New Method for Modeling and Operating of the Virtual Enterprises

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Much research has been conducted to define what a virtual enterprise (VE) actually is and how it should work. This paper addresses the more specific question, how a virtual enterprise can be designed to be agile and to so best support short-term business opportunities.
The cases on virtual enterprises studied in this research suggest that in order to adequately respond to a temporary window of opportunity in the market, engineering and implementation competencies cannot be created for the occasion but need to be preinstalled and on standby. Thus, each research study conducted in this sense has tried to ascertain a set of methods and tools to select partners, reengineer business and logistic processes and to set up an information and communication platform for the virtual enterprise.
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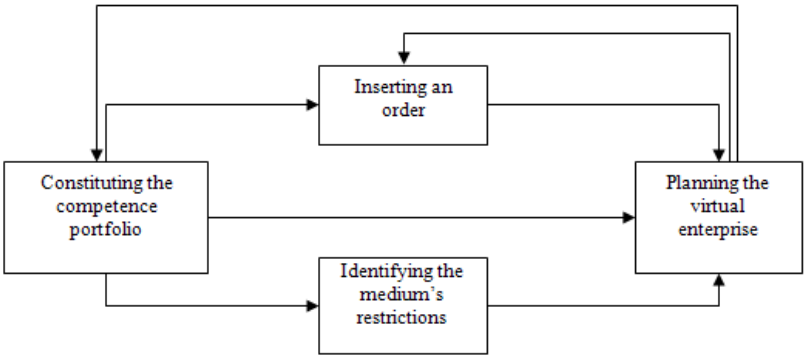
Current methods of modeling and operating

This paper focuses on modeling approaches and their applicability to capture and structure organizing tasks in VEs. There are numerous existing enterprise modeling approaches and definitions for reference models that support the full range of needs from strategic business management to organizational design, Enterprise Software implementation and software development. An example of a general management model is the St. Gallen Management Model, examples for organizational process development is Value System Designer while GERAM and related initiatives address enterprise integration and system design/enactment. Rosettanet, for example has been defined as a standard for technical system collaboration.
The St. Gallen Management Model structures the enterprise into different important elements which can be grouped into general categories of parameters: strategy, structure, and culture. The purpose is to understand the enterprise and its behavior better through observing, describing and analyzing it according to this structure. Every firm would be a specific combination of the different elements, which could be described verbally or through different diagrams.
The Value System Designer's main application is designing the processes for new businesses such as in virtual organizations and for business process engineering. Reference models according to this approach are blueprints for business processes, which depict their generic elements without the features of the individual firm.
GERAM provides a description of all the elements recommended in enterprise engineering and integration and thereby sets the standard for the collection of tools and methods from which any enterprise would benefit to more successfully initial integration design, and the change processes which may occur during the enterprise operational lifetime. It does not impose any particular set of tools or methods, but defines the criteria to be satisfied by any set of selected tools and methods. GERAM views enterprise models as an essential component of enterprise engineering and integration; this includes various formal forms of design descriptions utilized in the course of design.
Rosettanet covers business-to-business e-business processes within the information technology, electronic components, and semiconductor manufacturing industries. Rosettanet's main deliverables are definitions for so called partner interface processes (PIP). These PIPs cover many different areas from transactions to administration, joint forecasting or quality management. PIPs standardize only the data exchange between different companies, they do not provide any models for company internal processes, or even on

ways how the often rather rich information exchanged can best be used internally.
By analyzing the afore mentioned methods it can be assumed that the process of forming an enterprise that is able to react quickly to market demands as well as the immediate coordination of a number of partners requires not only flexibility but also predefined rules and roles. Therefore, recent research has shown that the quick formation of such VEs requires some kind of stable platform called "breeding environment". Its purpose is to assure the preparedness of companies to form a VE whenever a business need occurs.
By starting from the previous hypothesis and considering that the virtual organizations have the following characteristics: boundary crossing; complementary core competencies; geographical dispersion; changing participants and participant equality; I have come up with a new methodology of model making and operating for the virtual enterprises, one which would allow the application of optimizing algorithms to their structure.

A new perspective

The method that I further describe is constituted of four interdependent stages (see the following diagram) and deals with three distinct categories of elements influencing the virtual enterprise, which will represent the ground for the future optimization mechanism.



Generalizing, we can say that the structure of a virtual enterprise depends on internal factors related to the communion of agents involved, on external factors related to the operational medium, as well as on the characteristics of the market opportunities that we wish to speculate.
Constituting the competence portfolio represents the first stage. When organizing the partner team we shall first of all consider the functional domains which are necessary to achieve our projected goals. Once we have identified the partners who shall constitute the source network, we have to outline the medium in which we wish it to operate, as well as their positioning. Positioning does not mean, in this case, their geographical localization, but their placement in the operational medium when related to the factors which have contributed to the medium's delimitation. When applying this method, all the limits of the operational medium (utterly important to the efficiency of virtual enterprises) shall be identified, along with the possible obstacles in the partner relations.
The configuration of virtual enterprises requires the temporary, yet coherent and efficient joining of the abilities of the partners co-opted in the source network, in order to obtain the final outcome while best observing the performance criteria. This determines us to identify the competences of the agents involved and to properly evaluate them, taking into account the projected goals. Therefore, tracing an evaluation grid for the available competences is necessary, in order to see which ones best fit within the structure of the virtual enterprise. At the same time tracing a representative common grid shall be considered impossible, and the grids to be drawn shall be specific to each functional domain, being structured on one or more performance

criteria.
By concluding this stage we shall consider that there have been identified all constituent elements of the platform whereon future virtual enterprises shall be configured and that we have built the general competence portfolio for the entire source network.
The second stage consists of the identification of medium restrictions because the source network's performances are not conditioned solely by partners' competence performances, but also by the restrictions the medium wherein they shall operate imposes. Thus we are presented with the necessity to determine the limits of cooperation between the agents, while observing the purpose of the source network.
The partners' possibility to exert the competences is affected by the restrictions, which makes their impact analysis a necessity for each competence of the source network portfolio, when related to the other competences.
While considering the goals set out by the source network and then the operational medium wherein it shall work, we shall determine all the categories of restrictions to be taken into account and we shall decide the way in which they shall influence the final outcome. For each restriction we shall have to know the elements it influences, the extent to which it achieves that and its way to manifest.
The third stage consists of the identification of the opportunities/demands temporarily present on the market and their transmission to the source network in the form of orders. For it to be properly assimilated, such an order must specify the following:
- categories of competences necessary to achieve the output;
- the minimal requirements for the output's performance;
- the output's competitiveness criteria.

Considering the volume of information specific to such an order, as well as the necessity of its correlation to the particulars of the source network, the setting of an expressing mechanism is required.
At the end of this stage it is compulsory to have clearly delimited the categories of competences necessary to achieve the output, while the two sets of requirements shall be more or less present and complex depending on the situation, directly proportional to the complexity of the required output.
The fourth stage consists of the planification of the virtual enterprise. By now it is safe to say we hold all the data and we have to present them in an accessible manner so that the hypotheses and the problems can be distinguished.
The hypothesis is constituted of the competence portfolio provided by the source network, along with the medium restrictions. The competence portfolio shall be considered the amount of internal factors that influence the virtual enterprise's configuration process, while the medium restrictions shall be considered external influence factors.
The problem shall be the request/order addressed to the source network. This lets us know „what is wanted", „in what conditions" and „at what competitiveness level".
In other words, the structure of the virtual enterprise, in terms of solution to this problem, must simultaneously meet the following criteria:
- to limit at the source network's performances;
- to observe the restrictions imposed by the operational medium;
- to provide a positive answer to the broker's request;
- to observe the minimal performance requirements;
- to provide the partners with the optimal benefit, in the given circumstances.

The best solution shall be made of a number of competences which provide (by their amount) the greatest efficiency in relation to the aimed competitiveness criteria. These (while observing the order of optimal values) completely meet the competence requirement to carry out the request, directly interacting and providing the highest performance level when compared to the collaboration restrictions that influences them. At the same time, the output provided by the present configuration observes the minimal performance requirements the client demanded. The compe-

tences identified in the optimal solution represent the constituent elements of the virtual enterprise's structure.

It is possible that the optimization mechanism of the virtual enterprise's structure does not provide any solution for some orders, the causes leading to such a situation being: dysfunctionalities of the competence portfolio, aspects related to the quality of order expression or cases wherein both causes combine. Therefore we must consider two distinct mechanisms for the regulation of the conditions that are the bedrock of optimizing the configuration of a virtual enterprise.

The first mechanism implies the application of certain adjustments to the performance portfolio by supplementing the amount of competences according to the requirement or by developing the performance levels that the partners offer.

The second mechanism is the direct concern of the one in charge with identifying the opportunities present on the market, which – in most cases – is the same with the broker, because either the level of the minimal requirements' performance set in the request to the source network surpasses the possibilities of the source network or the required competence categories are incomplete (or incorrect).

Both mechanisms are meant to provide various optimization conditions for the virtual enterprise's configuration. Their impact is differentiated and acts on various categories of influence factors, which makes a mixed solution in the remodeling of the virtual enterprise's constituent conditions a preferable option, when analyzing complex requests.

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