

The Continuous Enterprise View Model (CEVM) for Virtual Enterprises

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Abstract

The virtual enterprise (VE) that is the collaborative partnership to increase competitiveness, to optimize resource utilization and to take advantages of the complementary capabilities of the business partners, have a shorter lifespan to be succeeded. The goal of this paper is to present a new modelling framework, which is focused on the agility and the effectiveness of the virtual enterprise models, for the virtual enterprise. This framework is used for designing the business components and the collaborative business processes across the life-cycle of the virtual enterprise. This framework also facilitates the selection of the partners for the virtual enterprises.

Keywords: Enterprise Modelling, Virtual Enterprise, Enterprise Models.

1. Introduction

Today, enterprises are facing the rapidly changing business environment and can not make predictable long term provisions, because of the turbulent market conditions, disorder of the working conditions, rapid technological innovations and so on. In order to be competitive, enterprises must show enough flexibility to adapt rapidly to changing environment conditions, enough know-how to manufacture advanced products and enough resources to compete globally. They must continuously revise their operations and cooperate with each other. Since its introduction, the concept of a virtual enterprise and enterprise modelling has received a lot of interest in the manufacturing community.

However, the challenge in a virtual enterprise is how to present business structures rapidly for all members of the virtual enterprise. This paper takes advantage of enterprise modelling and examines the issues of modelling of partner enterprises in the virtual enterprise. The proposed modelling framework describe how enterprise modelling can be used to support modelling of VEs in the various phases of their lifecycles and prove a rapid and effective modelling method for VE.

The rest of this paper is organized as follows: Section 2 reviews the enterprise modelling and Section 3 describes an overview of the virtual enterprise and the virtual enterprise modelling. In Section 4, we introduce our modelling framework for

virtual enterprise. Finally, Section 5 provides some conclusions and gives some suggestions for future work.

2. Enterprise Modelling

The term enterprise modelling is a collective name for the “use of models in enterprise engineering and enterprise operation”. A model in this sense is any construct, on paper, in the computer, or in any other medium, which shares some important properties with e real or contemplated system that is being modelled [1].

In the other definition, an enterprise model is defined as a representation of a perception of an enterprise. It can be made of several sub models including (but not limited to) process models, data models, resource models, and organization models. The content of an enterprise model is whatever the enterprise considers important for its operations [2].

Gruninger [3] defines an Enterprise Model as a computational representation of the structure, processes, information, resources, goals and constraints of a business, government activity, and other organizational system.

In the literature, we can find a lot of definitions of the enterprise model or enterprise modelling. Common focus of these definitions is the aim of enterprise modelling. The aim of enterprise modelling is to provide [4]:

- A better understanding of the enterprise structure and operations (i.e. to visualize enterprise knowledge),
- Support for enterprise engineering of existing or new parts of the enterprise both in terms of analysis, simulation, and decision-making; and
- A model used to control and monitor enterprise operations.

Enterprise modelling has long been used to understand and represent traditional enterprises and their behaviours, [2] and [5]. Especially, enterprise models have played a central role in the design of enterprises and the management of the business processes of enterprises. With advances in distributed information technology and the ever-changing needs of the global business environment, enterprises have been challenged to adopt agile and flexible organization models to be able to adapt to the dynamic business environment. Enterprise modelling has become a significant part of supporting enterprises' success in such an environment. While enterprise modelling plays a significant role in traditional enterprises, its role becomes even more important in virtual enterprises [6].

3. Virtual Enterprise and VE Modelling

The virtual enterprise (VE), which is in general the collaborative partnership between partners in value chains, has become a key factor for survival in the competitive business environment. The VE is designed to increase competitiveness, to optimize resource utilization, to increase scale of the business, and to take advantages of the complementary capabilities of the business partners [7].

As any enterprise, a virtual enterprise must have a clear goal and a clear mission [8]. The VE can be described as an entity that has a goal or a set of goals that need to be achieved. So, the mission of the VE must be defined in the any modelling effort.

Virtual enterprising is a process through which enterprises are grouping their capabilities, counting on their ability to define multiple cross-operational teams [6]. The main objective of a VE is to allow a number of organisations to rapidly develop a common working environment; hence managing a collection of resources provided by the participating organisations toward the attainment of some common goals. Because each partner brings a

strength or core competence to the consortium, the success of the project depends on all co-operating as a single unit [9]. Because the enterprise modelling is the only way of the understanding the partner enterprises, it is so important for the VEs. The enterprise modelling reveals the VE capabilities and abilities through the modelling of the structures of the enterprise such as strategy, customer, process, knowledge, resources etc.

The life cycle of a VE starts when one or more of the partner companies see business opportunities and request the other companies in the business network to join the virtual enterprise. To support the management of the life cycle of a virtual enterprise, the partner companies are not only required to provide resources and equipment for their part of the business, they are also required to bring along knowledge and technologies that are appropriate to the virtual enterprise [10].

A very simplified lifecycle of a VE can be assumed to have the main phases: design, formation and operation [6]. In the design base, VE model is created which consists of the goals and the mission of the VE. The modelling and the selection of partners for a VE is the main activity of the formation phase. Once the VE is formed, the operation phase is performed by the partner enterprises. The proposed model provides corresponding models for the each of the life cycle phases of the VE.

Due to the dynamic and flexible nature of the virtual enterprises, there is a greater need to build models to help understand them and their evolution. Enterprise models provide the support that is required in the design and analysis of the virtual enterprises and the interactions within a virtual enterprise and they are powerful tools for analysing and understanding the flexible nature of the virtual enterprises [6]. An overview of approaches and techniques for modelling a VE is provided in [11]. One of the early examples of applying enterprise modelling to describe VEs is TOVE (Toronto Ontology for VEs), [12], where they defined a formal model to describe the goals, activities and other components of an enterprise. In the most of the studies, agent and multi-agent based approaches are used to model the VE [13,14]. Some of these studies consider restricted views (information, process and application views etc.) of the virtual enterprise [7]. The proposed framework covers more comprehensive views of the virtual enterprise than the previous studies.

4. CEVM for Virtual Enterprises

VE that is the collaborative partnership to increase competitiveness, to optimize resource utilization and to take advantages of the complementary capabilities of the business partners, have a shorter lifespan to be succeed. So they need to be formed as quickly as possible. Our modelling framework supports the establishing the VEs. This framework is used for designing the business components rapidly and effectively.

Initially, we established the enterprise modelling approach for any type of the enterprise. And as Vernadat [2, 4] emphasized, we agree that the enterprise modelling process must be continuous process. The most important problem of the enterprise modelling is that the enterprise model can not keep on the currency. The way to solve this problem is to make the enterprise modelling a continuous process. So, we proposed the continuous enterprise model and called it as Continuous Enterprise View Model (CEVM). The graphical representation of CEVM is presented in Fig.1.

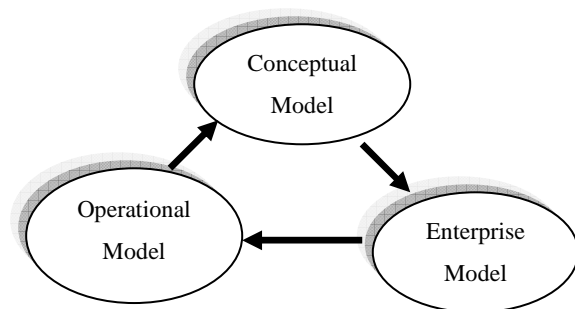


Fig. 1. Continuous Enterprise View Model-CEVM

In this paper, we consider the significant role of the enterprise modelling in the VEs and attempt to use the CEVM for the VEs. The CEVM provides the three sub models for the each of the life cycle phases of the VE (see Table 1).

Table 1

The VE's life cycle phases and the CEVM's sub models.

The VE's life cycle phases	The CEVM's sub_models
Design Phase	Conceptual Model
Formation Phase	Enterprise Model
Operation Phase	Operational Model

However, the general objective for companies is obviously to increase its market share and benefits. Participating to a VE project may help to reach this objective. A large variety of organisations can be set up according to the industrial option taken by the VE partners. These options are characterised by several strategic objectives [9]:

- Maximise flexibility and adaptability to environmental changes.
- Development of a pool of competencies and resources.
- Reaching a critical size to be in accordance with market constraints.
- Optimisation of the global supply chain.

But the key point of a VE project is customer demand. The variety of VE structure is originated by the different kind of demand and environment. It is possible to identify three groups of characteristics, which would mainly influence the kind of VE organisation [9]:

- a) Market characteristics.
- b) Production processes.
- c) Strategic objectives of the association.

The characteristics of these groups are tightly linked and each group can be seen as an aggregation of several parameters. Thus, we can not to be careless these three characteristic groups in the modelling framework of VEs.

So we considers these three characteristic groups as an important points for the virtual enterprise and propose the enterprise modelling framework which covers these characteristic groups through presenting market characteristics in the environment view, production process in the process view and strategic objectives in the strategy view and so on. Furthermore, the CEVM enterprise modelling framework provides the other aspects (product view, technology view, customer view,

knowledge view etc.) of the partner enterprises to understand them completely.

As Figure 2 presents CEVM Enterprise Modelling Framework extensively, CEVM consists of three models :

- Because of the VEs must have a clear goal and a clear mission, we must define a mission and a vision of the enterprises. Before the participating the virtual enterprise, the partner enterprises identify their mission and goals in the Conceptual Model. So they can see their situation and evaluate how they fit to the target virtual enterprise. In the other hand, the goals of the VE are also determined in the Conceptual Model.
- Enterprise Model includes strategy view, technology view, process view, product view, customer view, knowledge view, risk view, performance view, socio-economic view and environment view of the enterprises. Before the partner selection, every candidate enterprises should reveal their own pictures through these modelling views. These pictures are not only a basis for the partner selection but also constitute the whole model of the virtual enterprise. At the same time, the formation phase of the VE life-cycle is achieved.
- Operational Model covers constraints, resources, organizational and behaviour (relationships, rules, policies etc.) components of the enterprise. Once the enterprise is selected in the Enterprise Model, these components are modelled for each of these enterprises. Because these components are necessary for the operation of the VE. Through the Operational Model, the operation phase of the virtual enterprise life-cycle is accomplished.

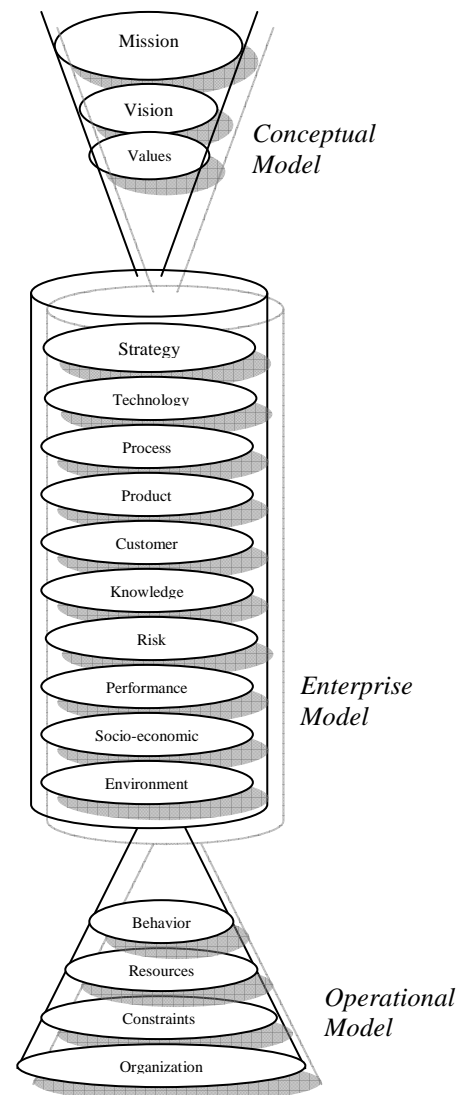


Figure 2. CEVM Enterprise Modelling Framework.

5. Discussion and Conclusion

This paper discusses the enterprise modelling and the role that enterprise model can play in the lifecycle of a VE. A VE can be described as an enterprise model during its life-cycle phases, which helps identify the skills and components requirements that must be met by the partners of the VE. In order to support the establishment of VE

model, the authors propose a kind of enterprise modelling framework. This modelling framework provides agile and effective environment for VE modelling during the lifecycle of a VE.

Although the modelling framework is developed in this paper, works are currently underway to enrich it further. The development of the modelling constructs and the partner selection process approach are the future works.

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