

Enterprise Competitive Intelligence System

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Abstract: - This paper analyzes functions analysis of enterprise competitive intelligence system (CIS) based on the complexity of enterprise CIS. Establishment of CIS of enterprise is an important approach to promote the research level of enterprise CIS. Quantitative analysis, technologies such as Group decision support system (GDSS), decision support systems (DSS) are useful to study the structure of the Hall of Workshop of Meta-synthesis so that enterprise can build CIS which fit to the competition.

Key-Words: - CIS, structure of CIS, quantitative analysis, meta-synthesis, hall for workshop of meta-synthesis

1 Introduction

As businesses throughout the world face unprecedented challenges to remain competitive, the importance of Competitive Intelligence (CI) to their survival should not be underestimated. Today, CI plays a key role in enterprise success. Competitive Intelligence research is the outcome of market competition intensifying and high speed development of social information. It is an edge subject mingled with administration, economics and Intelligence. Since CI research is still in the developing period, so far there is no uniform definition. Some scholars began to study this subject long time ago. McGonagle and Vella (1990), among the earliest authors seeking to define competitive intelligence (CI) in a formal fashion define CI programs as being: "A formalized, yet continuously evolving process by which the management team assesses the evolution of its industry and the capabilities and behavior of its current and potential competitors to assist in maintaining or developing a competitive advantage" (Prescott and Gibbons 1993). A Competitive Intelligence Program (CIP) tries to ensure that the organization has accurate, current information about its competitors and a plan for using that information to its advantage. It is easy to see that CI emphasizes the prediction of competitive environment and competitors, how to harmonize the internal and external resources in competitive actions, the complexity of main parts, content of the research, the environment. All these decide the design of CIS, which has itself particularity, should be different from traditional manage information system and decision-making system.

At the same time, it is necessary that Enterprise Competitive Intelligence is developing as the country, group and market competition growing. To research modern enterprise competitive intelligence has a lot of realistic meaning in terms of how to improve the core competitive power of enterprise, and how to face the market competition. Enterprise competitive intelligence system combines the thought of management, the method of analysis and advanced information technology, which make it become an integration and systematism tool for the outside competition and inside cooperation of enterprise. ECIS can afford early precaution to the possible opportunity and danger, and it can offer support for the enterprise to establish the strategic planning and tactic decision, lastly, ECIS can evaluate and monitor the competitors' developments.

1.1 Complexity Analysis of Enterprise CIS

The principal part of CI activities is a competitor who has decision-making ability. Along with the increasingly complexity, relationship of principal parts get connected by combining social network, organization network, information network. The three networks which affect one to another, form an open and dynamic complex decision-making system. The content of CI actions is mainly involved enterprise actions respect to competition. The research topics are mostly especially complex and non-structure. The process has the feature of changing and results incertitude. The complexity degree is up to needing experience and knowledge of different research area experts to determine the nature and judge. So it needs support from experts in many different fields,

including System Engineering, Operation Research, Economic, Management, Statistic and so on.

Enterprise CIS is not only used in making competitive strategies, but also in shriveling competitive environment and protecting the knowledge patents and so on. If we designed the CIS as Intelligence decision-making support system based on data-base and model-base, then we will shrivel on plentiful changing, uncertain, non-structure problems. CIS design should be different from Intellective Decision Support System (IDSS) and Group Decision Support System (GDSS) which face the problems which have been already structured or semi-structured. In these kind of systems, machines play the main role while human being just assistant machines to finish certain input and run. We call these relationship human beings assistant machines. Since the information technology high-speed development, it changes the ways enterprises get and spread information as well as the production structure and element. In this case, no organization can establish a long competitive advantage, which means each competitive advantage can be eroded rapidly. An enterprise's success depends on if it can turn from one competitive advantage to another advantage rapidly. In this new features, new phenomena, new problems competitive environment, CIS of enterprise adapt the main parts actively which effects with external reduplicative environment to make the CIS keep developing and evolve.

In general, the construction methods of Enterprise Competitive Intelligence are divided into independency construction method, outsourcing construction method, and alliance construction method, etc.

1.2 Function analysis of enterprise CIS

Competitive Intelligence offers a real strategic advantage for many businesses. Refer to the currently systems, we should notice that Information data is a kind of unstructured document information, so it is necessary to build a proper computation model. Most times, we use the vector space model (VSM), which is widely used in the field of document categorization, automatic indexing, information search, and so on. VCM is a digital document model which is simple and efficient, too. When we use VCM, document will be formalized as a vector $D(W_1, W_2, \dots, W_n)$ in the N -dimensional space. Every vector will be represented a word or word series, and W can be showed as weight in document, which can be described how much this word or word series effect on the document content.

To ensure the dimension of vector space, firstly, we

should segment the document, and distill the feature according to some arithmetic, etc. At last, we use the feature unit of document to form vector space. It is usually that the model of vector space use TFIDF arithmetic based on the statistical information to describe the weight of the term:

$$W_{ik} = tf_{ik} \bullet idf_k$$

As the top formula, tf_{ik} is term t_k 's frequency, which means how much times term t_k appear in document D_i ; idf_k is term t_k 's inverse document frequency. They have a lot of computation methods, the common formula is:

$$W_{ik} = tf_{ik} \bullet \log\left(\frac{N}{n_k} + 0.01\right)$$

And N is the amount of document of all the training set. n_k means t_k 's document frequency in the training document. According to the theory of Shannon, more high t_k 's frequency in all of the document, more small t_k contain information entropy; if t_k occurs into focus in the document, which means t_k has a high information entropy.

The design of system process and functions basically depend on the intelligence process of intelligence plan, information collection, information processing, intelligence analysis, intelligence spread. The developed intelligence software on the market is mainly emphasized particularly on three parts: information collection, solving and spread. In the aspect of information collection, upon the development of search technology, this software can realize communion between human and machine. Information can be customized by users' requirement; function of intelligence analysis is mainly to get solution of structured problems by mathematic models. Few software have inducted tools of intelligence arithmetic and date mining; in intelligence spread aspect, some big enterprises have been able to interconnect their interior CIS, MIS and ERP so that intelligence system can be as a learning system in some degree to realize intelligence share though this function is limited. Intelligence analysis is the core of the whole intelligence value chain, however, it is the feeblest part of the whole CI software design. Some software companies use the Business Intelligence (BI) as Competitive Intelligence (CI) to spread, however, they have essential difference. Business Intelligence, is focused gathering, storing and analyzing customer data and in-depth analysis of business statistics, most usually a

quantitative exercise. Sometimes Competitive Intelligence is employed to help gain insight or hard-to-find figures for Business Intelligence initiatives, but most often they are related disciplines, both of which help senior management to make more informed decisions.

2 Research of CI Integration from Qualitative to Quantitative

Mr. Qian Xuesen thinks that to handle open and complex mega-system, analytic-quantitative Integration method should be employed. This was later developed into "from Qualitative to Quantitative Hall for Workshop of Meta-synthetic engineering". This method, based on man-centered man-computer cooperation concept, addresses problems as a whole, and synthesizes information and knowledge of experts at different levels and in different fields.

The process of Competitive Intelligence Integration is composed of the following stages: The first stage starts from raising demand for intelligence. Experts from different fields put forward hypotheses according to their experience and judgment. This stage is called the workshop stage. The second stage involves integration of qualitative knowledge. At this stage, all the hypotheses would be combed, analyzed, and synthesized to obtain a basic hypothesis on the competitive intelligence. In this process, information technology plays the role of integration. To verify the hypothesis in a scientific way, we need to transfer the hypothesis into quantitative data, and then utilize the existing model bank, knowledge bank, data base, and employ tools and methods offered by mathematics, system science, control science, human intelligence, many information technology based on computer, to verify the basic hypothesis. The third stage is machine verification stage. If the verification results match the basic hypothesis, then the expert intelligence products can be directly sent to the relevant decision-making departments. If the result does not match the hypothesis, the machine generated information shall be allocated to all experts. The experts shall then modify the hypothesis or raise new hypothesis after careful thinking. Then the above-mentioned process would be repeated as indicated by figure 1.

From figure 1, we can see that the key to the realization from Qualitative to Quantitative Competitive Intelligence Integration is the agreement in experts' opinions, or rather, the integration of expert knowledge. If the experts' opinions cannot be gradually convergence in the circle process, then "Integration" cannot be achieved, and the workshop will not conclude. Considering the fact that problems

involved in competitive intelligence are open, dynamic, and fuzzy, this paper, by employing the AHP method, divides the expert workshop handling semi-structured and non-structured issues into four hierarchies. Hierarchy one: determining the workshop objective. Before the workshop starts, the demands for intelligence from different departments shall be synthesized into shared demands, namely, determining the core issue to be discussed. This is the precondition for experts to reach agreement. Hierarchy two: determining experts participating in the workshop. W_h is used to indicate the degree of importance of experts. The weight depends on the knowledge background and relevance to the issue in question. Hierarchy three: determining the evaluation standards for the issue in question. The standards shall be raised by experts, which will obviously vary as each expert would have a standard set in his mind. The standard set can be divided into several sub-sets according to specific needs. A_{ij} is used to indicate the degree of importance that expert i holds for standard j . Hierarchy four: determining decisions. Each expert is required to make corresponding decisions or put forward action plans according to each evaluation standard. r_{ijk} is used to indicate the priority that expert i in the Hall gives to action k according to evaluation standard j . After the priority of each action is determined by experts by quantitative means, the machine can then verify the reliability of each expert and the expert group. If the result does not live up to the reliability requirement, the workshop must continue; if the reliability requirement is satisfied, the workshop is concluded. Verification of group reliability and agreement on action set can be accomplished by using group information aggregation, group utility theory, fuzzy evaluation method and AHP.

3 Research on the Realization of CI Hall for Workshop of Meta-synthetic Engineering

The Hall for Workshop of Meta-synthetic Engineering (HWME) is the theory framework proposed by Tsien to solve the complicated problem through the collective wisdom of the group of the experts and the capability of the computer, which consists of the group of the experts, the computer, the Internet and Intranet. Hall for Workshop of MetaSynthetic Engineering (HWMSE) in 1992 to solve those open complex giant systems problems, such as economic system, social system, environment system and military system etc. (Qian, Yu& Dai, 1990). The formulation of idea of HWMSE

assimilates both theoretical and practical knowledge, such as seminars, meta-synthesis from qualitative to quantitative approach, CI S and war gaming in military sciences, information technology, artificial intelligence; virtual reality; systematology, and other

new advanced technologies. It aims to exceed the traditional decision support systems (DSS), which mainly based on computers, to man-machine hybrid systems, where people play main role to give judgment for strategic planning and decision analysis.

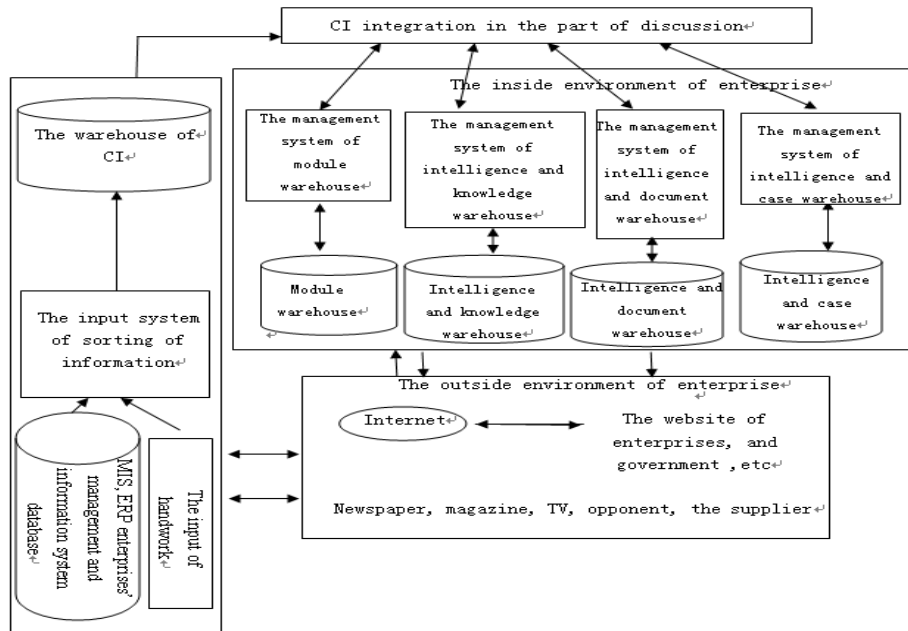


Fig.1 Process of CI integration from qualitative to quantitative

There are three systems in HWMSE, machine system, experts system and knowledge system, where machine system does not only limit to a traditional DSS but refers to a network system, such as the Internet. Experts system puts people as the principal role in HWMSE, and machine system helps people work. For strategic and critical problems, experts are selected based on those information such as background, age, knowledge and experiences stored in experts system. Knowledge system not only consist available knowledge stored by machine and experts systems, but also new knowledge produced with in the Hall. Actually both the experts system and machine system are carrier of knowledge in knowledge system. Then the Hall not only has

abilities in collecting, storing, transferring, analyzing and synthesizing information and knowledge, but also abilities for creating new Knowledge. (See Figure 2). Therefore CI Hall for Workshop of Meta-synthetic engineering is an embodiment of highly intelligent man-machine collaboration. Its design needs to integrate various decisions supporting system, such as the existing intelligent decision supporting system, group decision support system, and the key is to address three issues: “ from Qualitative to Quantitative analysis”, “Synthesis and Integration”, “Hall for Workshop”. In the following part, we will focus on the analysis of the “Synthesis and Integration” and “hall for workshop”.

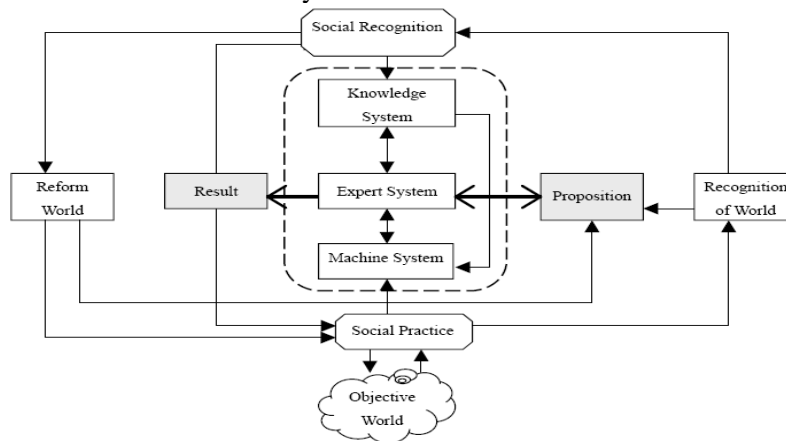


Fig.2

3.1 Realization of Synthesis and Integration

Synthesis and Integration refers to the technology integration, data integration, network integration and application integration in designing the “Competitive Intelligence Hall for Workshop of Meta-synthetic engineering” (see Figure 3). Technology integration means that the design of hall for workshop shall involve the integration of such information technologies as distributed network technology, multimedia technology, model bank and data warehousing technology, fuzzy decision-making and qualitative reasoning and analysis, among which the distributed network environment is the hardware and software environment backing the Hall for workshop, and the material basis for building such a hall. Data integration is the core of synthesis and Integration. The data base, model bank, knowledge bank, file bank, case bank of the hall for workshop are carriers of various resources, integrating different types of existing data, different problem analyzing and solving methods, calculation methods, and various related rules and knowledge. Some of these data is from internal MIS (MIS、ERP、CRM), some from the enterprise website, some from newspapers,

magazines, TV, competitors, and suppliers. Some of these data is recorded automatically, and some is recorded manually. Data integration allows the data to be managed in a distribution way, while the data ware management system, model management system, and knowledge bank management system allow the data to be displayed, visited, synthesized and treated. Network Integration means that the Hall for Workshop should be linked seamlessly with the Internet, intranet, and extranet through corresponding network protocol and interface technology with the purpose of realizing data integration and application integration as well as meeting the requirement of an open system design. Application integration means that the hall for workshop is able to provide experts participating in the workshop with various resources in the system. The participants may have remote access to model warehouse, knowledge warehouse and file warehouse, and share the resources. Meanwhile, the hall of account setting, limitation of visit authority setting and various security protections can manage the experts centralized.

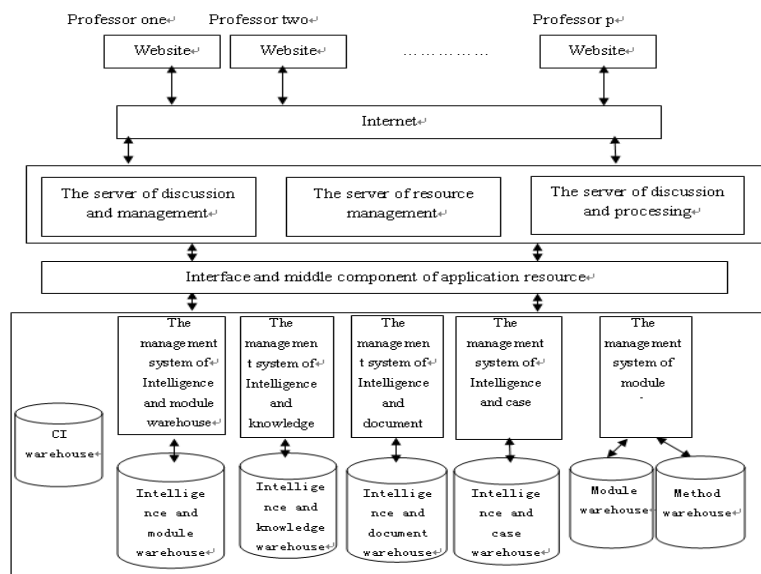


Fig.3 Data Integration Model of CI Hall for Workshop of Meta-synthetic engineering

3.2 The Realization of Hall for Workshop

Hall for Workshop refers to the design for the overall workshop and the functional structure. Experts would first confirm their legal identity through registration, and then enter role management in the Hall for workshop. The hosts are entitled to proposing the topic, determining the intelligence template, managing time, managing the discussion process, and saving the discussion results. The participants have the rights to use different workshop management tools, including retrieving information, referring to

the group discussion, requesting speak, electronic vote. The host is also entitled to using these tools. The system shall also have function of discussion state management, i.e. during the process of “participants” discussing, system should note the present statue in time, informing the experts the contents to be discussed, participants, the type of intelligence template being used, and time schedule of the workshop, and offering speaking management. As the realization of Competitive Intelligence Hall for Workshop of Meta-synthetic engineering is rather

complicated and cannot be built within a short time, the concept of prototype method can be introduced to guide the implementation process, namely, build a

workshop prototype first, which is small-scale involving centralized departments, narrow intelligence scope, and fewer experts. (see figure 4).

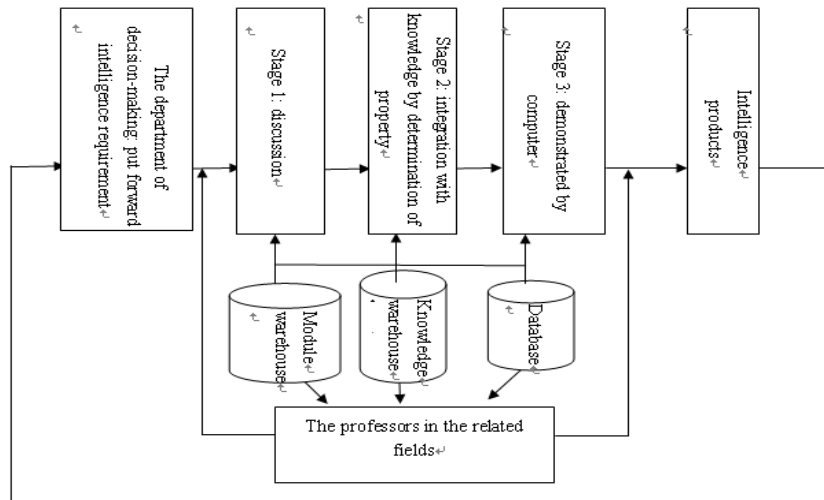


Fig.4 Structure of Prototype System for CI Hall for Workshop of Meta-synthetic engineering

4 Conclusion

Competitive Intelligence Hall for Workshop of Meta-synthetic engineering from Qualitative to Quantitative analysis is an innovative way of thinking and method aimed at solving complex system problems. It will be increasingly optimized with the development of system science, artificial intelligence and computer technology. The Hall for Workshop method is of great significance to improve the work process and decision effectiveness of group intelligence activities. The enterprise competitive intelligence system will trespass the limitation of the old system which can only offer assistance to decision-making on structural problems, and become free from the confinement of department, organization, location, time, and the computers, enabling experts of different fields to share and exchange information both within and outside the company to discuss large numbers of non-structural strategic issues. It is definitely conducive to improving the agile reaction capability of enterprises.

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