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A Study of Corporate Managerial Module and Information System Orienting Agile Virtual Enterprises

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ABSTRACT

The operation modules and information system construction are essential contents in agile virtual enterprises. Based on the analyses of the characteristics, organization forms and operation processes in agile virtual enterprises, studies are extended to the corresponding information systems, and the development of systematic logic modules and kernel methodology is also proposed in the paper.

Key Words: Agile virtual enterprises, Operation modules, Management information systems

1. INTRODUCTION

With the development of information technology, there are great changes in global economic environments. Consumers prefer the concept of individuality and diversity, and the uncertainty of the market demand is increasing greatly. All these call for the enterprises to have flexibility and adaptability in the market. The changeable markets also call for the enterprises to have simple managerial structures, which are easy to reorganize and adjust. The customers' needs of individuality and diversity call for the enterprises to have creativity to develop new products. Consequently, the enterprises and management review the traditional managerial modes and competition models.

In 1991, supported by American National Defense Department and 13 well-known enterprises, Roger and Rick Dove, together with more than 100 experts in Iacocca Institute of Lehigh University in USA, proposed a report entitled Manufacturing Strategies of the 21st Century before the American Congress. A new manufacturing model was put forward in the report, i.e. Agile manufacturing on the basis of agile virtual enterprises (VE). The fundamental concepts of VE are that the enterprises make good use of the latest achievement in information technology and social resources and strategically join the competitive advantages of enterprises, concentrating on the development of new products and better management. The management, development, manufacturing and marketing of products are implemented by means of VE, which vary with the markets and become the kernel part of agile manufacturing.

2. CHARACTERISTICS OF VE

The motivation of the emergence and development of VE is to fulfill the joint destinations and to achieve the agile effects. The characteristics are integration, agility, virtuality and time-validity.

- *Integration of VE*: Integration indicates that the relevant enterprises with varied managerial advantages dedicate their competitive privileges to the VE, conforming and exerting their unity effects in order to develop prominent competitive edge. This can be realized by means of resources conformity and resources complementation. Integration is the primary function of VE and also the major approach to the system reconstruction.

- *Agility of VE*: Agility indicates that the enterprises are able to react and accomodate to the demands of the dynamic markets by grasping the market opportunities and promoting creativity, such as being reconfigurable, being reusable, and being scalable, namely RRS characteristics. From the perspective of business management, these characteristics refer to connection, cross-organizational participation, manufacturing flexibility and managerial relevance.

- *Virtuality of VE*: In order to fit the dynamic markets, the structure between members is not stable, but they can reconstruct in terms of changing objectives, replacing products and varying environment, namely organizational virtuality. The VE have functions such as manufacturing, assembling, management and finance, but there are no corresponding internal organizations, namely functional virtuality.

- *Time-validity of VE*: VE are based on the market opportunities, uniting or dismantling in terms of business opportunity. Their members are autonomous and independent.

3. ORGANIZATION OF VE

The managerial approaches of VE focus on the production procedures, adopting the forms of teamwork. There are four tiers, namely Virtual Enterprise (VE), Virtual Group (VG), project team based on products or services (TEAM) and Basic Organization Unit (BOU).

The first tier is the virtual enterprise made up of numerous functional projects. The second tier is the cooperation between enterprises made up of many functional projects by information network, and their methods of cooperation are virtual cooperation, interrupted compatibility, transference and supply chains. The third tier is the mobile organization between enterprises by establishing basic organization units. The fourth tier is the basic manufacturing organization units made up of equipment, staff and technology. All the four tiers represent the many-to-many mapping between the physical material and dynamic associations within the enterprises, illustrated as Figure 1.

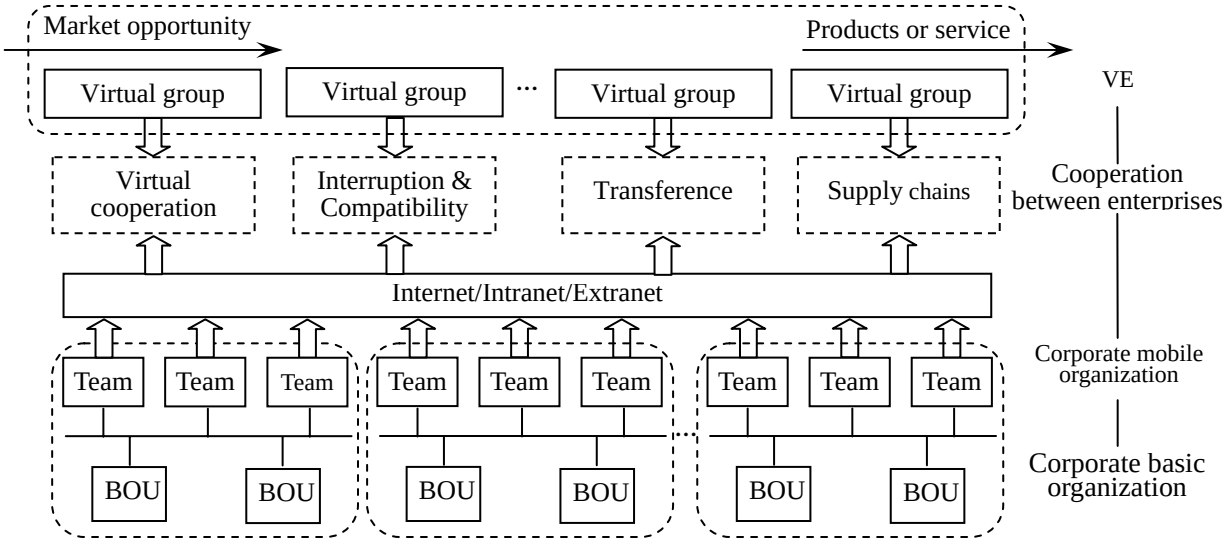

Fig.1 The Description of Tier Structures of VE

In the construction of VE, the procedure is as follows: the description of the business opportunity → definition of the business processes → the confirmation of the essential resources → selection of the business partners → decision on the cooperation strategies → the allocation of the profits and risks → management of dynamic organization. The whole procedure involves priority combination issues between internal organizations, between internal and external organizations, and between members among other cross-disciplines, etc. The ultimate goal is to establish the effective cooperation by setting up network system.

4. MANAGEMENT PROCESSES IN VE

The management of VE is proposed by one or several enterprises that manipulate the essential resources (e.g. vital technology, markets or brands), and members provide their predominant resources and share the risks and profits. Consequently, the management of VE can be decomposed into 5 phases.

- *Identification of Business Opportunity*: It is the starting point to grasp and identify the business opportunities. There are varied approaches for VE to acknowledge the business objects, namely market investigation and prediction, analyses of the market feedback, research and development of new products, analyses of market competition and social environments. The VE will discover the potential products and service in the market in terms of the product and technology development strategies of their members.

- *Structural Analyses of VE*: The advantages of Virtual Enterprise are gained by means of sharing information between enterprises and harmonizing the production and management processes within enterprises. The member enterprises achieve their supply of chance products or services by their own kernel capability. VE ensure the demand resources in light of the characteristics of the chance products, involving the resource distribution and the conditions of Internet communications between resource possessors. The coalescence capability plays a vital role in the success of VE.

- *Selection of Partners and Establishment of VE*: VE make profits through time-limited cooperation and reset of kernel resources, and they also concentrate the market objectives, investigate and evaluate the relevant potential partners. In particular, the evaluation of the vital capabilities is the basis for the selection of partners. VE observe such principles as resource complementation, profit sharing and risk partaking, define the allocation forms, ensure the relationship between member enterprises and accomplish their establishment. Sound allocation programs of risks and profits are the important bases for the establishment and normal operation of VE.
- *Managing, Tracing and Recording*: Members of VE have cooperation and competition. In terms of

regulations and market situations, VE adjust organizational structures dynamically. If the feedback suggests that there are great changes in the member enterprises and markets, VE will reorganize and even disorganize.

- *Reckoning and Disorganizing*: When VE complete the specific products and services of the business opportunity, they will reckon the correspondent expenditure, rights and interests in light of the contracted interest-allocating program, involving the apportionment of management expenditure, development expenditure, and manufacturing expenditure. Additionally, VE reckon the funds in the business management, and tackle with the belonging of the new technology and its future application. These processes will occur during the operation or after the disorganization of VE.

5. MIS OF VE

In the relatively balanced market environment, the traditional information system plays a vital part in the business management of enterprises. However, in the chaotic changeable environments, particularly in the virtual manufacturing module that is the major structural form in VE, the business information systems are required to accomodate quickly to the changes and development of enterprises. Compared with the traditional information system, the prominent characteristics of the management information system *(MIS)* of VE are the complete distribution of the system information, structures and functions, dynamic reorganization and agility.

5.1 Characteristic of MIS of VE

- *Openness and Compatibility*: VE is a new type of virtual business that takes the advantage of the network information technology and breaks the regional barriers. Information flows between member enterprises and within enterprises, which requires that the Management Information System within VE is not blocked and that diversified management information system can be integrated.

- *Flexibility*: The reconstruction of dynamic business operation and the reorganization of the units require that the corresponding MIS is rather flexible for VE so that it can execute functional integration and adjustment, and meet the needs of new business flows after the dynamic reorganization.

- *Robustness*: MIS in Virtual Enterprise is quite sophisticated, which meets the demand of the information integration and management between and within member enterprises. It should be reliable and effective, and it is robust in supporting large-scale cooperation on the basis of multi-disciplines and multi-tiers.

5.2 Logic Module of MIS in VE

In the logic module of MIS in VE, there is information flow within enterprises, between member enterprises, between enterprises and the environment, between VE and the environments, illustrated in Figure 2.

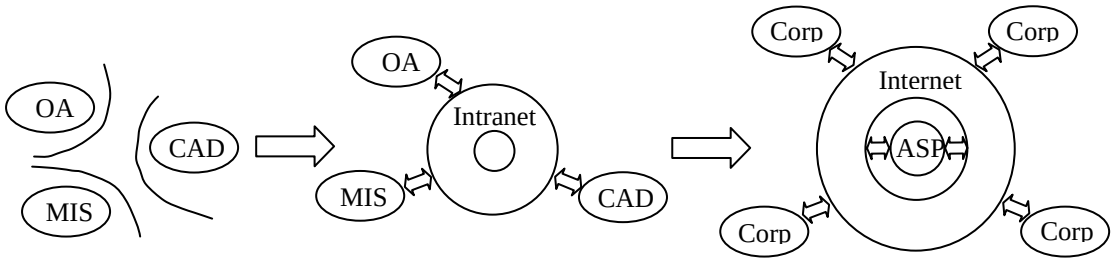

Fig.2 Logic Module of MIS in VE

Information flow within enterprises is based on Intranet. Their MIS is responsible for the collection and settlement of the basic data of enterprises, corresponding to the treatment of the businesses and interior information in all the business management departments and all the production phases. It provides the enterprises with environment for information sharing, communication, cooperation and decision-making. Object-Oriented Methodology has such characteristics as encapsulation, inheritance, multi-states, modifiability, dynamic connection and being reusable, so that it is convenient to develop the renovative and connective MIS. The designing concept is based on the business opportunity and production missions of the enterprises. Objects are selected from the object-bank, orderly business processes and sound business organizations are matched. The parameters are configurated corresponding to subsystems such as people, property, materials, production, supply, sales,

prediction and decision-making of business management.
Information flow between member enterprises is based on Extranet. Their MIS is outstretched, and it is a cooperative network that makes enterprises connect and accomplish their mutual goals. It can be a bridge between public Internet and specialized Intranet. It assumes the information communications between intimate member enterprises. It can also be viewed as a part of Intranet between the enterprise and its cooperative enterprises.

Information flow between VE and the environment is based on Internet. Their MIS is applied to information promulgation and communication, advertising systems, e-commerce systems, which can be fulfilled through setting up corresponding external server of the enterprises. Regarding the security of the system, data bank safety of MIS and network system safety are the two major factors to be considered.

5.3 Core Methodology of MIS in VE

This sort of information flow is integrated in enterprises on the basis of Internet/Intranet/Extranet technology, and supported by significant technology, namely object-oriented methodology (OOM), standard for the exchange of product model data (STEP), a module-setting language (EXPRESS), common object request broker architecture (CORBA).

OOM expresses through objects. It is corresponding to the characteristics of VE such as versatile information data and enormous data quantity. Also, it improves the encoding efficiency, system maintenance, and the capability to be reusable.

STEP is to offer data module in establishing distributive information system for VE, and then it is transferred to the traditional package treatment data through corresponding formats.

EXPRESS is to present objects, information units of the objects, and the operation that confines and permits the objects. It is a formal information module-setting language, and it provides the datum information that has the engineering datum structure and distributive information system conforming to STEP.

CORBA is an essential communication mechanism that can operate between distributive objects, and it is a canonical system construction that can make an individual visit to objects possible in a separate structural systems. It defines a structure for object request broker (ORB), and it meets the demand of inter-operation between management objects and applications, and the compatibility of the separate structural systems. Additionally, it can maintain the relative independence between member enterprises.

Information Treatment Methodology of agile virtual enterprises also involves:

- open inter-operable underlying network protocols (TCP/IP, HTTP, RMI, SOAP),
- open distributed object oriented middleware services (J2EE Framework, ActiveX Framework),
- information/object exchange mechanisms and tools (XML, ebXML, WSDL),
- standardized modeling of business components, processes and objects (EJBs, OAG and OMGs Business Objects and Components),
- business process modeling tools and languages (UML, UEML, WfMC XML-based Business Language, PSL),
- open and standard business process automation and workflow management systems (WfMC, OMG-JointFlow, XML-WfMC standards, many commercial products),
- standard interfacing to federated multi-databases (ODBC, JDBC),
- intelligent mobile agents (FIPA, OMG-MASIF, Mobile Objects),
- open and standard distributed messaging middleware systems (JMS, MS-Message Server, MQSeries, FIPA-ACC),
- XML-based E-commerce protocols (BizTalk, CBL, OASIS, ICE, RosettaNET, OBI, WIDL),
- web integration technologies (Servlets, JSP, MSASP, XSL).

The current security mechanisms can be fulfilled through safety methodologies such as the state and behavior of datum bank, rich semantic association, the specification of managerial purview, datum encryption methodology, firewall technique, network security scanning methodology, network invasion testing methodology and hacker inducement methodology.

6. CONCLUSION

The traditional management theory concentrates on the internal relationship in the enterprises, whereas VE focus on reshaping the relationship between enterprises. The managerial methodology of VE replaces sequential management with juxtaposition managerial procedures, and replaces manipulating management with concentrated and cooperative managerial methodology. VE are the advanced organizational management behavior and market competitive strategies directed by the concept of agility, accommodating to competition and manufacturing development. The soul and kernel of VE are agility and integration.

The development and application of the Internet technology make it possible for the former enterprises to transfer the specialized information from the comparatively higher tiers to the lower tiers, and to feed back the information from the mid or lower tiers of the enterprises to the high-tier management through excavating data. Virtual enterprise modules enable

enterprises to reconstruct their production, supply, sales and service flow. All these demand that enterprises completely construct their MIS to support business management of VE. Enterprises are also required to build up concepts of competition and competition, and to integrate the external advantages through taking the advantage of internal resources, and to react quickly to the market demands, and thus to enhance the competitive edge of the kernel enterprises.

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