

# Virtual enterprise: decision-making process of its formation

Kateřina Huspeninová

**Abstract**— This article deals with the business network in the form of a virtual enterprise and focuses on the initiation process of a virtual enterprise's formation. A virtual enterprise is understood as a temporary coalition of companies that may be competitors of each other and unite in order to use certain business opportunities. This article describes the decision-making process of virtual enterprise formation, where is the role of the initiator really important. To the correct decision whether to create a virtual enterprise or not it is necessary to know parameters of the contract and especially the cost calculation of each process. In this article is using the concept Activity-Based Costing, which is most suitable for this purpose. The aim of this article is to define the process of initiation of a virtual enterprise's formation that is for companies that initiate the creation of the business network an effective solution that will increase its competitiveness.

**Keywords**—virtual enterprise, networking, competitiveness, ABC concept.

## I. INTRODUCTION

**T**ODAY is the market environment characterized by dynamic and often unpredictable changes [12]. Companies face increasing pressure from the market, are forced to reduce their costs and provide customer products or services in the highest quality and more efficient. To ensure competitive success must constantly develop and implement new and innovative strategies. Considerable benefits accrue to those who are able to adopt a strategy of product differentiation according to the customer.

Strong customer orientation and changes in the technical field (especially in information and communication technology) cause strong links between economic entities [1, 14]. With business network now can be subjects of interest common with each other more than ever before. On this basis, companies are forced to rethink their core processes and business models. Business network with different levels of relationships can share resources, activities, and reduces the cost of risk. A typical business network is a virtual enterprise that allows focusing on those activities that a company can

perform on the world level, and whose borders are completely permeable and variable.

In this paper, the basic idea of a virtual enterprise network is meant to establish a dynamic organization by the synergistic combination of dissimilar companies with different core competencies, thereby forming a best of everything consortium to perform a given business project to achieve maximum degree of customer satisfaction.

The aim of this article is to define the process of initiation of a virtual enterprise's formation that is for companies that initiate the creation of the business network an effective solution that will increase its competitiveness [8].

## II. LITERATURE REVIEW

### A. Virtual enterprise

A virtual enterprise is understood as a temporary coalition of companies that may be competitors of each other and unite in order to use certain business opportunities. Thompson [16] characterizes virtual enterprise as a temporary alliance of business subjects (company, individual, university etc.) that may perform as mutual competitors. According to Goranson [5] virtual enterprise is established in order to exploit business opportunity which could not be exploited individually. Through efficient cooperation and integration of tools, knowledge and capabilities owned by members of virtual enterprise, virtual enterprise is able to reach desired aim with high quality and low costs.

Zhou et. al. [18] and Schönsleben [11] point to the fact that virtual enterprise is only a temporary consortium of companies that come together to respond to a transient or short-term market opportunity through collaboration of their individual competencies. In this case of transient or short-term market opportunity, firms prefer to form a cooperative network than to invest in the purchase of necessary and key resources needed to fulfill the contract. Companies in the virtual enterprise are to become partners in developing new products or services and share together the business risk.

Domberger [3] and Essig [4] agree that companies in a virtual enterprise may obtain complementary assets from partners for processes of production innovation, enlarging market shares and shortening the time of product development.

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Partner companies may also reduce their costs in research and development, procurements, production and marketing in a consortium because the economies of scale are reached when those activities are collectively performed. Essig [4], McCutcheon and Stuart [9] completed this thought that companies may share their risks in product or project development, because research team is more knowledgeable.

According Camarinha-Matos and Afsarmanesh [2] is a virtual enterprise temporary alliance of independent and geographically dispersed enterprises set up to share skills or core competencies and resources in order to respond to business opportunities, the cooperation among the enterprises being supported by computer networks. This is considered one of the most promising business strategies for enterprises to face global competition [6] and it is meaningful in quite different contexts such as manufacturing, healthcare, tourism, transportation and others. The success of such an organization is strongly dependent on its composition. In this context, the selection of the right partners is crucial. The creation of a virtual enterprise is usually triggered by an emerging market opportunity, giving rise to a 'project' that is decomposable in relatively independent sub-projects or activities. Therefore, before a virtual enterprise is formed, the different inputs and outputs of each activity have to be clearly defined.

According to the literature the restrictions of virtual enterprises can be summarized as follows:

- less of control and flexibility - activities and resources that can be directly controlled by the company will become less, because into the processes can enter more partners [3];
- product quality may be worse [10];
- loss of main competencies - losing skills and innovative capability [3];
- have to handle the problems of potential patents and copyrights [17];
- costs necessitated by the virtual - may increase transaction costs, because it is necessary to coordinate and monitor distributed production and activities members in the supply chain [11];
- partners of virtual enterprise may create relationships with the company's competitors, which can cause unintended creation of a new rival [9].

Moreover, the literature suggests that benefits of virtual enterprises can be summarized as follows:

- in most cases are benefits of virtual enterprises lower cost, more profitable and delivering higher value to customer [7];
- reducing costs by sharing infrastructure or an asset [15, 16];
- reducing costs by sharing a service [16];
- reducing costs or improving utilization by sharing a resources [16];
- reducing the number of transaction and increasing the scales of economy [4];
- product quality may increase and also techniques of production; reducing time for delivering a new design [9];
- networked small companies can adjust more quickly and at lower cost to changing demand conditions [3];
- each member may develop their distinctive capabilities, skills in which is excellent and competitive [3];
- members in this business network may have a position of competitive advantage [4];
- increasing of sales by collective marketing getting better prices by collective procurement - material, products or services [16].

### B. Life cycle of the virtual enterprise

According to Strader et al. [7] is a life cycle typical for a virtual enterprise. It begins by identifying market opportunities and ends with dissolution of the virtual enterprise. The life cycle consists mainly from the identifying of market opportunities, identification and development of the partnership, formation of a virtual enterprise, process of the realization and the dissolution of the virtual enterprise.

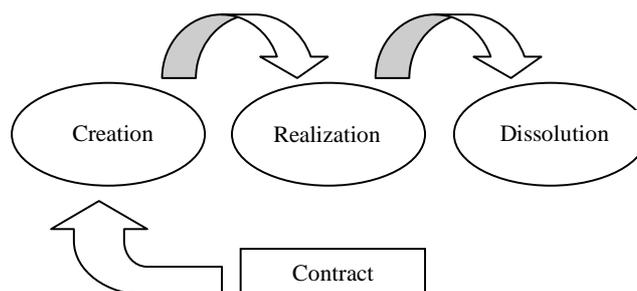


Fig. 1 Life cycle of the virtual enterprise.

### C. Role of the virtual enterprise initiator

Role of the initiator is for the creation and existence of the virtual enterprise absolutely crucial. This is a company that is able to exploit business opportunities in the market, but there are several reasons that lead to the necessity of cooperative networks of firms along the value chain. The reasons may be:

- initiator cannot realize the contract in time because don't have enough capacity or
- initiator doesn't have sufficient resources to realize the contract – hasn't the necessary production equipment, storage facilities, human resources, know-how, or it may require a completely different business focus than he realizes, and many others. Part of the value chain of the contract is not able to secure their own capacities;
- initiator is aware that the potential partner has the opportunity to realize some part of the value chain more effectively.

The initiator is responsible for creating of a value chain, is the initiator of the business opportunity whose realization is aim of a virtual enterprise, carries out the selection and evaluation of potential partners in the network.

The company, which became the creator of the virtual enterprise, will also coordinate other partners involved in the business network. It can be called as a "parent company". There must be a clear division of responsibilities and accountability for individual activities within the business network [13].

It is therefore necessary to determine and define a process that should precede the emergence of a virtual enterprise - including the determination of all parameters of the contract, costing each process of value chain contract, setting the environment for sharing data and selection of partners, who will participate in a virtual enterprise.

### III. RESEARCH METHODS CONDUCTED

The aim of this paper is to define the process of initiation of a virtual enterprise emergence, including determination of necessary conditions for ensuring the sharing of data. To achieve the objectives have been carried out interviews with managers of companies who have experience with the creation of virtual enterprises. Based on these interviews has been described a process of initiation of a virtual enterprise emergence, including decision-making process of creation a virtual enterprise.

Hypotheses:

H1: The decision-making process of the virtual enterprise formation can be designed.

H2: It is possible to define the most suitable method of determining costs.

The first hypothesis is that the decision-making process of the virtual enterprise formation can be designed. The second hypothesis is if it is possible to define the most suitable method of determining costs of the contract. These hypotheses will be confirmed or refuted.

For the initiation of the virtual enterprise is very important knowledge of this process and also for research activity

because it is still missing a model that would be able to directly say if is the formation of the virtual enterprise advantageous for the initiator or not.

### IV. CALCULATING OF THE CONTRACT COST

One of the key benefits for both the initiator and the other entities involved in the virtual enterprise should be of course mainly achieving of the financial effect from participation in the virtual enterprise. Any entity that implements a sub-process of the virtual enterprise contract, expects the financial benefits (share of sales for the execution of the contract) that are higher than costs associated with the implementation of the contract. Therefore, each potential partner should have a ready cost calculation before the actual participation in the realization of the contract. Calculating of costs of the contract is particularly significant for the initiator of the virtual enterprise and its decision-making process on whether to initiate creation of cooperative business networks.

Gained contract in this case we consider as the object (purpose) of a virtual enterprise, i.e. why is the virtual enterprise created. It is necessary to know many as possible about the contract, i.e., what products are produced, in what quantity, quality, which customers, etc.

The basic required parameters of the contract may include the following:

- the required volume of the contract, such as number of units produced;
- time requirement to fulfill the contract, such as the date when should be handed over to customers manufactured products;
- identification of product requirements of each stage of production;
- raw material and production requirements;
- technological requirements of production, technical documentation for any obtained parts of contract, etc.

Before the initiation of the virtual enterprise emergence it is necessary to estimate the expected costs associated with implementation of sub-processes of virtual enterprise. The aim should be to quantify all the costs (direct and indirect) to be caused by the realization of value chain sub-processes of the contract. Suitable tool to determine the actual cost of the processes (activities) can become a concept of ABC (Activities Based Costing). Determination of input to the ABC system is as follows:

- 1) modification of accounting data;
- 2) design activities (processes);
- 3) defining costs resource;
- 4) evaluation of activities (processes);
- 5) define the cost objects (contract of the virtual enterprise);

6) evaluation of cost objects.

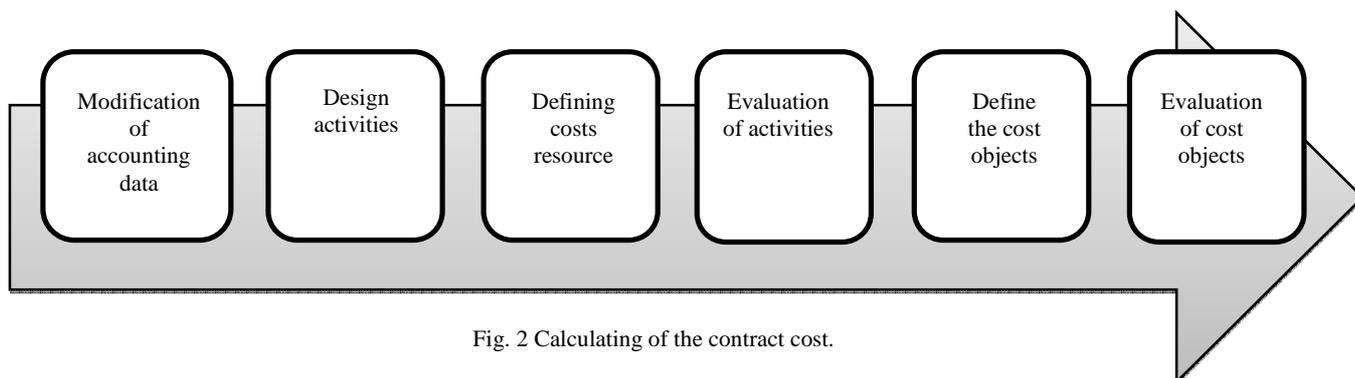


Fig. 2 Calculating of the contract cost.

Ad 1) Adjustment of accounting data consist in costs modification, in particular related with tax accounting. Furthermore for example, the cost of advertising, education, development, acquisition of new markets, etc.. These costs are not, strictly speaking, the costs directly attributable to the cost object, or rather are not connected with the appropriate revenue. It is rather as an investment and investments are one-off and somewhat longer term character. The other way around when are not the real incurred costs included in financial accounting, this item should be increased. That may be the costs of the repair machinery in multi-annual cycles.

Ad 2) In the second step follows the definition of sub-process operations, by which wants every involved subject participate in the realization of the virtual enterprise contract. Number of defined activities depends mainly according to the requirements of the scope and flexibility of the model. With the growing number of activities is appropriate their division according to kinship groups that better reflect the structure of the activities of the organization.

Ad 3) Determination of cost types is to clarify specific accounting costs, which will be assigned in the next phase to the proposed activities (processes). The best way to determine cost types is based directly on the chart of accounts (5 - costs).

Ad 4) The fourth step is to re-allocate all costs according to the type to individual activities (processes). For the distribution of cost types to the activities is used relational value. The aim is to find an accurate causal relationship of cause - consequence between resources (costs) and activities (processes). These relational values such as meters, pieces, kg (t), area, hours worked, time, etc. The result is an appreciation of all sub-operations.

Options on the distribution of cost types to activities can be as follows:

- percentage estimate;
- cause of time - the estimated time spent on the

implementation of a particular process, hours worked, etc.;

c) estimate of the amount consumed - pieces, kilogram, meters, areas, etc.

Ad 5) The next step should be defining a cost object, which is in our case a contract of the virtual enterprise. Costs, which accumulate to the activities that the cost object (contract) used, are assigned to this contract.

Ad 6) In the final stage should be assessed price of the chosen cost object (contract) where will be assigned only those costs, which led to the cost of objects. This is primarily needed two things - the amount consumed activities in a one cost object (contract of the virtual enterprise) and prices of individual activities. With knowledge of these information can be finally calculate the actual costs.

Total financial benefits accruing to the initiator of the virtual enterprise can be expressed as follows:

$$\text{Financial benefit} = \text{share of revenues on the contract} - (\text{direct costs} + \text{indirect costs})$$

This financial benefit can be applied to all partners of the virtual enterprise.

### Traditional

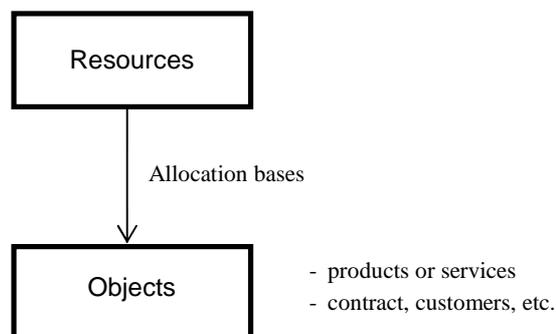


Fig. 3 Traditional costing method.

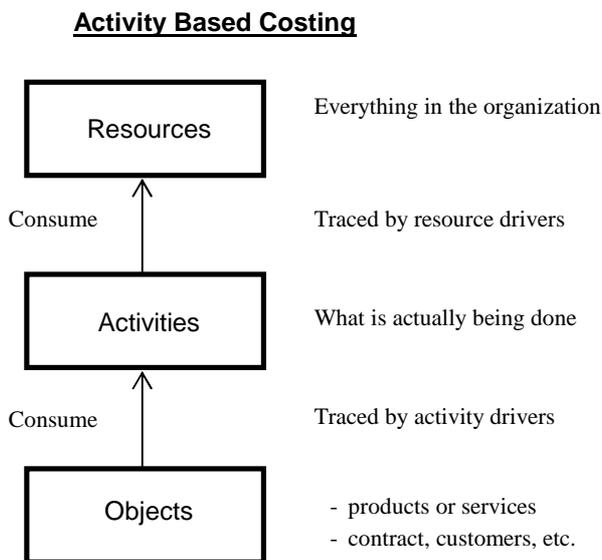


Fig. 4 Activity Based Costing.

#### V. THE DECISION-MAKING PROCESS OF INITIATION OF A VIRTUAL ENTERPRISE

Once all parameters of the contract are known, including costing of individual processes, the initiator is considering whether it is able to realize the contract with their own capabilities. The emergence of the virtual enterprise is initiated in the event that there exists a part of the value chain which cannot be realized with their own capacities, or is aware that this part of the value chain can be realized more effectively by an external partner. Significant is also the possible need to invest in additional assets, if it is needed for realization of the contract, and the financial performance of this investment. The decision-making process of initiation of a virtual enterprise is shown on Figure 2. In many cases of short-term contract, which requires expensive investment, companies are organized into business networks, because for them this version is much better. This is especially true for small and medium enterprises (SMEs), which often have limited financial resources.

#### VI. SELECTION OF SUITABLE PARTNERS

To ensure the effective function of the virtual enterprise and maximizing benefits to the initiator of this business network is a substantial selection of partners for the virtual enterprise. Likewise, quantification of benefits is based on evaluation of individual partners.

For the right selection of the suitable partner, it is better to compile a group of potential cooperators, who could be

suitable to work with the initiator. Ideally it is a group of companies with whom the initiator has a long relationship. This relationship supports confidence between partners and it is necessary for its effective functioning. But cooperation with an unknown subject raises caution and distrust, which may be counterproductive for emerging virtual enterprise.

It is necessary to select processes, which will be demanded of potential partners. From modelling value chain processes (Fig. 5) are selected parts to be offered to potential partner of emerging virtual enterprise. For each part of value chain are assigned metrics by which we can evaluate the efficiency of its implementation. Using these metrics we can select suitable partners for cooperation in virtual enterprise. Potential partners will be compared with each other based on a set of metrics, which will be assigned for each of the selected processes.

Metric is chosen according to actual needs and the importance of the process. There are cost evaluation metrics, quality, time, flexibility. For the hard quantifiable metrics there is used evaluate scale. Then is assigned an importance for each of metric, which is helpful for the evaluation of the process. It is expressed as a percentage improvement of the potential partners' results. So they are compared results of the potential partner with results of the initiator. The aim is to find a partner that achieves the best results according to selected metrics. The best results means if partner achieve the highest positive change. If all of the evaluate partners achieve only negative change compare with initiator, initiator is the most effectiveness in this part of the value chain.

The resulting criterion function has the following shape:

$$\Delta \text{value} = \text{importance} * \Delta \text{metric } 1 + \text{importance} * \Delta \text{metric } 2 + \dots + \text{importance} * \Delta \text{metric } n$$

$\Delta \text{value}$  express the sum of changes of evaluation results, whether positive or negative, according to chosen metrics. The potential partners (1...n) will be compared with the standard set by initiator.

#### VII. SETTING ENVIRONMENT FOR SHARING DATA

A virtual enterprise is to combine a group of users regardless of their geographical position but such a manner that it flows together and to provide the best performance. Another advantage of a virtual enterprise consists of administrative solutions which accompany the products, allowing users moving from one group to another through a simple reconfiguration of the equipment.

In order to properly operate a business networking, it is also necessary set up environment for sharing information across the entire value chain, where can individual processes realize more external partners. For cooperation in the virtual company

pays direct proportionality in the sense of complexity of cooperation.

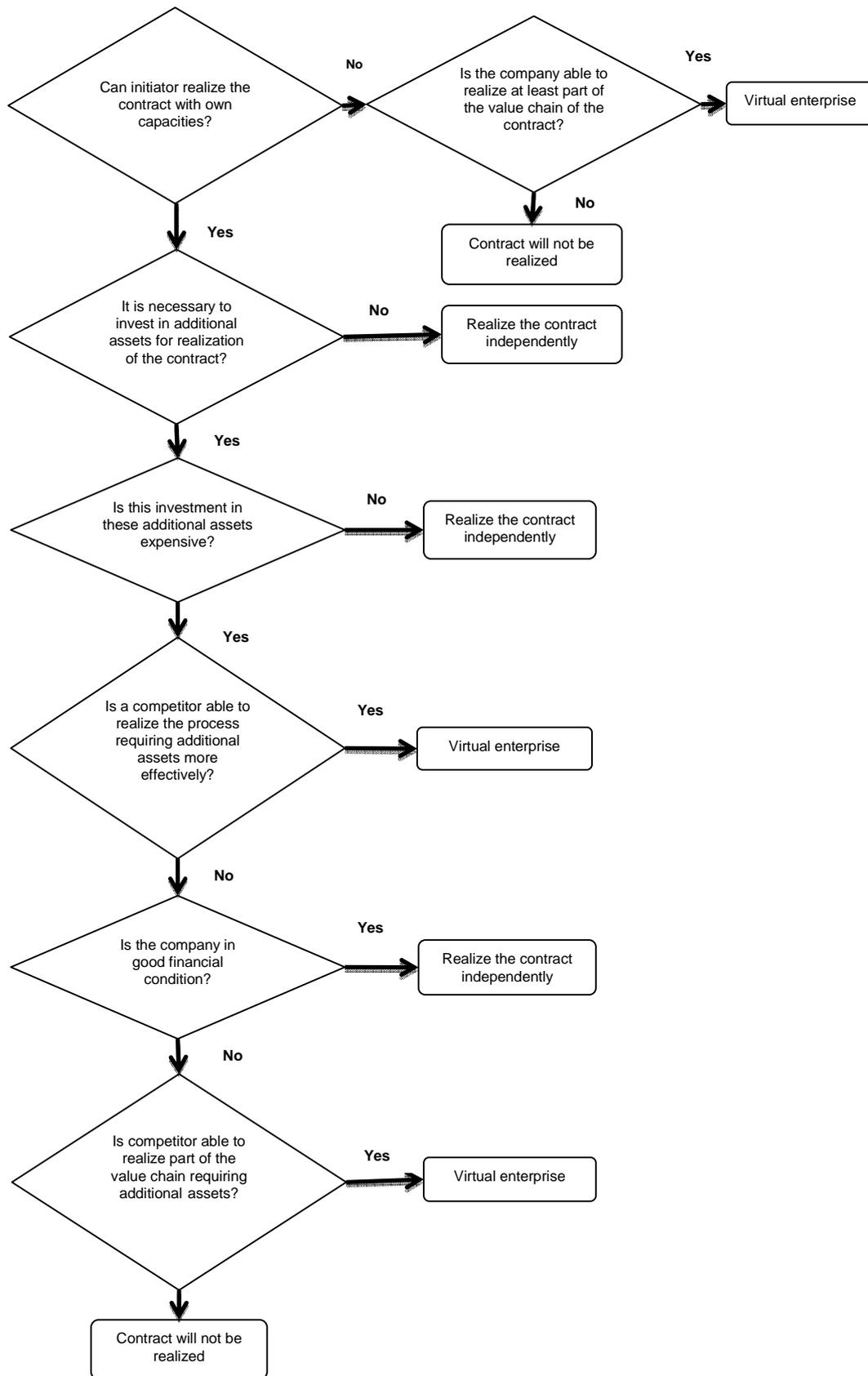


Fig. 5 The decision-making process of initiation of a virtual company

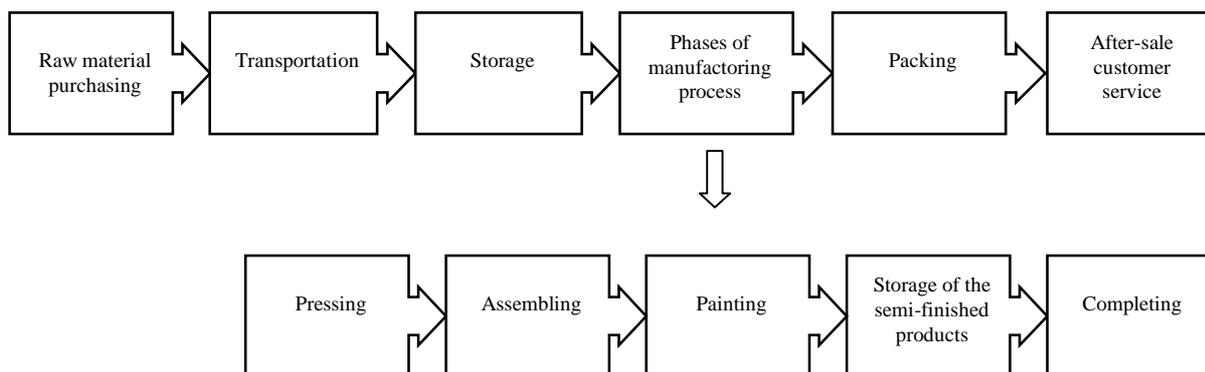


Fig. 6 Example of the virtual enterprise's value chain.

With the increasing number of involved partners also increase demands on the cooperation of all subjects, which it is necessary to expect during the preparation of the contract. Before the emergence of virtual enterprise it is necessary to expect that all the potential partners have their own rules for cooperation, as well as for sharing information. Cooperation of companies is defined on the level internal and external. Internal cooperation means that internal units cooperate with each other, such as various corporate departments. The second type of cooperation is the external, which is greatly influenced by the ability to communicate with the external environment. And it is this type of cooperation should be given high priority to address common interests in a virtual enterprise. Each company must be able to adapt their processes to work in a business network. One of the main problems is lack of access to sharing information.

#### A. Document Management System used in virtual enterprise

Nowadays of modern information systems can minimize the problems of inter-company communication through well-chosen information system for sharing critical information. Shared information must be stored in one place, to avoid creating duplicate information. It is therefore important that the initiator have set correctly document management system (Document Management System - DMS). Document management system is used for storing electronic documents, images, spreadsheets, etc.

It is necessary that all such documents were available for all partners, the DMS provides this assumption. Another important aspect is the ability to ensure the timeliness of the documents. So if happens that the document is not stored in one location with access to a given user, there can be chaos in working with these documents. Individual access rights to the relevant documents, folders and metadata can be set directly

through DMS. Through DMS can also set the synchronization of document versioning and history, because in practice often happen the necessity of multiple users working on one document at a time. In present time can be documents version through programs for working with documents such as MS Word, OpenOffice.org, etc. The cooperation of these programs with robust DMS can ensure proper processing of documents across a virtual enterprise. Another advantage of deploying DMS is the possibility of traces the historical records by the metadata of each document or by directly searching the content of the document. DMS becomes a necessary part of a document management in a virtual enterprise.

#### VIII. DISCUSSION

The aim of this article was to define the process of initiation of a virtual enterprise emergence, including determination of necessary conditions for ensuring the sharing of data. For this purpose were asked managers of companies, who have experiences with the creation of virtual enterprises. With their help has been defined decision-making process of initiating of a virtual enterprise. For the initiator is important to know, which benefits and restrictions follow from the initiation of the virtual enterprise and what needs to ensure to operate virtual enterprise effectively. The entire process of creating of a virtual enterprise is very complex and complicated and this article focuses only on the part of the initiation of a virtual enterprise emergence. This article describes in detail the calculation of the cost of the contract under which the initiator of the virtual enterprise decides whether it is beneficial to create a virtual enterprise. This article also describes the setting for sharing data, which is an essential condition for the proper functioning of the business network.

## IX. CONCLUSION

The initiation process of emergence of a virtual enterprise, which is described in this article was verified in the real practice of enterprises in the form of interviews with managers of companies, which proves that the virtual enterprise, which is properly created, can be an instrument to increase the competitiveness of not only the initiator but also other involved partners.

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