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A Novel Partner Selection method in virtual enterprise Based on the ontology and SOA and AHPmodel

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Abstract - **Partner selection is a key problem in virtual enterprise. This paper researches on selecting the dynamic, Competitive and compatible partners, which is the key link in the establishment of virtual enterprise.**
this paper presented a method have two main steps , first step is detecting candidate partner using semantic concept and second step is selecting proper partner using competency and quality of service in AHP method .
The advantage of this method scrutiny of partner selection problem , and partner selection in this method occur dynamic and automation.

Keywords- *partner selection,virtual enterprise-quality of service-ontology-AHP-**SOA***

1. INTRODUCTION

With rapid development of information technology and economical globalization, the competition between companies has been changing from the quality and service of the product to the performance of the virtual enterprise (VE) in which the company is located. In the VE, the product is provided by the corporation of all the partners from material supplying to product marketing.

Thus, even a small mistake taken place in one partner will slow down the response time to the market and customers' demand. In order to improve or maintain the whole competitive power of VE, appropriate partners are very important. The selection and evaluation of partners is a very complex problem due to its inner multiple factors being interactive with each other. [1]

Many methods are presented on the optimization, such as DEA (data envelopment analysis), AHP (analytic hierarchy process), FCE (fuzzy comprehensive evaluation), mathematics statistics and MODM (multiple objective decision making). [4] but this method have quotation ,such as loss of detection phase and dynamic and outomation in select partner and nonuse of semantic concept . The advantage of our method scrutiny of partner selection problem , and partner selection in this method occur dynamic and automation.

In this method formation of virtual enterprise based on service oriented architecture (SOA), namely we creation a services semantic network and then candidate partner of virtual organization first detect as for services in ontology based on semantic rules, and then using AHP method for ranking partner based on competency and quality of services, so using conclusion for select the set of appropriate partner in diverse criteria.

2. VIRTUAL ENTERPRISES

As mentioned previously, the key to sustaining competitive advantage is to collaborate with other business partners to promote synergies through expanding market power and decreasing competition at the same time. To achieve this, businesses need to form a so-called virtual enterprise. A VE is a dynamic business organization of collaborating enterprise partners for a short time period to pursue market opportunities and may disband when opportunities have passed.. This is described as the third wave of e-Business where new collaborative models are employed.

The purpose of this collaboration is to share core competencies in different complementary areas.

Information and communication technology (ICT) particularly computer networks are the main driver to the establishment of virtual enterprises. In a VE, a partner can take on the roles of a supplier or customer or both.

Therefore, in this research the term partner is used to refer to suppliers or customers.

Collaborating across enterprise boundaries in VEs leverage competitive advantage and a great number of advantages such as reduction in cost, reduction in cycle time, reduction of time-to-market, increase in production quality, ability to develop innovative products, improve the company strategic position, increase customer satisfaction, flexibility and faster information exchange. However, despite the advantages in VEs, there are a number of

Drawbacks of VEs, for example loss of independence, lack of trust and cultural problems.

The emergence of advanced ICT and the constantly changing economy have affected the way businesses operate. The traditional business model is usually conducted ineffectively and organizations that refuse to

change are losing profits and are unable to obtain fruitful opportunities for expansion . New technologies and common standards make global business interactions cheaper and easier to manage.[3]

3. LIFE CYCLE OF VIRTUAL ENTERPRISES

Various authors have depicted the lifecycle of VEs in different stages. It can be divided this process into three distinct stages: Formation, Operation and Dissolution.

Meanwhile, another author separated these three stages further using terminologies like: Design or Creation, Management or Operation and Disbanding or Dissolution.

On the other hand, classified the process into four stages i.e. Identification, Formation, Operation and Termination. Figure 2 shows the life cycle of VEs as presented by Strader (1998).

Each of the phases in the lifecycle consists of a number of activities as outlined in Figure 1. In the Identification phase, one or more organizations might realize some new market opportunities that is worthwhile to work with in order to exploit these opportunities (Opportunities Identification). These opportunities are evaluated by the management of the organizations to ensure that profits can

be gained through collaboration (Opportunity Evaluation) and only selected opportunities will be taken by them (Opportunity Selected).

figure 1: A Life cycle of VEs

The key broker or the VE initiator then identifies the task that needs to be solved, determines core competencies required as well as skills and capabilities expected from prospective members. In the Formation phase, a group of potential partners that is willing to

collaborate is identified (Potential Partner Identification) and evaluated to choose the suitable partners for the collaboration (Potential Partner Evaluation). In this context, the main issue is to determine what criteria should be used and what mechanisms should be applied to select the best partner(s) for the VEs (Potential Partner Selection). This is a significant step and needs to be done carefully because choosing the right partner is a key to the success of VEs as the wrong match may lead to eventually poor performance of the VE. This research particularly focuses on partner selection criteria for VEs in the context of collaborative-commerce or c-commerce.

Once the partner selection process is completed (Partnership Formation), the Operation phase begins by the partners collaborating and integrating their core competencies to satisfy requirements as identified in the Identification phase. In general, the Operation phase involves five different major decision processes, i.e.

Design, Marketing, Financial Management, Manufacturing and Distribution. In contrast to the

relationship between the processes in the first two life cycle phases, the processes in the Operation phase do not flow sequentially.

Finally, the Dissolution phase takes place once the market opportunities have passed (Operation Termination).

In this phase, partners in VEs should be able to evaluate each other on various aspects related to timeliness, quality, cost or time. Additionally, business partners are also able to

Evaluate their experiences in working with other members.

Such information is important for continuous learning and provides feedback for further collaborative work. The process of VE formation may then be re-started depending on the feedback and new needs of the organizations.[3]

4. PARTNER SELECTION IN AGILE VIRTUAL ENTERPRISES: MODELS AND FACTORS

To be competitive from an agility standpoint, organizations must adapt their supply chains efficiently and build strong relationships with customers and suppliers more quickly to develop a "promiscuous" and "opportunistic" series of responses to fragmented and fast moving markets. A company cannot become internally agile unless its external relationships with the supply chain are also agile. Strategic partnerships and alliances exist in a number of industries and are on the increase. A "partnership" type relationship can be described as a voluntary agreement that commits both the supplier and customer to mutual openness, productivity, and quality in the service of the customer's customer. It is an agreement that involves sharing proprietary information, risks, and rewards (Meade et al., 1997; Sarkis and Sundarraj, 2002; Taylor, 2005).

Although choosing the right supplier for a given job is the most fundamental and important decision a buyer makes, it may also be one of the most difficult ones. It also becomes more complex as the selection evolves to the level of partnerships. Supplier evaluation and motivation functions typically involve the utilization of one or more of the following approaches:

(1) formal quantitative rating systems;

(2) in-depth performance reviews; and

(3) on-going communications and development of business partnerships.

The selection process and its maintenance needs to incorporate these three important dimensions. Yet, when a partnership has to be considered among more than two organizations, these issues are exponentially more complex.

Traditionally, to complete a comprehensive evaluation of suppliers, a number of criteria can be used. For example, the supplier could be screened technically on a number of variables. For AVEs, the number of characteristics and specific need areas can be quite extensive (Table I).

Brokers and AVE partner development managers need to analyze and document the significance of several of the above mentioned factors, converting instinctive qualitative

indicators to concise empirical measures, some of which we describe in our model.[2]

Business	Technical
Design for customer delight	*Rapid response*
Information highway	Accommodate for the changing environment
Customer education	Adaptive infrastructure
Customer involvement	Standardized interfaces
Common protocols	Concurrency
Performance measurements and benchmarking	Risk management
Synchronized processes	*Information management*
Business process reengineering	Recognition information is a critical asset
Resource inventory of skills and competencies	Mathematical underpinning
Standards for product/process integration	End-user centered deployment of IT
Manufacturing product/process integration	Education and awareness programs for users
Management philosophy	Standards for product/process integration
Dynamic multiventuring	Vision-based leadership
Certification process for organizations	*Enabling tools and techniques*
Code for forming and dissolving enterprises	Useful tools with effective human interfaces
Legal requirements	Effective global communications
Distributed cross-functional teams	Incorporation of new software and hardware
Synchronized processes elements	Virtual reality systems
Refined accountability	Simulation and modeling
Strategic planning	*Adaptive infrastructure*
Process-based performance measures	Modularity
Self-empowered work force	Extensibility
Continuous education and training	Distributed information
Info. system infrastructure	Monitoring support
Vision-based leadership	*Connectivity*
Dynamic multiventuring	Access
Adaptable standards	Affordability
Natural language-based information models	Openness

Table I.

Summary of key andspecific need areas forintegrating the agile virtual enterprise

5. THE PROCESS OF PARTNER SELECTION AND EVALUATION BASED ON THE ONTOLOGY-AHP MODEL

The ultimate goal in this situation is to form an AVE by selecting from a grouping of partners (within the Partner Sets cluster). The arcs represent controlling relationships among the factors. The W indices that appear next to each of the arcs in Figure 2 shows sub-matrices of relationships that will form the supermatrix. The supermatrix formation will be detailed later in the discussion.
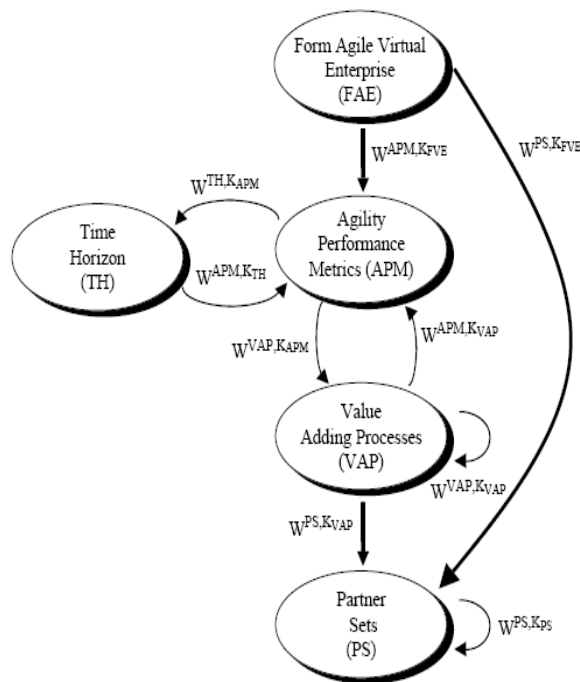

Figure 2.

A high level schematic ofthe network decisioncluster for agile virtual enterprise formation

5.1: The architecture of this model

In partner selection for agile virtual enterprise we consider two step :

    I.   Partner Detection base on ontology

    II.   Partner Selection based on AHP
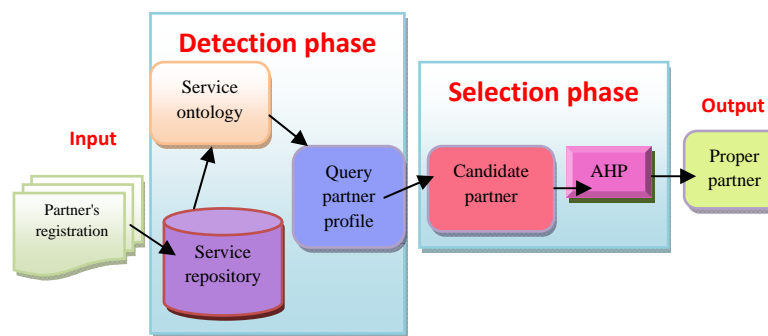

Figure 3: architecture of this model

5.1 .1- Step 1:

In this step we assume that a agile virtual enterprise in virtual breeding environment has a profile and agile performance metrics and value-adding processes to introduce its to VBE,and a set of partner to collaborate with them self.
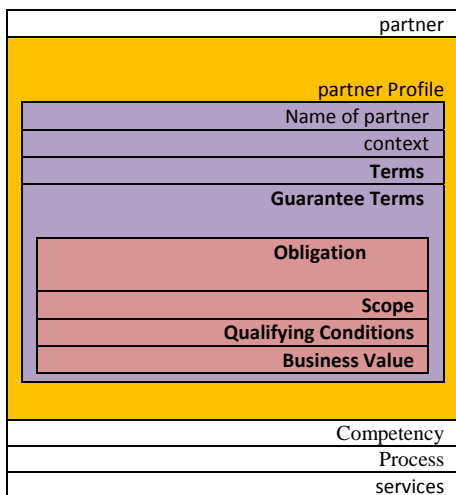
Figure 4: the virtual organization profile

each service need a profile as a follow for it operation in this cycle.

Figure 6: the service detail

As a result, with respect to upper profile , the virtual organization has an ontology for introduce its entity and relation between them.

the ontology of vo consist semantic consept of vo profile and agile performance metrics and value-adding processes to find appropriate partner for collaboration .

in addition business partner also have a profile in introducing each services in the form of services.

Virtual organization have an antology and thus it associated with a virtual organization partner semantic network.

In this ontology the competency of partner have a capacity and there are connected to resources, also the process are connected to resources for implementation.
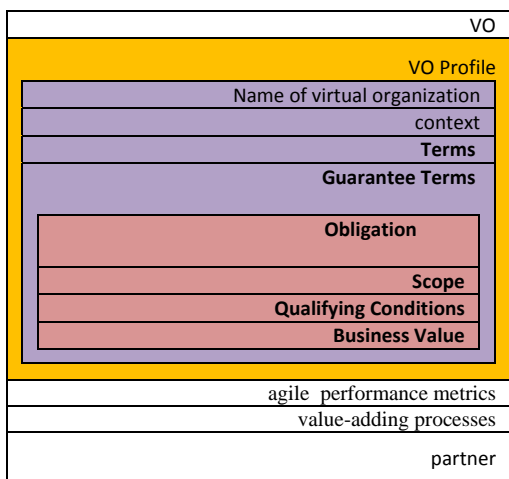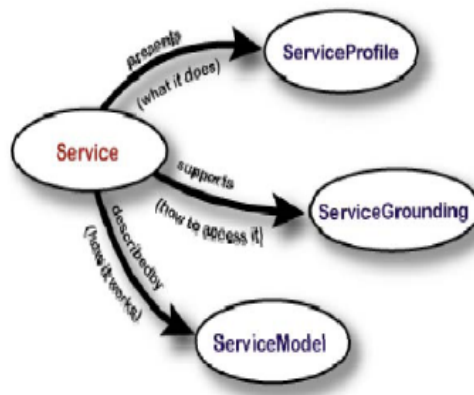
The Service Profile describes all the information of an "atomic service". It includes the service provider's information, functionalities of this service and some non-functional features such as quality rating, reliability, and service category. The specification of service functionalities uses IOPEs (Input, Output, Precondition, and Effect) .

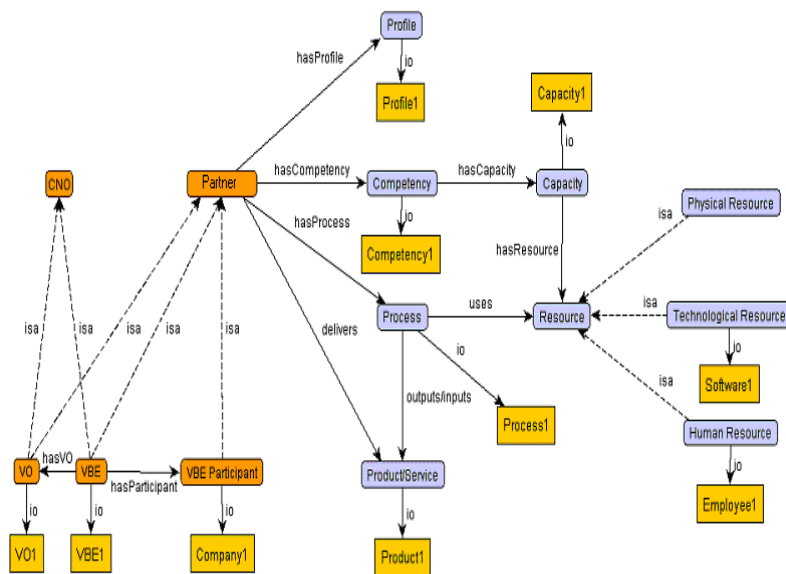In Figure 7, we show details of the ontology and semantic network of this model.

Figure 5: the partner profile

Figure7 : ontology and semantic network of partner selection model

In this step vo using adding-value and introducing service from partner ontology , select a series of partner that carry on sgthly services. And gather organization with the same services and puth them in a large package of finding partner.(figure 8)
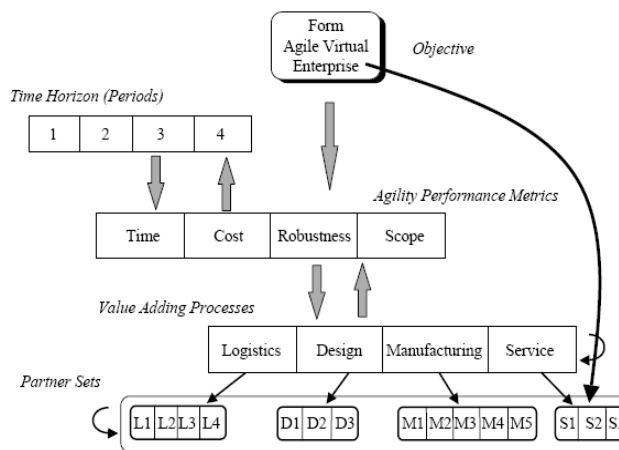

Figure 8.

Detailed graphicalrepresentation of

analytical networkdecision framework foragile virtual enterpriseformation

One of the core issues in selecting the appropriate partners and functionality focus depends heavily on the agility performance metrics that need to be met by the AVE. In this situation, we used the four major agility performance metrics that have been defined by the agility literature (Dove, 1994a, b, 1995; Meade and Sarkis, 1999; Ren et al., 2003; Yusuf et al., 1999; Arteta and Giachetti, 2004), which include cost, quality,time, and flexibility.

The value-adding processes in an enterprise comprise of a number of functions and activities, which are critical to its success, and containing four major organizational processes central to the delivery and maintenance of a product or service: logistics , design , manufacturing , and services.

The final major cluster of factors is the partner sets cluster. This cluster has a number of complex relationships that need to be managed. The decision in this situation is to select an organization for the AVE that has a core competency in each of the major processes.[2]

5.1 .2- Step 2: Partner selection based on AHP Basic ideas

5.1.2.1 :Traditional methods

a. Qualitative analysis

There are lots of methods for partner evaluation, in which qualitative methods consist of intuitive method, bidding method, negotiation method, etc. Table.2 gives a comparison of them.

	Intuitive	Bidding	Negotiation
Note	based on experience	call for bidding	consult separately
Strength	Simple, easy-to-use	broader area for selecting	Quality is guaranteed
Weak Point	Highly subjective	Complex process	limited range of options

Table 2 : Qualitive methods

b. Analytical hierarchy process

In the last century, A.L. Saaty, an American

operational expert, put forward the Analytical

Hierarchy Process (AHP) in the seventies. It is an analytical decision-making method which combines the qualitative analysis with the quantitative analysis. To apply this method, decision-makers have to break down the complex problem into several layers and elements, which would allow them to obtain the weight of the different options through simple comparisons and calculations within elements, that provides a basis to choose from the best option. AHP is suitable for analyzing the complex problem with multi-criteria and objectives, and is also widely used for the comparison of regional economic development plans, the evaluation of scientific and technical achievements, resource planning and the quality assessment of personnel in enterprises.

In reality, the relationships between partners are really complicated, but indexes selected by AHP are relatively independent. AHP doesn't consider the possible complicated relationships so it cannot meet the requirement of agility perfectly.[4]

5.1.2. 2: The Process Of The Partner Selecting

The Selecting Process (The selecting process is as Figure 9 shows)

Optimizing section to decide the partner enterprise by himself, or go to the next section.

And the main evaluating method is that experts in different fields give points to the bidding enterprises. Due to the score, the evaluating system becomes more professional.

Optimizing Section: Select the best partner enterprise from the possible enterprises. In this section, we use analytic hierarchy process (AHP) to optimize the enterprises for the best partner.[6]
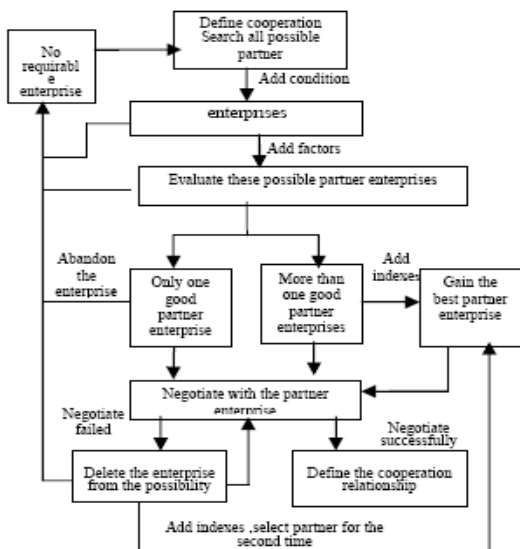
Figure 9: selecting process

5.1.2. 3: THE CORE SECTION OF PARTNER SELECTION—OPTIMAZING SECTION

The optimizing section is the most important section in the partner selection system. And the algorithm of AHP is the core of the optimizing section.

Suppose that there are N enterprises take parts in the bidding, and there are N indexes to select best partner. To simplify the model, we set N equals 3.

First, we construct the hierarchy structure as Figure 10 shows.[6]
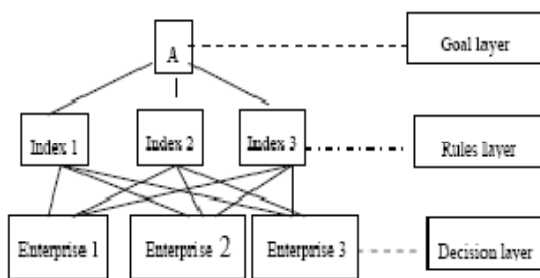

Figure 10 : Hierachy Structure

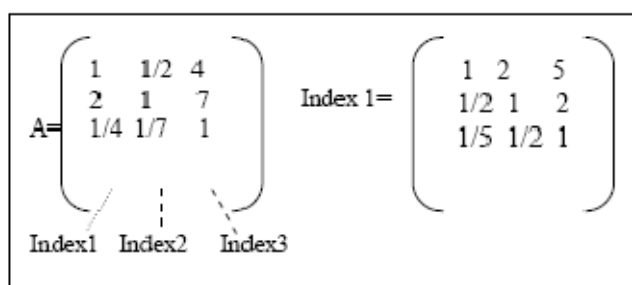Second, the matrix for judgment is build like Figure11

Figure 11: Matrix For Judgement

Third, check up the consistency.

a) Work out the maximal eigenvalue of matrix A.

λ=3.073

b) Work out the relevant eigenvector.

ω={0.262, 0.474, 0.055}

Work out the index of consistency, $CI = \frac{\lambda \max - n}{n-1}$ If CI>0, then go to the next stage. If the ratio of consistency

less than 0.1, these points pass the test. CR=$\frac{CI}{RI}$ The value of RI is shown as Table 3.

n	1	2	3	4	5	6	7	8	9
R I	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45

Table 3

c) The other matrixes are as Table 4.

	Index 1	Index 2	Index 3
ω	0.263	0.475	0.055
E1	0.595	0.082	0.429
E2	0.227	0.236	0.429
E3	0.129	0.682	0.142

Table 4

d) Work out the total weight of every enterprise.

6. CONCLUTION

This paper focus on the partner selection of virtual enterprise using semantic network ontology , and the algorithm of AHP to apply to the optimizing section for best partner, and how to use ontology in detection of partner. But the cooperation among enterprises and selecting a splendiferous partner enterprise is a complex problem. In many paper study the selection phase of partner selection , but in this research we study the previes phase of select phase and its detect phase ,in this phase we detect and find partner based on same competency with semantic network in ontology and then import them in to select phase. We offer a novel model , and check the apply with protégé and expert choice program.

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