprise management and flexible customization of business models and business processes to the changes in the external environment, a dynamic update of the value proposition and resource capabilities of enterprises and their partners. The development of a competence model of the interaction of the main agents of the activities of enterprises is the novelty of the proposed approach of building network architectures of enterprises.

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