Virtual Enterprises: Strengthening SMES Competitiveness via Flexible Businesses Alliances

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Abstract This chapter presents some results of the implementation of the Collaborative Networks / Virtual Enterprise approaches in a group of mold-maker SMEs in the South of Brazil as a means to enhance their competitiveness. Working in collaboration more formally and intensively with each other leverages SMEs to better handle variable, on-demand and larger customer requests, thanks to the larger scale and wider pool of competences that companies get when working together. Those approaches allow SMEs to share resources, knowledge, risks, costs and benefits. This article also stresses the main obstacles and issues that have to be dealt with when implementing this strategy as well as good practices from a number of equivalent examples all over the world.

1 Introduction

Small and Medium sized Enterprises (SMEs) have faced enormous difficulties to remain sustainable in today's highly globalized and increasingly competitive market. Demands from the market are more and more complex, unpredictable and instable, which requires higher and higher quality, innovation and efficiency on the one hand, and lower costs and shorter delivery times on the other (Dekkers and Luttervelt 2006).

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Several SMEs have invested in new equipment, in more qualified people, in better manufacturing methods and other "operational" measures to face that reality. However, studies have been showing that this is not enough, as they do not pave companies' strategic growth for longer-terms (Westphal et al. 2010). One of the reasons is that companies keep trying to work too individually in their businesses. As a result, they lose many opportunities due to their intrinsic limitations (Vallejos et al. 2007).

Strategic alliances are one of the directions that have been pointed out as a powerful strategy to cope with that reality (Porter 1998). Actually, most of SMEs use to have some partnerships. However, they are often established sporadically, with pre-defined and very well-known partners, for given and *a priori* known businesses. This method is not sufficient to fully address the challenges of the modern business environment. Many works have highlighted the competitiveness boosting benefits of SMEs in getting more involved in larger and dynamic alliances (Vallejos et al. 2007).

Working in alliances is not a new strategy. Porter (1998), for instance, has established foundations about clusters since the 1990s. Collaborative Networks represents a wider vision upon strategic alliances that are grounded on alliance and cooperation. It embraces clusters, supply chains and industrial districts, among other types of alliances. In spite of their values, they are limited in providing companies with another dimension of scalability, flexibility and agility to cope with market needs (Camarinha-Matos and Afsarmanesh 2005).

More recent types of alliances have been proposed and implemented to overcome those limitations. Regarding the purpose of this paper, two of them are of particular importance: *Virtual organization Breeding Environment* (VBE) and *Virtual Enterprise* (VE). They are in fact complementary to each other. In general, they leverage companies to have larger production scale and access to larger pools of competences that companies would likely never have if they worked alone. Thanks to the intense collaboration enabled via these alliances companies can share resources, knowledge, risks, costs and benefits. This all increases the significance as VBEs and VEs are by far mostly composed of SMEs, which are often very limited in terms of finance, human resources, knowledge and technology.

Nevertheless, working collaboratively and so being empowered to reach those mentioned competitive advantages, requires a deep change in SMEs' working mindsets. In this scenario collaboration becomes a fluid, seamless and integrated routine activity applied to almost all businesses, rather than occurring only on the exceptional basis. There are many obstacles and issues to be dealt with in making this working method routine.

This paper aims at describing a Case of implementing the VBE and VE concepts in the *Moldmakers Association*[1] as well as at presenting some of the achieved results. It was conducted essentially as an action-research, qualitative, applied and

[1] For privacy reasons a trading name has been used in this article.

mostly inductive investigation, mixing a strongly grounded review of literature, case study and participative methodological technical procedures.

This paper is organized as following. Section 1 introduces the main problem and motivation for the proposed approach. Section 2 describes the *Moldmakers Association*. Section 3 presents a brief explanation on Collaborative Networks. Section 4 depicts the general methodology used to prepare companies and to implement the VBE and VE concepts. Section 5 focuses on the business processes modelled to represent the entire VE life cycle as well as on the software prototype developed to help SMEs in managing their VE-related businesses. Section 6 discusses about the results and best practices related to the implementation of VBEs and VEs. Section 7 presents final considerations of this work.

2 The Moldmakers Association

Moldmakers Association is a Brazilian network of mold maker SMEs placed in the Joinville City, south of Brazil. These manufacturing companies supply molds and tools mostly to automotive, electro-electronics and home appliances industries, mainly from Brazil. It was established 20 years ago and its members are completely independent to each other, being some members competitors of one another. Since 2011 *Moldmakers* started an initiative to work under the VE strategy having two main strategic goals: enlarging business possibilities (via larger production capacity) and maximizing resources utilization.

In its daily business, *Moldmakers* is used to receive a "package" (a set of) of molds. In very general terms and applying the VE approach, when a given package is contracted, the most suitable *Moldmakers*' members are duly selected (from the VBE) to manufacture it and then a group is created. Therefore, these are the members of the VE related to this given package. After being selected, these members become responsible for a single or set of molds, part of it, or for some specific manufacturing operations. This strategy of "collaborative division and work" is also communicated to the involved customers, who then know which members are involved with which mold. Following the rules defined in each VE's governance model, partners can be replaced in the case of severe problems during the production of given molds or when their performance becomes too low. *Moldmakers* members' performance is continuously measured and managed.

3 Collaborative Networks

Collaborative Networks (CN) is a general concept that embraces the diverse manifestations of collaboration-grounded alliances among disparate organizations. This involves the structure, behavior and evolution dynamics of networks of autonomous entities that collaborate to better achieve common or compatible

goal (Camarinha-Matos and Afsarmanesh 2005). As mentioned in the introduction, the VBE and VE types were used as the main basis for this work.

A VBE (*Virtual organizations Breeding Environment*) consists of a long-term alliance of autonomous companies—mostly SMEs—which have the willingness and minimum level of preparedness to collaborate intensively with each other so to operate more efficiently together. It can include competing companies as well as companies and service providers from one or more sectors. Companies can be very heterogeneous and largely distributed and they can belong to other networks (Afsarmanesh et al. 2008).

The ultimate objective when establishing a VBE is to create a trustful basis to breed and to more quickly launch VEs to attend given business opportunities. Afsarmanesh et al. (2008) stresses some of the other benefits a VBE provides to its members, including for example certifications, sharing of costs and resources, common and standardized policies, and access to best practices.

A VBE has a governance model, bylaws and code of conduct (Romero et al. 2010) and may be legally established. A VBE member loses part of its autonomy (but not its independence) since it has to follow some globally agreed rules.

A VE (Virtual Enterprise) is a dynamic, temporary and logical aggregation of autonomous, heterogeneous and geographically dispersed enterprises that cooperate with each other to better handle a given demand. Its operation is achieved via a coordinated access over partners' competences, resources, information and knowledge, mostly enabled by computer networks. It allows companies to offer a group of services as if they were an only single organization, sharing risks, costs and benefits. Once a VE is created, it works as a collaborative *network* of companies (manufactures, logistic operators, services providers, etc.), each one having an explicitly and legally settled set of rights and duties, both to the own network and to the involved customer. A VE dismantles itself after finishing all its legal obligations (Rabelo et al. 2004).

Figure 1 illustrates a VBE and a given VE which would emerge from it to cope with a given business. The dashed line indicates that customers start conversations with a VBE (or with some of its members directly) and then with the formed VE once the business becomes an official request.

Lifecycles of both VBE and VE are shown in Fig. 2. They are independent from each other but deeply inter-related. The success of both implementations fundamentally depends on how their processes are properly deployed (Vallejos et al. 2007).

The VBE lifecycle is generally composed of seven main phases.

– *VBE Analysis & Design*: strategic discussions and decisions about how to implement the desired VBE, the steps, timing and required resources, taking into account existing conditions (of several natures) and strategic objectives. This phase also includes the design of VBE's architecture, namely its components, types of actors, roles and relationships, infrastructure requirements,

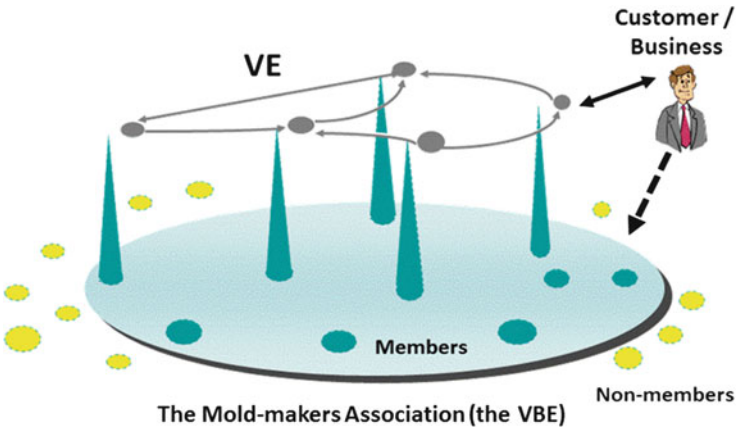

Fig. 1 The VBE and the VE creation

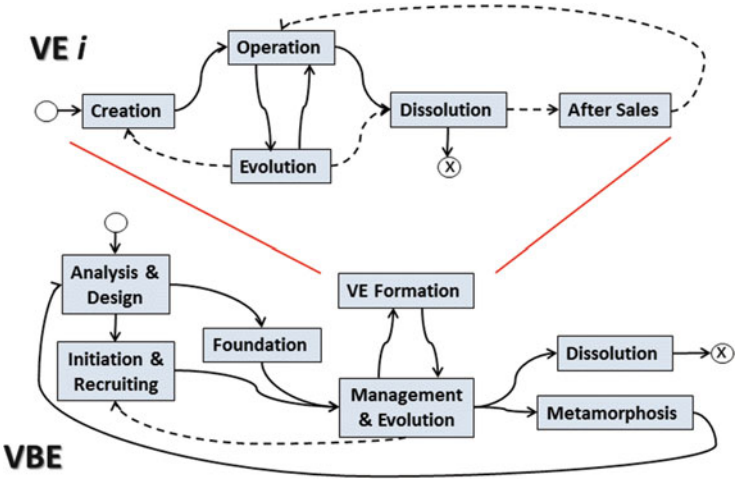

Fig. 2 The VE & VBE lifecycles. Source: Authors, adapted from Rabelo et al. (2014)

governance, operating and business models, bylaws, code of ethics, and mechanisms to attract members.

– *VBE Initiation & Recruiting*: the initiation phase refers to all legal preparations to launch the VBE and to be able to recruit members. Recruiting refers to advertising, selecting and transforming the approved companies into VBE members. Every company should be empowered with basic knowledge on how to work in a VBE, which includes many aspects, such as trust, governance and ICT infrastructure.

- *VBE Foundation*: this phase refers to the official VBE foundation. Depending on the deployment model, this can involve its legal establishment. Other actions may include hiring administrative staff, creation of visual identity, etc.
- *VBE Management & Evolution*: this includes management activities of the VBE and covers two levels: the implementation of the VBE itself and the management of the VBE's daily operations. VBE management acts more at the operational level (financial, organizational, technological, governance and personnel), including the performance and behavioral management of members, the inclusion and exclusion of members. VBE Evolution corresponds to tactical and strategic level management, coping with its sustainability. Actions to perform in this phase include handling changes in the VBE in terms of policies, marketing, customer relationship, governance rules and actors' roles, actors' feedback, business models, etc.
- *VE Formation*: the VE formation encompasses activities devoted to initiate new VEs once new collaboration opportunities are identified.
- *VBE Metamorphosis:* Occasionally the VBE's mission or profile should radically change as a consequence of a new strategic direction and of high impact internal or external factors which create the need for major changes in the VBE.
- *VBE Dissolution:* this phase refers to handling the closure of the VBE. A number of "drastic" factors can lead to this, such as the VBE's poor medium- to long-term outcomes or loss of commitment from crucial VBE actors.
- The VE lifecycle is generally composed of five main phases.
- *VE Creation*: it incorporates the activities to support the creation of a VE for a business. It includes issues like selection of the most suitable SMEs (based on a proper set of criteria), development of the governance model, setting up related performance indicators and metrics, identification of risks, setting up the VE as a project to be managed, contracts signature, and launching the VE.
- *VE Operation*: this refers to the daily VE operation management. It is constantly monitored to ensure the collaboration is on track, the involved processes are being correctly performed, and the performance metrics and SLAs are being fulfilled.
- *VE Evolution*: this handles the problems that happen during the VE Operation (e.g. inability of a partner to execute its task in time, the need to increase the workload, etc.). These problems usually lead to the addition, exclusion or replacement of a partner; changes in business' specifications and contracts; or even the business cancellation in very serious situations.
- *VE Dissolution*: this embraces activities involved with all the organizational, technical, financial, legal and regulatory aspects related to the VE ending. This can happen either when the associated business has been properly accomplished (i.e. VE partners delivered the service's solution as contracted) or when the VE did not succeed due to major problems.
- *VE After Sales*: this last phase involves processes related to, for example, maintenance, warranty, devolution and new extra services if the related business requires. This also refers to a set of concrete actions that VE partners should carry out after the "product" (in a broad sense) has been delivered (dissolution

phase), assuming that the VE has accomplished the business requirements successfully.

4 *Moldmakers* VBE Implementation Methodology

Implementing a VBE and creating VEs involve several aspects, which make this a complex and long process regarding the number of technical and non-technical aspects to embrace. Practice has shown the importance of applying a supporting methodology to decrease project complexity, costs, time and mainly, risks of failure (Romero et al. 2013).

In this work a methodology was developed, building upon two other works. The first one refers to ARCON (*A Reference Model for Collaborative Networks*). ARCON is a generic and abstract model used to understand and capture all the involved CNs entities and the relationship among them, both into the CN (the so-called *Endogenous* subspace) and between the CN and external elements and actors (*Exogenous* subspace) (Camarinha-Matos et al. 2008). Therefore, it is a model which allows the description of any kind of CN (e.g. VBEs and VE).

However, ARCON is an abstract representation, not being directly convertible into processes (i.e. in concrete steps through which a given VBE can be modeled and its processes defined). In order to tackle this issue, the work of Romero and Molina (2009) was used. It is a kind of generic representation of ARCON in the form of processes and their relationships, which are identified and modeled along the VBE and VE lifecycles.

In order to be ready applied, such reference model and processes should be *instantiated*. By instantiation it is meant the transformation of abstract concepts into real entities, i.e. instances, which in turn should be customized to a given particular case. In this sense, it can be said that the work being presented in this paper is an instantiation of Romero's model to the *Moldmakers* case and complemented with its deep characterization using the ARCON model structure and elements.

This section describes the methodology used in this work for deploying a *VBE* considering the *Moldmakers* case. The next section has the equivalent goal, but it is directed to the *VE* creation step of the whole methodology.

ARCON demands that the many aspects about the CN (that is going to be created) should be known in advance so as to serve as the input for deriving the particular model. In this sense, a set of preparatory actions had to be carried out to make a comprehensive analysis about the *Moldmakers* case. Such actions are actually related to the *VBE Analysis & Design* and part of the *VBE Initiation & Recruiting* phases (see Sect. 3). The following steps were executed (Baldo and Rabelo 2010):

1. *VBE Model Specification*: analysis and selection of the key-elements of *Moldmakers* that should be considered for implementing it as a VBE (Table 1).

Table 1 *Moldmakers* members' characteristics for preparedness assessment

Business process	Organization structure	Resources (human and ICT)	Organization culture	Market
– Production planning process – Production control process and data collection (for performance assessment) – Purchase process – Suppliers election process (enterprises and logistics operator) – Budget specification process – Raw material quotation process – Financial management process – Work power hire process – Third-part hire process and production control – Software acquisition, deployment and maintenance process	– Departments well-defined and structured – Functions and responsibilities defined – Low accumulation of functions per employee – Flexible structure and with few levels – Methodology for performance measurement and assessment well-defined and deployed	ICT – High utilization of ICT – Enterprise resource planning system – Internet resources – Internet utilization, systems via Web – Collaborative systems utilization (e-mail, chat skype, wflow, forum, etc.) – Enterprise website & Intranet service – CRM system – CAE/CAD/CAPP/CAM systems – Budget specification system – History record system – Systems for production control and data collection – Logistics system – Inventory management systems Human Resources – Qualified employees – Employees with good education (including other languages)	– Resource utilization optimization – Quality prioritization – Pro-activity – Standards and norms utilization – Partnership stimulation (interns and externs) – Process and conducts documentation – Group working – Creativity motivation – Employees satisfaction – Participation in events with other enterprises – Exchange enterprises with other enterprises – Sharing of information with service providers – Record of past experiences – Past knowledge utilization – Work with enterprises or customers from abroad	– Target market well-defined – Market strategy well-defined – Customer interaction (post-sales) – Post-sales – Product advertisement (Marketing) – Brand enrichment – Long-term planning – Co-creation of products (i.e. with customers)

(continued)

Table 1 (continued)

Business process	Organization structure	Resources (human and ICT)	Organization culture	Market
		– Employees adapted to work with technology – Employees with flexibility for changing Equipments – CNC machines – Industrial networks – Data collectors	– Participation in any type of strategic alliance	

2. *Assessment Characteristics Definition*: definition of the assessment elements that should be considered to evaluate the partners' preparedness level so as to better prepared to indeed be able to work as a VE. It considers the ARCON model's elements as well the analysis performed in Step 1. Table 1 shows part of the mentioned characterization of *Moldmakers* after Step 2.
3. *Preparedness Analysis*: assessment of the companies based on the elements defined in Step 2, identifying their weaknesses and strengths of the potential VBE members. It was done by applying questionnaires regarding the characteristics defined in Step 2.

   This questionnaire was composed of 45 questions related to and distributed over five categories: *business process, organizational structure, resources, organizational culture a*nd their *market/customers*. The questionnaires were distributed to six companies, selected by their own group as to better represent their variety in terms of size, organization and technology level. The responsible researcher for this task has assisted each manager in their filling. Answers were mapped using a *Likert Scale,* from 0 to 4, where 0 meant that the company basically didn´t support the given aspect or issue, and 4 that it strongly supported it. The questionnaire covered questions related to the aspects listed in Table 1.

   After analyzing all answers, the average value was 2.26 (2.28 for *business process,* 2.63 for *organizational structure,* 2.39 for *resources,* 2.15 for *organizational culture,* and 1.87 for *market)*. This global value was not considered good at all. Thus, *Moldmakers'* managers started to promote meetings with consultants to improve the most critical aspects and members, regarding their priorities and existing conditions.

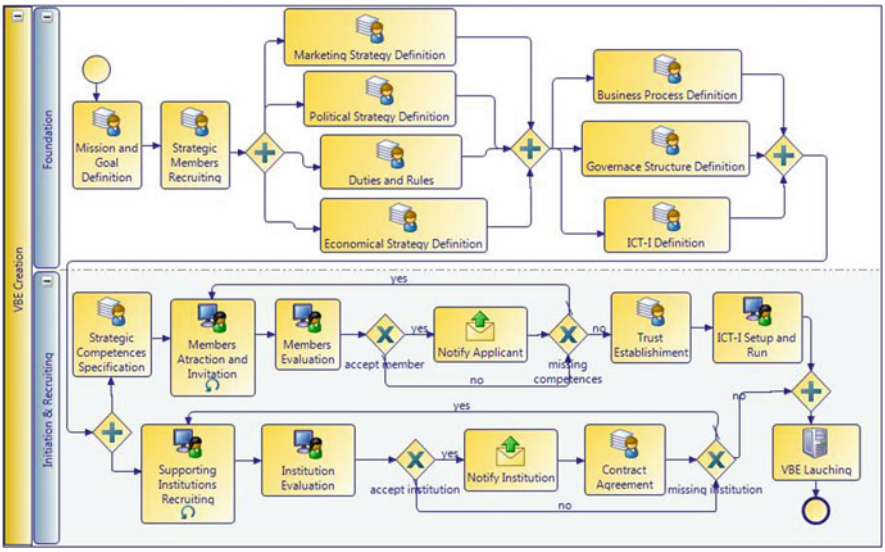

Fig. 3 *Moldmakers* implementation methodology; creation phase

4. *Implementation Methodology Specification*: this step refers to the definition of the actors, activities and all relationships related to these two elements taking into account the analysis done in Step 3. The underlying rationale of this step refers to the feasibility of the VBE implementation regarding members' preparedness, which is seen crucial for the successful creation of VBEs (Afsarmanesh et al. 2008). This step was carried out by instantiating the Romero's reference processes model for the *Moldmakers* case.

   Figure 3 shows part of this methodology instantiation, modeled using BPMN.[2] For conciseness the description of each process will be not be provided in this paper. It is assumed here that readers can have a rough idea about the processes by names, which are self-explanatory. Refer to Baldo and Rabelo (2010) for a detailed explanation. This instantiation is not a mere definition of "how to do" within every single reference process in each VBE lifecycle's phases. Instead, it involves a number of adaptations, new processes, the splitting of processes into subprocesses to deal with very specific issues of *Moldmakers* regarding its culture, working methods, decision-making points and general reality.

[2] BPMN—Business Process Modeling Notation language—http://www.bpmn.org/

5 *Moldmakers* VE Implementation Methodology

This section depicts some other phases of the VBE lifecycle, paying special attention to the VE creation and launching.

In the same way that it was done in the *VBE Analysis & Design* and *VBE Initiation & Recruiting* phases (Sect. 4), adaptations were also introduced in the VE reference processes to cope with the particularities of the case. Figure 4 shows the part of the conceived methodology related to the VBE management and VE creation phases. Again for conciseness it is not possible to explain the involved processes. They are described in more details in Baldo and Rabelo (2010).

The first task performed was the selection of a pilot group with eight members that were in charge of defining the VBE's mission and goals, marketing, political and economic strategies, and duties and rules. After that, they were involved with the definition of *business process, governance structure, performance indicators* and *ICT related issues*.

Concerning *business processes*, seven macro processes were designed covering the entire VE lifecycle. Each process comprises a set of steps expressing how the given process should be executed in the *Moldmakers* VBE. Figure 5 illustrates the modeling of one of those processes (*product testing*) within the *VE dissolution* phase.

Governance in networked enterprises can be defined as "the specification of rules, criteria for decision-making, responsibilities, and boundaries of actions and autonomy for the involved actors" (Roth et al. 2012). A governance model is

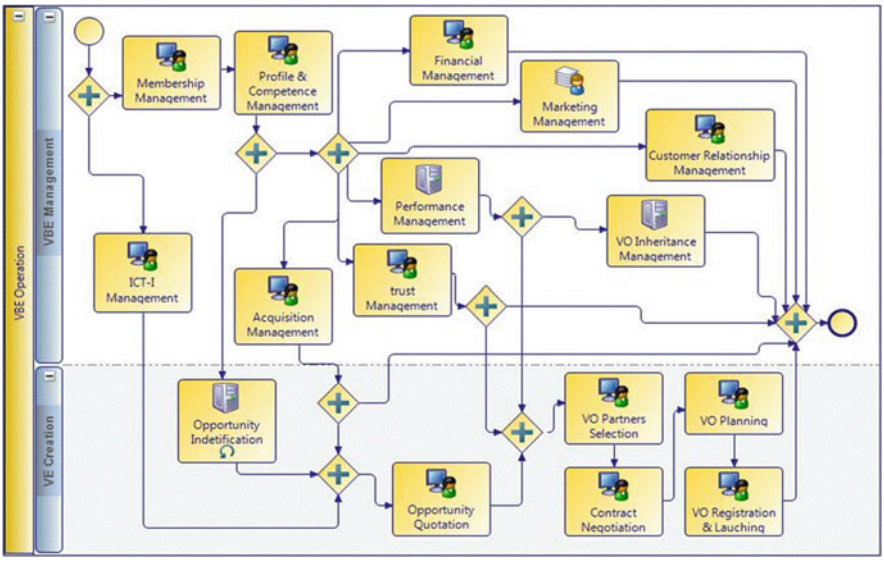

Fig. 4 *Moldmakers* implementation methodology; operation phase

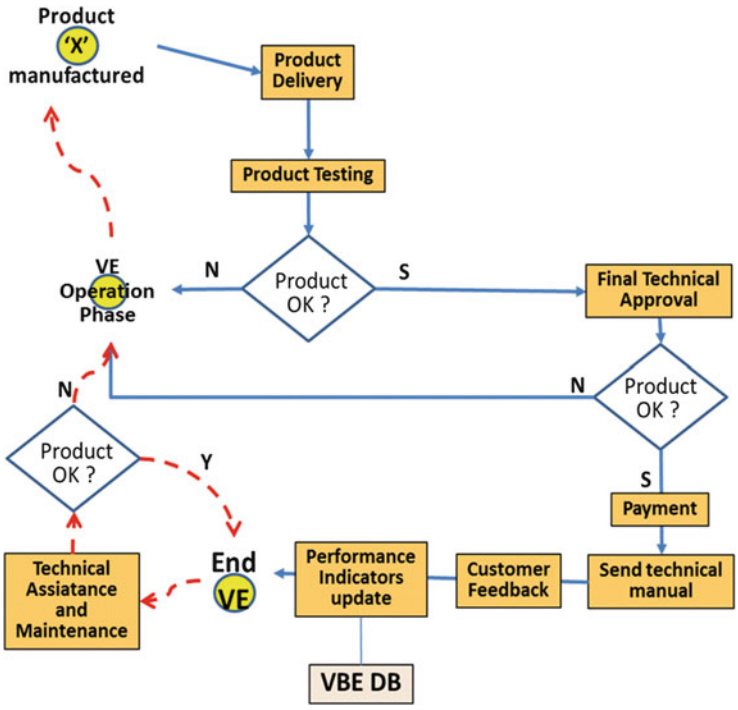

Fig. 5 *Moldmakers* VE dissolution process

fundamental for avoiding conflicts among partners, for speeding up decisions, and hence to mitigate VE failures.

A governance model for the *Moldmakers* VBE and VE were devised (Rabelo et al. 2014), comprising 54 rules to be followed by the different kinds of intra and inter-organizational identified actors that can be involved in each VE lifecycle phase's processes. Rules were expressed using the 5W2H technique (Koa 2013), mainly due to its clarity and simplicity to be understood, documented, consulted and maintained by SMEs. As such, all rules contain the following information and structure: *what* the rule specifies; *how* and *why* it is specified; *when* and *where* it is applied; *who* applies it and *how much* this is going to cost. A set of rules was designed to every single macro process (e.g. as the one showed in Fig. 5). Figure 6 shows an example of a rule to be applied in the VE creation phase when a given partner decides to subcontract another company to make a specific operation which any of the other members are capable of.

During the VE execution conflicts among partners often occur and they should be solved to guarantee the VE success. Considering that partners are geographically

What	Rule: Right – Supervision - Operational Remove a given mold from VE Member <i> when serious problems are in place.
Who	***Inter-organizational Actor:*** *Customer*
	Intra-organizational Actor: *VE Coordinator, VE member <i>*
Why	*A very serious technical or ethic problem happened related to a given package's mold produced by VE member <i>*
When	*When the customer consider that the way a given mold is being produced or was delivered by VE Member <i> is not correct regarding the specifications.*
Where	*Not applicable.*
How	*VE certifies the problem and notifies VE member <i> about the problem, grounded on the contract's clauses.*
How much	*According to the contract's clauses.*

Fig. 6 Example of the governance model's rule

dispersed, this can be helped by a web-based distributed decision support system, as the one developed by Drissen-Silva and Rabelo (2011).

Performance indicators have a critical role in a VBE and VE and should reflect operation and strategic goals. Partners are continuously evaluated as well selected to VEs through performance indicators. Following the implementation methodology and in order to define the list of such indicators, the main competences to be fulfilled by the VBE members were identified. This list is composed of 87 competences classified into the follow categories: *design, machining* and *injection*. All this was transformed into operation and strategic (KPI) indicators, which in turn were categorized into three levels: VBE level, VE level and organization level. The conception of the indicators has used the frameworks of Baldo et al. (2009) and Alves-Junior and Rabelo (2013), which in turn is based on SCOR.[3] Examples of indicators devised for *Moldmakers* generally include: increasing of orders fulfillment, decreasing of lead time, increasing of equipment utilization and increasing of customer satisfaction.

In terms of *ICT*, a system prototype was developed to support *some* of the designed VBE and VE processes and lifecycles. It has 42 functionalities (*use cases*). Figure 7 shows one of the several user interfaces provided by the system. It lists the Gantt diagram of one of the members of the VE identified as *VE Tower with 16 cavities*, where one of the package's molds is under responsibility of a given VE's member. Important to mention that this information can be accessed on-line by the respective customer as well as by the VE Coordinator according to what would have been specified in the contract and VE's governance model. Equivalent functionalities in the system allow companies' managers and VBE managers (if this is configured in the VBE's governance model) can go through the VEs already

[3] SCOR—The Supply Chain Operations Reference model http://www.apics.org/sites/apics-supply-chain-council/frameworks/scor

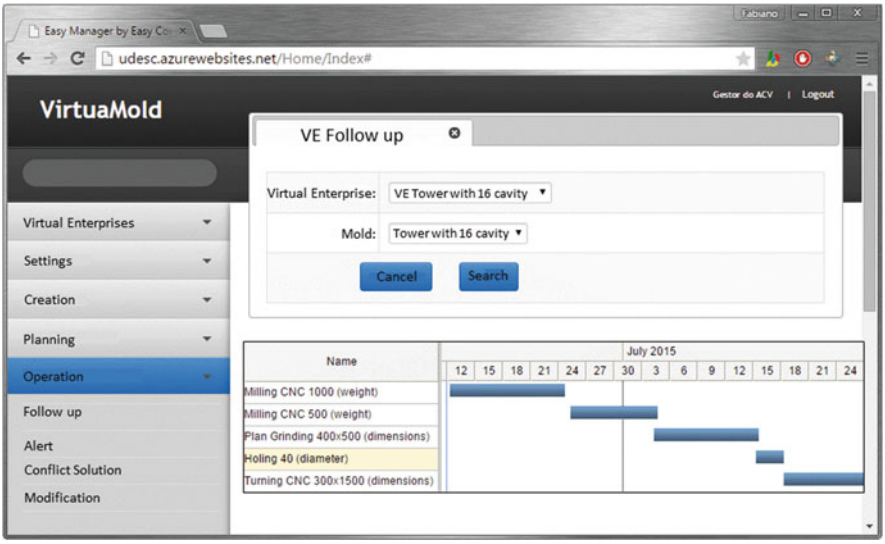

Fig. 7 A screenshot of the VBE & VE software prototype

created for e.g. historical purposes, performance comparisons, identification of common members, etc.

The ICT issue can become very complex in VBE and VE environments, especially due to the need of integrating and interoperating members' legacy systems to the VBE/VE high-level management systems. In Rabelo (2008) this issue is extensively analyzed.

6 General Assessment

This project is still ongoing. Reports have pointed out that some changes and effects of the implementation of the VBE and VE concepts in companies can only be perceived after many years; however, other results start appearing sooner.

In order to provide more useful and appropriate analysis (specifically on the *Moldmakers* case), a wider panorama of results is presented. It covers many initiatives on VBE and VE from many other cases and countries, and includes some of the already observed results of this case. Therefore, this can be seen as best practices and lessons learned on real VBE and VE implementations.

Three sources of information have been considered for best practices. The first one gathers results from the European ECOLEAD project[4] which studied nine VBE-like alliances, ending in 2008.

[4] http://ecolead.vtt.fi/

The second one joins the experiences of 18 VBE-like alliances collected from their presentations in the PRO-VE Conference (*IFIP Working Conference on Virtual Enterprises*) in the years of 2009, 2010 and 2011 (PRO-VE). The reports include 12 networks from Europe, 4 from Brazil, 2 from Mexico and 1 from Australia, which have been created over the last 15 years. Fifteen networks are composed of 7–30 SMEs, created with the core objective of joining efforts to gain some competitive advantage. Three networks were created within large companies with a focus on open innovation.

The third one considers *ad-hoc* readings of reports, blogs and conference papers that have analyzed VBE-like and VE-like alliances. It also included a special issue journal dedicated to describing the real implementations of VBE cases (Romero et al. 2013).

The analyzed networks are from the following sectors: engineering services and consultation, mold makers, lift industry, education, aerospace, textile, wine, construction, home appliances, traffic management, software, food and paper.

Implementing the VBE and VE concepts is complex, takes time and provokes many internal impacts in the involved companies during its implementation. Only with adequate methodologies the expected results can be achieved in way to solidly support the VBE evolution and sustainability. However, in spite of all these difficulties, SME managers have given some testimonies about VBE and VE implementation such as:

- *"We increased the closed deals in 30 % and the global VBE profit in 25 %";*
- *"The major challenge was building the trust among the members. However, having clear rules and governance mechanisms elaborated by all members helped to gradually create an environment with trust and greater collaboration";*
- *"The technological problem was the far less complex. The major problems were related to the change of the organizations' culture";*
- *"The level of interaction—even informal—among the members has increased immensely, which helped not only in the discussions about technical issues (e.g. in the exchange of experiences) but also in the trust building process";*
- *"The collaboration with competitors was less problematic in some cases, and it has even generated concrete synergy in certain businesses";*
- *"We have reduced the training cost in 35 % by creating larger groups with common interests";*
- *"All members have improved their general operational performance when their indicators were gradually exposed and compared one to another. However, there were cases where members left the VBE as they could not absorb the collaborative model at the expected level";*
- *"Some important results have showed up right in the first year of the VBE implementation, while other results only appeared about five years. Is it a gradual and continuous process of companies' improvement and collaboration reinforcement".*

In order to decrease the risks and to successfully implement a VBE and VE, the following main lessons can be highlighted in terms of being avoided or considered:

- Underestimation of cultural and trust problems.
- Overestimation of immediate business results and full collaboration operation;
- Network members cannot be just associates. They need to have a good and quite equivalent level of preparedness.
- There are few software applications in the market to support the additional collaborative business processes' requirements.
- Lack of commitment of all members. They both kept looking at their own businesses and didn't have an idea about what working collaboratively means.
- Lack of leadership within the network.
- Difficulty to have access to reliable information from different companies (and from their legacy systems) to the VE management and to further do benchmarking.
- Lack of longer-term and strategic plans for the VBE evolution.
- There are many new (collaborative) business processes to be added and/or modified.
- Changes should be implemented gradually as people become more used to collaborating, supporting methods (and ICTs) are prepared, and the processes are indeed understood and modeled.
- Lack of governance model, including power distribution, comprehensive decision-making and conflict-resolution actions, revenue practices and punishment rules. However, it is very difficult to reach a consensus on aspects like code of conduct, business policies, common methods, tools, norms and standards as well as the timing for their adoption.
- Governance model is not static and should evolve along with the VBE. However, some partners consider changes as inappropriate when they affect their companies.
- Difficult to set up the most adequate legal framework for VEs.
- Training people for collaboration is just the initial step. This should be permanently reinforced and managed.
- Difficulty of partners to share their best practices and their market "differential".

As an overview, when SMEs consider implementing Collaborative Networks (CN) model as a competitive strategy (and in more particular VBEs and VEs) to augment their competitiveness, it is important to have in mind that:

- CN is a still emerging area. More solid foundations and real case studies are required.
- Working as a CN is a strategic decision. There are pros and cons, risks and costs.
- CN implementation takes times. It is a long and gradual process.
- Working collaboratively should measurably prove its competitive advantages to its participants, including customers.
- Collaboration is difficult to put in practice and requires deep changes in people's working mindset.

- Most SMEs don't realize the potentials of CNs, but the ones that start first will be better prepared to "play" when the "near future" arrives.
- Additional processes and performance indicators are required to measure collaboration and its results.
- These processes are mostly automated, which requires adequate software tools and big system integration efforts, including with the other partners' systems.
- CN both leverages new business inside the network and helps SMEs to be better prepared to work with large companies in more profitable global value chains.

7 Conclusions and Management Implications

Working as a CN deeply impacts the way and the supporting conditions SMEs operate, including a higher level of organization, standardization, professionalism, systems integration, good practices and methods, processes modelling and auditing.

This paper presents current results of an ongoing project describing the process of transforming an existing small mold-maker cluster into a VBE and hence to support the creation of VEs out of it.

In this work a top-down approach to derive comprehensive instances of VBEs based on CNOs reference models has been applied. This standardized support facilitates further VBE scalability and evolution as the VBE model was conceptually created considering most of the aspects related to a generic and reference VBE model. The model and methodology are generic enough to be used as a guideline to transform classic industrial clusters into a VBE/VE.

The deployment of this methodology should consider the particularities and preparedness of the SMEs that are planned to be included in the VBE. The methodology's steps can present different levels of complexity depending on the existing local conditions (in terms of legal frameworks, financial availability, level of heterogeneity of partners, etc.), which has a direct impact in the implementation time. On average, and including the issues involved with the VBE foundation and launching, the creation of the first VE applying the adopted methodology can take from 3 to 5 years to be achieved.

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