

26 A BRAZILIAN CASE OF VE COORDINATION

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The present paper describes the project VIRTEC, the first Brazilian Virtual Organization, which deals with nine technological SMEs from the region of São Carlos city. First, an analysis of the project and its steps is presented. Afterwards, an example of how the VE works within the VIRTEC is given, as well as, a discussion of the coordination aspects of the first VE formed by VIRTEC – the business opportunity of a recyclable hammer.

INTRODUCTION

Analyzing the Brazilian context of Small and Medium Enterprises (SMEs), many small high technology enterprises failed due to the lack of technical as well as management competencies. In general, Virtual Enterprises (VEs) and their form of organization based on cooperation can be assumed as adequate to fulfill these lacks and support the formation of high technology based enterprises (Eversheim et al., 1996).

Consequences of the striving for competitiveness, new paradigms that were inconceivable only a few years ago have been being defined. There are two clear trends within these new paradigms. In accordance with Reithofer & Näger (1997), the first trend is focused on new organizational structures for the enterprise, like Holonic Manufacturing, Bionic Manufacturing and Fractal Factories. The other one is driven for inter-enterprise relationships, globally or regionally distributed, what constitutes the goal of the present paper.

VEs are mainly based on the integration of competencies among independent enterprises, providing a product or a service, which could not be offered in time and with an attractive cost by none of the cooperation partners alone (Sieber, 1997). The proposal of forming VEs shows itself an advantage, because of their capability of quick market response, in a saturation environment, changing the manufacturing

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profile for a customer focused standard, instead of a producer one (Reithofer & Näger, 1997).

VEs may be formed within Virtual Organizations (VOs), which are then, a network of potential partners (enterprises) of a VE. A network may be considered a type of organization, which bears up as a basic project for the building of a social group. Within the context of enterprises, networks are stable or dynamic cooperations that aim the exploitation of market opportunities.

Therefore, a VO can be defined as a “stable network of enterprises, with the purpose of setting up VEs, where the partners are connected by their core competencies and market strategies. VEs are supported by Information Technology (IT). Although, the use of IT does not mean a key factor, but an enabler of performance enhancement within a cooperation” (Kocian & Scheer, 1996).

A VO can be then understood as a stable platform, where the enterprises share information about market and business opportunities. Keeping an opportunistic sense, the members of the VO use their previous cooperation for a quick set up of VEs, once the organizational structure already exists.

In this context, a project, called VIRTEC, has been created to develop a Brazilian Virtual Organization (Bremer et al., 1999), according to the framework for Global Virtual Business (GVB). The project deals with nine technological SMEs from the region of São Carlos city, and aims to deploy the VE concept in the Brazilian environment of SMEs.

Other researchers do not propose the existence of VOs as a pre-requisite for VEs. According to Goranson (1995), a VE is formed when an opportunity is identified, and a group of independent enterprises join themselves to exploit that opportunity. The task of a primary partner search is done by an enterprise, considered the project leader. A life cycle for this approach can be seen in Figure 1.

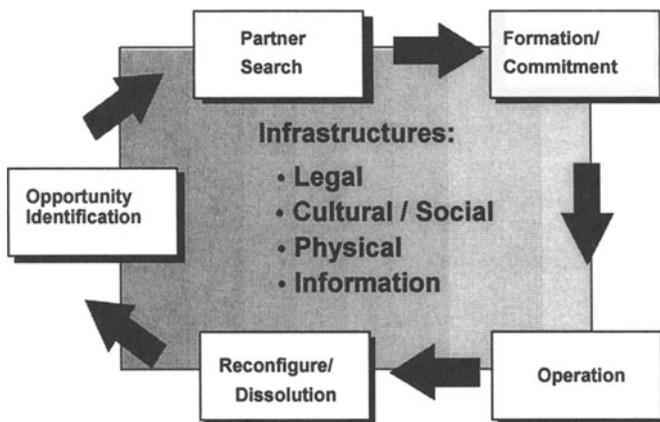


Figure 1 – The VE life cycle proposed by Goranson (1995)
Adapted from Goranson, 1995.

The AAMRC (Agile Aerospace Manufacturing Research Center) adopted its own reference model. Reid et al. (1996), a six step model, which does not request the figure of a Broker, neither the VO as well (Figure 2). The activities are performed always by means of processes from the partners of the VE, or by

processes shared among the partners, what depends on the objectives to be achieved and how they will be achieved.

The goal of this paper is to describe the coordination issues of a virtual business environment, the Virtec context. More specifically, it is related to the relevant aspects of VO and VE coordination.

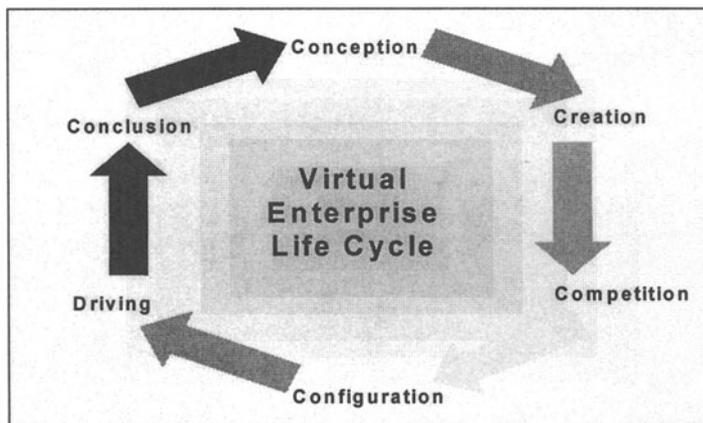


Figure 2 – The VE life cycle proposed by AAMR (1995)

Adapted from Reid et al., 1996.

VIRTEC PROJECT

The VIRTEC project started up at NUMA – Nucleus of Advanced Manufacturing (*Núcleo de Manufatura Avançada*) -, which is located inside the Engineering School of São Carlos, University of São Paulo, as the pioneer project of the first Brazilian VO.

The city of São Carlos has a very particular characteristic within the Brazilian academic environment, due to the two technical universities (University of São Paulo and Federal University of São Carlos) and one Agricultural Research Institute (EMBRAPA), recognized by their level of excellence in teaching and research. This characteristic allowed the creation of a wide range of high technological SMEs.

Despite of their capability on generating new ideas and products for the market, these technological SMEs from São Carlos face the lack in gaining space and projection within the globalized economy. There are already governmental entities that aim to support the bearing and consolidation of SMEs in Brazil, but there are not yet achieved results.

Looking for a complementary approach, the VIRTEC project aims the structuring of a common cooperation basis, where the members can find – within a trust culture environment – the necessary infrastructures for exploiting new business opportunities. The goal is to assume a global behavior not only in doing business, but also in performing their manufacturing processes.

The VIRTEC project accounts nine different SMEs, all of them from São Carlos, providing technological products and services, with high added value. These

enterprises act on areas such as electronics, metallic, ceramics and polymeric materials, mechanics, mechatronics, fluidic systems, applied software and services like exportation assessment.

In this context, it is important to notice how the companies within a VO will act. In order to understand this functioning, the VIRTEC project is based on a framework called Global Virtual Business (Bremer et al., 1999).

Framework for Global Virtual Business

The framework for Global Virtual Business was developed to explain how a Global Virtual Enterprise (GVE) is formed, run and dissolved (Bremer et al., 1999). The GVE can exploit the advantages of being global using local competencies.

This framework is constituted of three business entities: the Virtual Enterprise (VE), the Virtual Industry Cluster (VIC) and the Virtual Enterprise Broker (VEB). The VE are temporary networks of independent companies linked by information technology that share competencies, infrastructure and business processes, with the purpose to fulfil a specific market requirement (Byrne, 1993). According to (Eversheim et al., 1996), a VE may be formed within a VO, which is then a network of potential partners (enterprises). The VIC is an aggregation of companies from diverse industries, with well defined and focused competencies, with the purpose of gaining access to new markets and business opportunities by leveraging their resources. The VEB enables the creation of VEs through the use of the services provided by the VICs.

In the framework (Figure 3), the VE is created when an opportunity for business can be exploited by the VEB through the selection of the appropriate competencies from members of a VIC. A VEB will look for business opportunities around the world or will receive requests for specific products/services. In order to satisfy this demand, the VEB will search for partners in VICs for the best combination of competencies that, as a whole, will meet the customer requirements for a product or service. The success of the VE depends on the VEB abilities to ensure the integration of competencies and the co-operation among partners. Moreover, the VEB has to configure the adequate infrastructures (physical, information, legal and social/cultural) to support the operation/dissolution of the VE. Once a member of a VIC is selected it becomes a partner of the VE, according to the framework.

It is not necessary that a member of the VIC, or the VE partner contribute with a technical, shop floor or design competence. Business competencies, such as exportation/importation, and infra-structural competencies, such as videoconferencing expertise, are important as well as those mentioned above. In addition to this, the VEB has not necessarily to search for the required competencies only within one VIC, but within others VICs. This denotes, again, flexibility and quick response capability, primary issues for virtual enterprising.

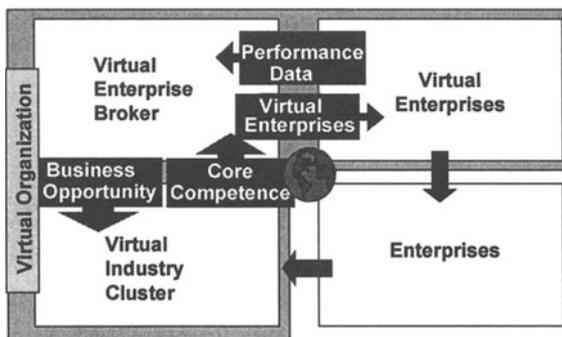


Figure 3 – Framework for Global Virtual Business

Adapted from Bremer et al., 1998

It is important to highlight that the Global Virtual Business Framework proposes the profit improvement of its members, by means of resources, processes and knowledge (skills) leveraging, and not by imposing to them the direction to be followed.

Another interesting issue to be considered is that not all the VO or VIC members will join into a VE. Only the necessary competencies will take part on it, and the profit - or losses - distribution will not be equally divided, but they must follow the individual commitment and investment of each partner, towards the several interests involved, like profit gain, marketing, knowledge improvement and development.

COORDINATION ASPECTS OF A VO

The main VIRTEC proposal, as it represents a VO, is to constitute VEs. In order to achieve this goal, a set of VO coordination aspects are being established. At the same time, as the project steps are being developed some others benefits are obtained from these coordination issues.

One of the most relevant and perceptible benefits derived from the VIRTEC is the marketing strategy. Through media exposure, such as an internet site and folders, the VIRTEC members gained a better visibility within the market as well as access to new customers. As a result, since VIRTEC was launched, there was an increase on the interest of the Brazilian technical media for the project, reflected by a series of published articles.

Moreover, as the university, represented by NUMA, has the coordination role within the project, a major integration between the academic and industrial environments was achieved. As examples, two academic courses are being offered to VIRTEC members with reduced costs and also, one of the VIRTEC members is having its business processes modeled and optimized without any extra charges (as a result of its adequacy to other NUMA project).

Also, by performing a simulation similar to a “game” - where each member has its Core Competencies (CCs) described and then, together, they try to aggregate some of them, as a whole, through a matrix of competencies – it is possible to pretend that a business opportunity (one of the viable aggregation of competencies)

is being explored by the enterprises involved in the game. As the game is being played, all the issues related to its coordination aspects are defined. The game's goal is to test the many situations, which might happen if a VE start to run. The result is an intensification of the non-formal cooperation capacity of the members, and a higher rate of know-how acquiring, by sharing ideas and concepts. Consequently, a better use of the enterprises competencies is obtained.

To provide a basis for the simulation, a set of processes is being defined and modeled within VIRTEC. The processes are classified according to the three entities described in the framework (the VIC, the VEB and the VE), providing a guide for VIRTEC members while acting in the VO or a VE.

Its important to notice that due to the different CCs of the VIRTEC members, it is necessary to provide information to support the VIRTEC managerial and operational processes, and to develop a common culture for the cluster. These tasks are being performed through different activities:

Profile description: each company of VIRTEC has a profile in terms of macro indicators, i.e., number of employees, annual income, company and mission. This profile intents to provide a portrait of the company, which may be used for long term and periodical comparisons;

Benchmarking: inside VIRTEC, associated companies may compete on the different existing competencies, i.e., it is perfectly possible to have two or more companies that are qualified in mechanical automation design or electronic instrumentation, but not on final products. These products must be different in order to motivate trust and cooperative work. SMEs also miss indicators to support decision making. Therefore, a benchmarking methodology is being applied within the companies, aiming to support the VEB decision making for a VE configuration and to provide means of continuous improvement for the VIRTEC members;

Cooperation capability evaluation: in terms of the cultural infrastructure, a serious problem is the capability of cooperative work. This includes not only a partnership relation, but also the exchange of information and ideas of new products, and the sharing of existing resources with the VE partners or others VO members. How fast a certain resource is allocated for a VE or how intense is the level of commitment in assigning these resources for the VE are important information to be evaluated. For such task, an analysis methodology was prepared and is being applied within the enterprises;

Core competencies identification: the enterprises CCs are processes, products or skills that ensure their potential and capability of keeping active in the market. A CC has a potential use, many times implicit, what decreases the chances of exploiting business in new market places through cooperation. In order to solve this problem, a methodology for identifying the CCs of the VIRTEC members is being created and applied.

As far as competencies are concerned, their handling and management relies on questions that need to be answered by the VEB, when a VE is being set up. For an example, how to match the required competencies (more then a single member may detain a specific competence), or how to allocate the competence for the VE.

In order to support the decision making in this specific case, an adequate approach for competence management is an information system, like Virtual Shop Floor (VISHOF) (Eversheim et al., 1997), to be implemented within the VO. The

VISHOF system is based on the Internet architecture, and its role is to store, manage and share information about shop floor resources in a specific region (Figure 4). Through VISHOF, the VIRTEC members can provide mutual assistance by selling non-used hours of their shop floor resources, like milling, grinding, and lather.

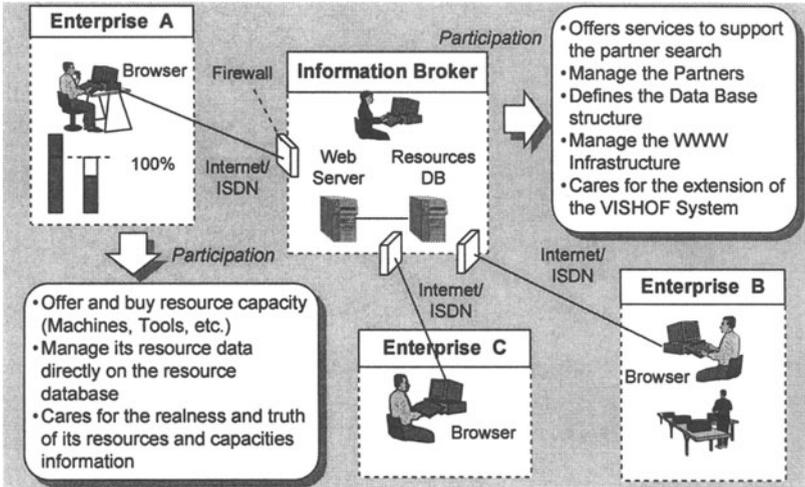


Figure 4 - The VISHOF concept
Adapted from Eversheim et al., 1997

In dealing with competencies development in VIRTEC, it becomes possible to extend the concept of VISHOF for products, business processes, and other types of competencies. It must be highlighted that even with VISHOF's concept expansion, a crucial problem is to provide not only means of integration and information sharing support, but means of understanding how the process of virtual enterprising works. This role was taken by the coordination aspects.

At this point it is important to notice that, as mentioned above, a VO must ensure the necessary infrastructures for its members. In this way, there are four different types of infrastructure to be implemented, as suggested by Goranson (1995):

Cultural: this infrastructure is based on a ethic code, which is considered as the rules of the VO and further VEs, as well as, regular and constant meetings among the members. Therefore, the role of the cultural infrastructure is to provide a basis for developing a trust culture within VIRTEC, and also the warranty of cooperation among the members.

Physical: this infrastructure encompasses processes that are governed by physical laws, like warehousing, logistics and equipment.

Legal: this infrastructure is also based on the ethic code. Specifically, the legal infrastructure aims to provide safety for the members, on issues like intellectual property, assets and profit sharing.

Information: it deals with the underlying means of communication and coordination used by the VO. The information infrastructure defines the standards and specifications for information technology tools networking and for the communication among its members.

These infrastructures can be divided in two types: the obligatory ones and the desired ones. Specifically, in the VIRTEC case, it was defined that the minimum requisites to its members, as they are SMEs, are e-mail (information infrastructure), telephone and fax (physical infrastructure) and the predisposition to cooperate (cultural infrastructure).

Once the members of a VO understand this process triggering, they will be able to perform integration with their partners competencies, through the actions of the VEB.

As an integration example, the first VE configured within VIRTEC is described below.

COORDINATION ASPECTS OF A VE EXAMPLE

As defined in the framework for Global Virtual Business, the VIRTEC project has the basic two entities to form VEs. The VIC is formed by the nine enterprises described above, and the research institute NUMA represents the VEB. These two entities working together form the VO, whose goal, as mentioned, is to perform VEs.

The VEs can be constituted in two ways: when a business opportunity is identified in the market to be explored – as described in the GVB framework, or when inside the cluster, some members create a business opportunity related to their competencies – as the first VE formed by the VIRTEC project.

Within the project steps, while all the members competencies were being identified and the marketing campaign was starting, a member came up with a potential business opportunity that he could not explore by himself.

Enterprise A, this VIRTEC member, has competence on polymeric rubbers and foams, specifically on biodegradable ones. As a result of several years of self-sponsored research, he had developed a type of vegetal polyurethane rubber. This rubber has several applications, like in mechanical assembling, finishing of goods, medical diagnosis, and so forth. Because of the characteristics of this material, it is possible to obtain several degrees of rigidity for the rubber, depending on the type of use. Considering this potential, the enterprise tried to develop a hammer totally made of vegetal polyurethane rubber.

However, the associated costs to the handle production and its non-satisfactory life cycle were determinant in searching for new solutions. As a result, enterprise A divulged the hammer opportunity during one of the VIRTEC meetings, among its members, in order to find another member with a competence required to develop a cheap, light-weight and recyclable handle for the hammer.

In this way, one of the members, enterprise B, found himself capable of contributing in the hammer development as its competence was recognized by all the others members as adequate. Enterprise B is a make-to-order producer of pieces in special stainless steel alloys.

As a result of this competence identification, a VE was formed by these two members to develop a recyclable polyurethane hammer, which should be cheaper, lighter and have a longer life cycle.

Enterprise A, as the major contributor of the product competencies, became the front-end representative to the client. As a consequence, all the warranties to the client are of enterprise A responsibility as well as the major profits or losses. Enterprise B responsibilities and benefits (or losses) are proportional to its contribution.

Nowadays, as the desired hammer characteristics were obtained, the hammer is being sold for the European Community and the United States. Moreover, because of its success, the enterprise A gained a better visibility within the market and access to new customers, which resulted in the sale of all its planned production for the following year.

Its important to notice that the NUMA role was crucial for the members integration within this first VE formed by VIRTEC. NUMA, in the VEB role, helped the enterprises A and B in various coordination aspects such as: how to establish the cooperation mechanisms, the legal points, the members commitment according to their responsibilities and the definition of profits/losses, all of which were based on the ethics code.

FINAL REMARKS

Once the VIRTEC project was proposed, there are different goals being achieved. As far as the coordination mechanisms are concerned, the game represents a good practice for the enterprises members in order to perform the integration of their competencies, and consequently, facilitate their cooperation on the exploitation of a future business opportunity. Moreover, it allows a better understanding of what competencies are and how these ones can be matched and worked out. In VIRTEC case, it was rapidly concluded that, once taking into account the existing competencies, there is an unlimited number of different VEs to be set up. The use of the competencies matrix represents a very low cost solution for VIRTEC, as it was associated only with labor costs.

The process modeling has a crucial importance in the game coordination, as well as in the members role within VIRTEC, providing the directions to be followed and the actions to be taken, not only in the VE level but in the VO as a whole.

Also, the benefit of a better exposure in the market, as a result of the marketing coordination aspects, is a common conquest among all the partners.

Finally, the feasibility of the approach described by the first VE formed within VIRTEC has proved itself efficient, as described by the sales return obtained by Enterprise A.

However, although all the coordination activities to make VIRTEC and its members suitable for the market are rigorously planned, the schedule is many times extended. Such fact may be assigned to the nature of the work of the SMEs owners, who usually centralize most of the managerial and creative processes. At this point, an important issue is learning how to work *virtually* through periodical meetings in order to allow a continuously accomplishment of the planned activities and the companies owners priorities.

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