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Development of Architecture of Virtual Enterprise Suitable for Small Organisations

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Abstract **- In turbulent market conditions small organisations used to face the risk of extinction due to fierce competition. The paper proposes a form of collaboration among small enterprises through which they can share risks, responsibilities, resources and rewards. A Virtual Enterprise is formed which may cater to fast changing business opportunities due to its flexible and effective collaborative principles.**

1. INTRODUCTION

Now-a-days organizations are facing the rapidly changing business environment and can no longer make predictable long term investment due to turbulent market conditions, regulation of working conditions, fast changing technologies, global competitions and so on. The business of competition is no longer enterprise to enterprise, but value chain to value chain. In order to achieve mass customization on a global scale, most pragmatic enterprises seek to enhance competitive performance by closely integrating the internal operations and by effectively linking them with external operations of suppliers, customers and other business partners.

This strategy requires the management of collaborative networks across business partners, and even business competitors. As each enterprise operates as a node in the network composed of suppliers, manufacturers, designers, project engineers, specialized service providers, customers, the collaboration among multiple business partners are becoming important. A collaborative network (CN) is a network consisting of a variety of entities (e.g. organisations and people) that are largely autonomous, geographically distributed, and heterogeneous in terms of their operating environment, culture, social capital and goals, but that collaborate to better achieve common or compatible goals, and whose interactions are supported by computer network. In today's society, collaborative networks manifest in a large variety of forms like virtual enterprises, dynamic supply chain, dynamic virtual organisations, virtual team, professional virtual communities, virtual organisation breeding environment, etc. [1].

2. HISTORY AND DEFINITION OF VIRTUAL ENTERPRISE

Since the advent of the concept of the virtual enterprise (VE) in the 1990s, many studies have progressed. However, the definition of the VE has not been prescribed completely. A variety of terms and definitions have been defined in various ways by scholars with different viewpoints [1-3]. According to Camarinha-Matos and Afsarmanesh, a VE represents a *temporary alliance of enterprises that come together to share skills or core competencies and resources in order to better respond to business opportunities, and whose cooperation is supported by computer networks*. An authoritative organization on VE is the National Industrial Information Infrastructure Protocols (NIIIP) consortium. According to the above said organization, a Virtual Enterprise is a *temporary consortium or alliance of companies formed to share costs and skills and to exploit fast-changing opportunities*.

Kim et al. define VE as follows: *In order to realize the common business goal which is to secure business opportunity, the VE is an active collaborative organisation structure which is temporarily made up of value chains. Each value chain consists of loosely coupled business processes of distributed business partners who offer the core complementary functionality and resources* [4].

In this paper term VE represents *a temporary collaboration among compatible organisations and people connected by information & communication technology to share resources, risks, responsibilities, rewards through effective and efficient solutions to fast changing business opportunities*

3. Modeling of VE

The fundamental concepts on which VE is formed provide better, cheaper, faster and newer products or services to the customer at the right place and right time. Accordingly VE is designed to behave in an agile manner towards market opportunities. This is achieved by stimulating organizational flexibility, particularly the competence to concurrently design a customer's product or service and the processes to produce and deliver it at the right time and right place. The flexibility is supported by the structure of VE. Any organisation or entity has two building blocks namely elements (people, non-human resources) and energy (technology, management and goals).

Figure-1: Basic elements of an organization

The tangible and non-tangible resources (similar to the elementary particles like proton, neutron) of the organisation are bound together by the forces of energy (binding forces like nuclear force, attractive electromagnetic force) of goals, management and technology.

Table-1: The binding energy in an organization

Goals	Management	Technology
Vision Mission Strategy Structure Governance rules	Product Process Quality Resources Project Innovation Culture and Value	Database , Information systems exchange platforms, Process technology Product technology Computers, Operating systems, Networks

The quality and quantity of resources and binding forces will determine the future growth and success of any organisation in new economy. The architecture of VE will be evolved taking into consideration the key elements and fundamental concepts mentioned above. In this paper modeling of VE will be considered in two perspectives (1) enterprise architecture[1] frame work to establish the structure and core activities of VE which encompass flexibility and agility and (2) integration of information & core competencies of member organisations for effective and efficient collaboration. Since VE is product oriented therefore the structure of it depends entirely on the project in hand. But a certain basic configuration is always present in each VE.

4. ARCHITECTURE OF VE

The architecture of VE is developed considering the fact that it represents a flexible, dynamic, autonomous, multilevel network. Flexibility will come by the combination of technology and people. Extensive use of ICT will give sufficient information at the right time for quick decision making. Since the collaboration among like minded partners is short term in nature, therefore it brings dynamism to the network. Any partner can join or leave the network at any time. All the members of VE maintain their individual identities while offering their core competencies for commercial exploitations. They are autonomous in nature. To satisfy above criteria the structure of VE must be multi-layered, modular, reusable and decomposable in nature. It operates in multiple levels--higher and lower levels. Each level has its own VE and Value Chains (VC).

4.1. Industry Cluster (IC): It consists of a group of organisations located in the same geographical region and operating in a common business sector. It draws competitive advantage through some common resources like technologies & tools, labour pools, buyers & suppliers, distribution channels etc. Some sort of cooperation exists among the organisations when business opportunities arise.

4.2. Virtual Industry Cluster (VIC): In CN the member organisations share their resources and responsibilities. Collaboration will be possible only when the organisations reengineer their activities from context dependent into context independent in nature. All the sharable resources are virtualized using information, communication technologies (ICT). These likeminded organisations with compatible processes form VIC. It may not be confined to same geographical region.

4.3. Virtual Enterprise Breeding Environment (VEBE): It represents all associations and their related supporting institutions, adhering to a base long term cooperation agreement and adoption of common operating principles towards rapid configuration of temporary alliances for collaboration in potential VE. When a business opportunity is identified by any member, a suitable subset of VEBE organisations can be selected to form a VE.

4.4. Virtual Enterprise Value Chain (VEVC): In a VEBE the organisations possessing common core competencies will form virtual enterprise value chain (VEVC) like design value chain, manufacturing value chain, logistics value chain, marketing & business development value chain, project engineering value chain etc. This value chain may not be confined to any specific geographical region. Marketing & business development value chain becomes the interface between the customers and VE during the execution of any project.

4.5. Virtual Enterprise Leader (VEL): A business opportunity which is identified by a member (it belongs to any value chain) may not execute as a project leader. In this case the project may be hand over to a project engineering value chain which will now be called as virtual enterprise leader (VEL).

4.6. Support Service Providers (SSP): For smooth and speedy execution of projects VE needs services from specialized organisations like banks & lending institutions, R & D organisations, regulatory & environmental bodies, quality certification bodies, federal organisations etc.

5. LIFE CYCLE OF VE

The life cycle of VE has strong relationships with creation, growth and destruction of the value chains which are based on the specific business processes. The evolution of VE is presented here.

5.1. Business opportunity: A new profitable opportunity may be identified by a member in VEBE. This opportunity may be a new product or service, new market, new distribution channel etc. BOF may evaluate revenue and profit potentials from the new venture and on the basis of that whether forming a new VE will yield value creation.

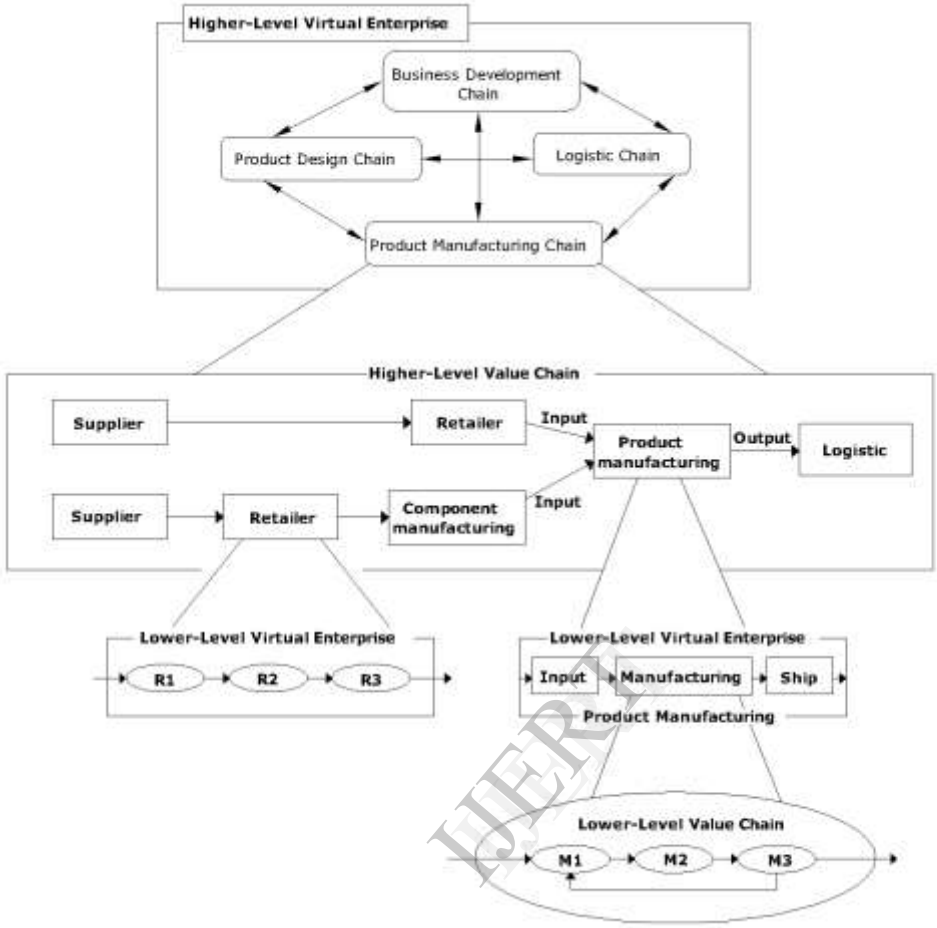

Figure 2: The various levels of value chains and virtual enterprises

5.2. Major partners' selection: VEL which takes the responsibility of VE creation, operation, evolution and dissolution, at first identifies the major value chains and the core capabilities needed for each value chain. Then VEL identifies and selects organisations as best partners for each value chain. These major VE partners in turn select other compatible organisations as minor partners in their value chain.

5.3. Enterprise configuration: Once major partners are selected then VEL establishes a suitable enterprise configuration on the basis of business processes, system architecture, information flow, resources available for sharing, etc. On the platform of evolved VE architecture a common business plan is developed where roles, responsibilities, risks and rewards for all partners are clearly specified. All the business processes are made well defined and standardized so that no future confusion occurs. Since VE is based on computer network, therefore relevant ICT infrastructure is configured so that sharing of information, knowledge and resources become fast and friendly.

5.4. Enterprise operation: The operation and control of projects in VE are crucial because the competitive advantages on which VE is conceptualized are faster, better, cheaper and innovative offers to customers compared to the competitors. The situation demands extensive use of collaborative processes and computer softwares so that the desired objectives are achieved. Therefore VEL must possess extensive project engineering skills.

5.5. Enterprise evolution: Since VE being a dynamic network, therefore one can expect change at any time. It has to be effective and efficient so as to survive in turbulent environment. VE will adapt according to changes in external and internal environments through means of redesigning or optimization of the value chains, the business scenarios, the business processes or the business partners.

5.6. Enterprise dissolution: VEL will dissolve VE after stopping the execution of the business processes, depending on the disappearance of the business opportunity.

6. CONCLUSION

For small organisations one better way to compete in market place is to form and join virtual enterprise. The flexibility and effectiveness of a VE will add competitive advantages to the consortium members. Since the cost of

ICT is decreasing day by day, therefore investment in IT infrastructure will not discourage the organisation to join any network. The future market will see the competitions among a

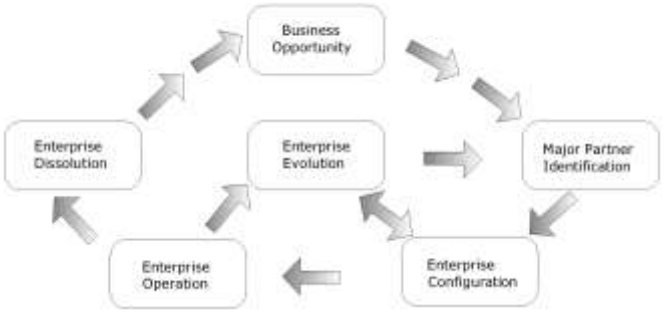

Figure 3. Life Cycle of VE

number of VEs and large organisations for same category of customers. The entity which will deliver the right product at the right time to the right customers at the right place in a cost effective manner will be the winner. In this front VEs have competitive edges over large organisation. Since the architecture of VE evolves with the nature of the opportunity on hand, therefore we will find different structures supporting different goals.

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