



# APPLYING A CORE COMPETENCE APPROACH IN VIRTUAL ENTERPRISES FORMATION

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## Abstract

*The application of core competencies as a key driver of Virtual Enterprise formation has been recently studied in many research centres. This paper describes some methods to assess different aspects of core competencies in order to perform quick, feasible small and medium enterprise qualification to form one enterprise – Virtual Enterprise - to exploit business opportunities. A database and a matrix of competencies are presented showing benefits during the formation process. The main objective of this paper is to enhance core competence and its possible uses, and consequently point out a safe path to achieve successful result.*

**Key words:** Virtual Enterprise, Core Competence, Co-operation

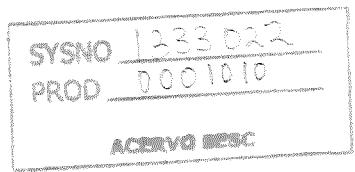
## 1. Introduction

In the recent years, many papers have been written describing an innovative way of organising enterprises with the objective to exploit business opportunities in a co-operative manner: the Virtual Enterprises. Many definitions and approaches of Virtual Enterprise can be found, however the following characteristics are common in the most of the papers:

- Enterprise Co-operation
- Distributed control and co-ordination
- Use of information technology
- Gathering of core competencies

While the three prime characteristics are well known, the latter still has a lack of concrete definition. Therefore, if the objective in a Virtual Enterprise is the gathering of the core competencies from different enterprises, then is necessary to know in advance all their existing competencies. However, if the enterprises barely know each other, or even do not know, there is a prior necessity to expose such competencies to each other.

In fact, is realised a lack of a stable definition about what are competencies and, mainly, a lack of a standard format to represent them. So those enterprises can search for and gather. The concept of competence is still steady in a strategic level, strongly surrounded by vagueness.



The gathering of core competencies is a requirement to achieve an agile Virtual Enterprise formation, but it is not standardised yet. Therefore, a critical area can be identified spoiling the success of the Virtual Enterprise (VE) organisational model.

This paper describes a model to be applied in virtual enterprise formation based on core competencies. It also describes practical results obtained within a Virtual Organisation, a stable network, which the primary aim according to its established processes is to facilitate virtual enterprise formation regularly, members of a virtual industry cluster. A Brazilian Virtual Organisation was formed gathering high technological small and medium enterprises in order to develop a consistent research field of co-operative environment. To develop this work, was fundamental to create a competence database. Primarily, the process of VE formation is described.

## 2. Virtual Enterprises

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 co-operation 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 profile for a customer focused standard, instead of a producer one (REITHOFER & NÄGER, 1997).

Analysing 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 organisation based on co-operation can be assumed as adequate to fulfil these lacks and support the formation of high technology based enterprises (EVERSHEIM et al., 1996).

According the *CO*-operation of Small and Medium Enterprise (COSME) model (BREMER et al., 1999), the adopted model in this paper, VEs are formed within Virtual Organisation (VO), which is usually made up of potential partners (enterprises) as an integrated network. VO members are elegised by a previous selection among regular enterprises from diverse industries defined commonly as a cluster. Cluster is a group of enterprises located in a determined region with extraordinary success in a specific industry segment (PORTER, 1998). In the COSME model this entity is called Virtual Industry Cluster. It is virtual because of the possibility to be expandable to other enterprises from different clusters.

The COSME model is constituted of three business entities: the Virtual Enterprise (VE), the Virtual Industry Cluster (VIC) and the Virtual Enterprise Broker (VEB). A VE is formed within a VO. The VEB enables the creation of VEs through the use of the services provided by the VICs.

In the framework 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 enterprise.

It is important to highlight that the COSME model 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.

Once the process of VE formation has been described, the next item will present a rough conceptualisation of core competence.

### 3. Core Competence Conceptualisation

Many models of viewing competence are being published in the last years by different authors, since HAMEL&PRAHALAD (1990) issued a article, whose title is "Core Competence of the Corporation", claiming that strategic planning process in the organisations should be started in an inside-out perspective. First, starts with internal analysis and then examines the external environment. Based on core competence, which their definition is " the collective learning in the organisation, especially how to co-ordinate diverse production skills and integrate multiple streams of technologies", the organisation has a very important tool to guide business and face external threats and improve internal flexibility.

TERHAAG et. al. (1996) define core competence as a competence which makes a substantial contribution to the uniqueness of the enterprise, and may be developed in two different ways. The first way is to define strategically important tasks, which guarantee the success or continued existence of the enterprise. The second way is to analyse the special skills and potentials of the enterprise and, then in a creative process determine and define promising future tasks.

TERHAAG et. al. (1996) still sustain that in literature core competencies can be defined following some set of criteria, which it must:

- give potential access to a broad spectrum of markets,
- contribute substantially to the advantages of the end product as perceived by the customers,
- be difficult for competitors to imitate.

Although core competence and its attributes can be defined, it is difficult for managers to include competence-based thinking in their managerial activities (DREJER&RIIS, 1999)

HAMEL&HEENE(1994) proposed a core competence classification according to three distinct levels: core meta-competence, core competence and constituent skills. Considering MOLINA&BREMER (1997) work, the concepts can be deployed in three levels.

- *Core meta-competence*: are in the highest abstraction level of competence. It contains emotional appeals, which normally an organisation is known. Such level of competence is tightly inserted in customer requirements perception;
- *Core competence*: is constituent skill aggregation output. This level is a link between core meta-competence and constituent skills. It may not necessarily

generate customer requirement perception, however it can lead the organisation to the competitive advantage by internal gains.

- *Constituent Skills*: are the basic capabilities that form competencies of the organisations. The product, process and technologies are considered constituent skills.

The first two levels of the classification, core meta-competence e core competence, have a high degree of abstraction, and they can not be used to identify what or for what an organisation may contribute in a virtual enterprise.

The level of constituent skills is the best contributor to the competence's trade-off, due to its role as competence bricks. This level may be used in integration of VEs, because of its explicitly characteristic of being represented by products, process and technologies.

The constituent skills are classified in:

- *Product*: A product is considered a process output. The adequate representation chosen in this work for product was defined by EVERSHHEIM et al. (1996). The dimensions of a product are the products as a whole, modules, components and elements.

- *Business process*: is considered a phenomenon that occurs within the enterprises. It contains a set of activities, associated to its information management, consuming enterprise resources and utilising organisational structure. Business process is cohesive unit and must be focused on a type of business, normally guided to a specific market/customer and with well-defined suppliers.(ROZENFELD, 1995);

- *Technology*: can be defined as “a set of knowledge that is applied to a determined sector of activity” FERREIRA (1975). TERHAAG et al.(1996) deployed technology in three types:

- *Human Skills*: Involves personal skills to accomplish technical and management tasks, and ability to manipulate various kinds of tools;
- *Organisational Practices* : represents practices and methods used by the organisation or the enterprise in order to execute its projects and process;
- *Facilities*: are the equipment used by the enterprise. It includes machines, computers, building, etc.

However, the level of detailing is not sufficient to assess technologies, especially human skills and organisation practices. Therefore, it will also be considered a typology proposed by ROZENFELD & SILVA (1998) to define technology:

- *Philosophies / Concept*: are employed to create theoretical and generic knowledge basis;
- *Techniques/Methods*: are structured in steps or related to something more specific;
- *Tools / Systems*: are often related to commercial products

After core competence conceptualisation, the methods developed to identify potential constituent skills, which are primarily used as brick of core competence, will be presented in a low level of detail due to their large extension.

#### 4. Method of potential constituent skills identification

The method was applied in order to identify potential constituent skills, which can be understood as raw material for core competence formation, and its prior objective is to provide the appropriate support to the product development process in virtual enterprises. As referred above constituent skill can be deployed in three different types: product, process and technology. Each type has a specific method developed to assess the regular enterprise before virtual enterprise formation.

The method developed for assessing product as potential constituent skill is divided in three interrelated parts. To cover the enterprise's inside view its portfolio is identified by product definition and manufacturing typology. The next part collects data from market perspective of each product, mainly concerning market share and growth. The first two parts are made up of open questions simply elaborated to scan products and its transforming process in detail. To identify product competitiveness, the part three uses weight factors to evaluate alternatives of pre-elaborated questions. In this case, the questions were elaborated strictly focusing on dynamic aspects of the product as flexibility and innovation, which are demanding characteristics for virtual enterprise success.

Spreadsheets are used to calculate the multiplication of the collected weight factors by product figures obtained from different criteria, e.g. Boston Consulting Group (BCG) approach, and percentiles. Analysing all outputs together a product can be identified as potential constituent skill.

Utilising weight factors as pondered data method all business process of a regular enterprise are assessed according to driven criteria with two different approaches external (market perspective) and internal (inside view), which are qualitative as well as quantitative. The business processes are picked from a previous list of all possible business processes by the interviewed, and then each business process chosen is given a weight factor regarding a particular criterion. After consider both external and internal perspective the final figures are calculated. If the final value represents more than final average output, then the business process can be considered as potential constituent skill.

As mentioned above in constituent skill description, technology can be classified in three different aspects. However technology also contains an abstract aspect to be considered as human skills, this method encompasses just the assessment of physical resources, e.g. machining equipment, and organisational practices. In order to measure technology evolution the regular enterprise needs to have its current status quo (physical resources and practices) and its respective criticality assessed, and in combination with the industrial segment technology average assessment the tool (spreadsheet calculator) applied by this method can identify technologies as potential constituent skills. The final result is depicted in a spider web chart to facilitate the visualisation and comprehension.

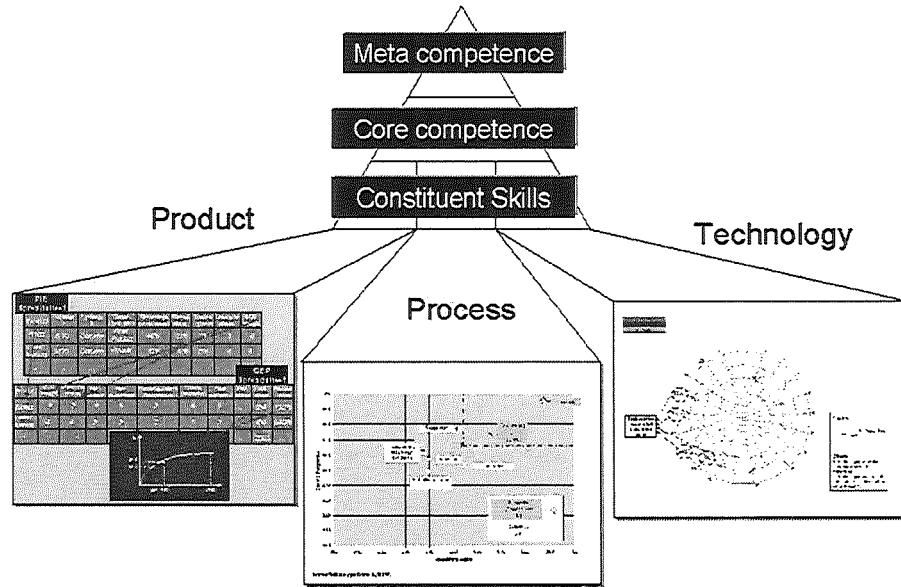


Figure 1 – Methods of evaluation of potential constituent skills

All methods had been developed while researchers catalysed the first Brazilian virtual organisation among small and medium enterprises to become virtual enterprise formation feasible. The respective research project (scientifically performed using action-research method) and a tool for competence matching are described as following:

## 5. Virtec as a practical scientific project

The *VIR*tual Organisation *TEChnology* (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 selected enterprise members act in different industry segments as for instance thermal plastic and special alloy casting.

After application of the methods of potential constituent skill identification in members of VIC, VEs formation needs to proceed rapidly to exploit any new business opportunities. Whereas at the first moment co-operation is mainly supported by a risen of trust among members, a former detailed map of core competencies should be built to enhance running performance. The core competence map is obtained combining potential constituent skills and has to be in accordance with opinion of the all VIC members.

A tool was designed to display core competencies from all VIC members. It was called matrix of competencies.

The importance of the perception of processes and resources as competencies, remains on the fact that it ensures the necessary flexibility the VEs require. Moreover, once the members have the capability of realising their resources and business processes as competencies that can be integrated, products with a high level of differentiation may be conceived and developed, as a result of competencies sharing.

Within the approach of BREMER et al. (1999), the search for new products has a complementary sense, in order to act as enabler of further VEs, which may create or attend business opportunities. A problem in conceiving and developing products is to provide clear and accessible basic information about the member's competencies. The importance of this is giving sense of "what can I do" and "what should I be able to do" within the VO (TERHAAG et al., 1996).

In the specific case of VIRTEC, there are enterprises of different industry segments, which in a certain manner, may act as a barrier of communication. Therefore, the key issue was finding out the potential co-operation that can be performed, by means of combining the competencies, and sharing ideas.

Primarily, an obstacle is how to put the idea on the paper, and make it clear for all the members. In the VIRTEC case, the adopted solution was a matrix of competencies. This matrix, is a 9x 9 one, where in the row and column are listed the VIRTEC enterprises and the identified core competencies.

As a result of such intensive work, several new products were conceived from the matrix of competencies.

It is important to notice that the matrix acts as a tool, which enables a better understanding for VIRTEC enterprises, of how to set up a VE with different competencies. However, if the number of enterprises increases, the visualisation of the competencies as a whole, becomes also increasingly worse. Either, the matrix does not represent an information system, which specifically deals with and matches competencies.

Aiming to store data of core competencies a Internet based system was implemented in VIRTEC, named VISHOF – *Virtual SHOp Floor* (EVERSHEIM et al., 1997). It was conceived to provide information about the availability of shop floor resources within VIRTEC.

Through VISHOF, the members of VIRTEC provide mutual assistance by selling non-used hours of their shop floor resources, like milling, grinding, and lather. This system can retrieve core competence information of the VIC members and support competence matching, therefore it may increase odds of succeeded product conceptions in the most of potential business opportunities.

After discussion based on combination of specifications extracted from the matrix of competencies, two products were identified as potential business opportunity. Products derived from the matrix of competencies

- One recyclable polyurethane hammer:
- One rubber damper

## 6. Conclusion

The identification of potential constituent skills for core competence definition and its consequent use may bring competitive advantage to the virtual enterprise formation process.

An efficient combination of the potential constituent skills identified by the proposed method may outline core competencies in a VE member.

In order to complement those methods, a matrix of competencies was practically developed to support decision-making of product conception process as an early stage of virtual enterprise formation. Indeed, in VIRTEC the use of matrix of competencies as well as VISHOF system database facilitated virtual enterprise formation resulting in eight succeeded products. As matrix of competencies contains core competencies combinations, it makes possible partially the gathering of core competencies.

The method presented in this paper can be considered an innovative attempt to identify core competence, however it requires improvement.

Formation process is another topic of research that continues to be studied due to a considerable lack of consistent knowledge.

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