Research on Competitive Intelligence System of Enterprise

YU SUN   CHANGCHUN GAO
Glorious Sun School of Business & Management
Donghua University
Shanghai, 200051 China
1882 West Yan'An Rd., Shanghai 200051
P. R. CHINA

Abstract: This paper analyzes the complex characteristic of enterprise competitive intelligence system (CIS). Establishment of CIS of enterprise is an important approach to promote the research level of enterprise CIS．All methods and techniques can be integrated from other science fields into CIS research through CIS．The author put up with the architecture of CIS, which includes fundamental architecture，and applied architecture．The architecture of CIS should fit to the complex characteristic of CIS．

Key-Words: CIS，structure of CIS, CI Integration, hall for workshop

1 Introduction

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.

Presently, since CI research is still in the developing period, so far there is no uniform definition. Some foreign scholars began to study this subject earlier than in China. Professor John E. Prescott of Business & Economic School in Pittsburg University in the US thinks that CIS of Enterprise is a keeping evolving enterprise management system which combines normal and un-normal operation processes. Its mainly function is to organize members evaluating the crux developing trend of a industry, tracking the non-continuity appearing change, catching the evolvement of industry structure and analysis ability and trend of present and potential competitors so that help the enterprises keep and develop the durative competitive 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.

1.1 Complexity Analysis of CIS

The principal part of CI action 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.

CIS is not only used in making competitive strategies, but in surveilling 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 this 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.
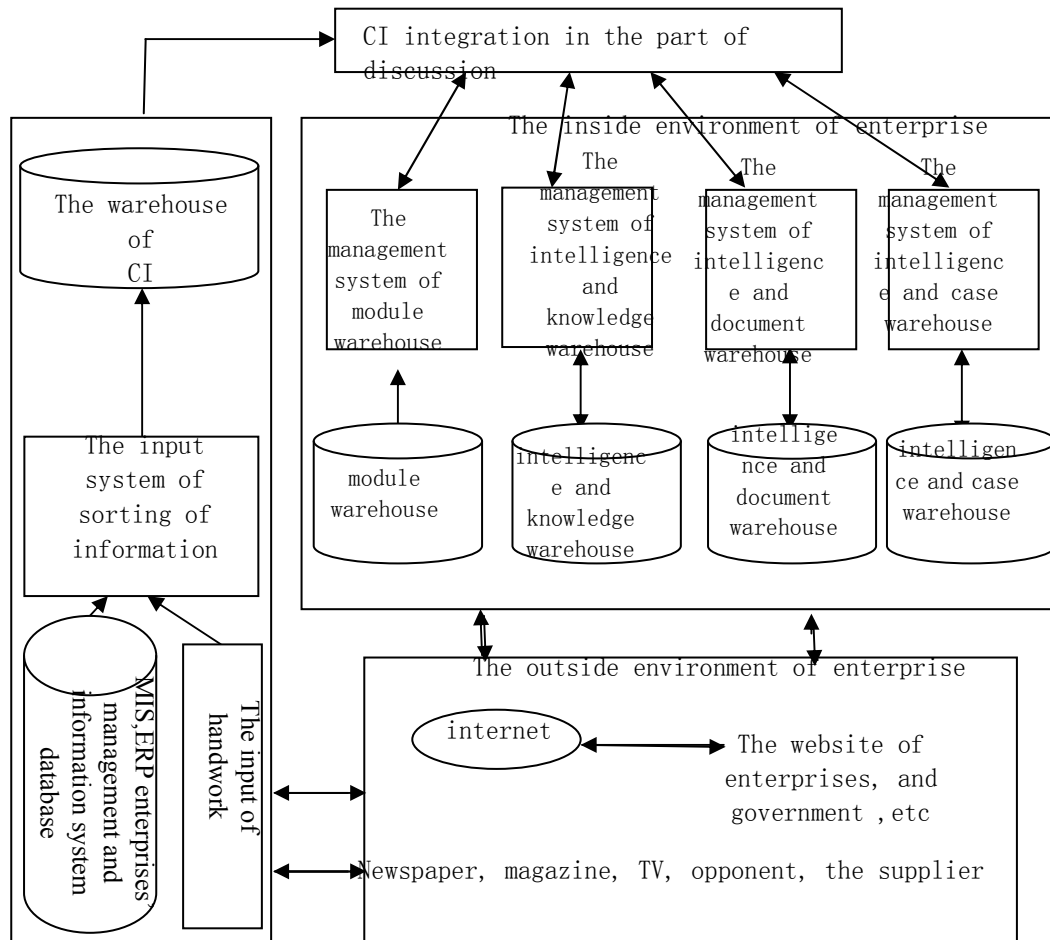
1.2 Function analysis of enterprise CIS

Refer to the currently systems, 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 are mainly emphasize particularly on three parts: information collection, solving and spread. In the aspect of information collection, upon the development of search technology, these softwares 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 softwares 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 the whole CI software design. Some software companies use the Business Intelligence (BI) as Competitive Intelligence (CI) to spread, however, they have essential difference. I software typically deal with date base and quantitative analysis; CI software intensively depends on the collected information and qualitative analysis. The complex of competitive intelligence requires it different from the ecumenical enterprise management information system and decision-making support system. In this paper, we believe that base on the enterprise Intranet, Extranet and Internet, build distributed multimedia database, model-base and intelligence base, having advanced expression ability of knowledge, intelligentized alternating environment. The "competitive intelligence Hall for Workshop of Meta-synthetic Engineering" will be an important approach to solve the problems of competitive intelligence of enterprise semi-structurize, non-structurize. It supposed to be indispensable complementarity of current competitive intelligence system.

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-machine synthesis concept, addresses problems as a whole, and synthesizes information and knowledge of experts at different levels and in different fields to achieve a quantitative understanding of the problem.

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 graph 1.

From graph 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

```
┌─────────────────────────────────┐
│ CI integration in the part of   │
│ discussion                      │
└─────────────────────────────────┘
```

The inside environment of enterprise

| The warehouse of CI | The management system of module warehouse | The management system of intelligence and knowledge warehouse | The management system of intelligence and document warehouse | The management system of intelligence and case warehouse |

The input system of sorting of information

module warehouse

intelligence and knowledge warehouse

intelligence and document warehouse

intelligence and case warehouse

MIS,ERP enterprises management and information system database

The input of handwork

The outside environment of enterprise

internet

The website of enterprises, and government ,etc

Newspaper, magazine, TV, opponent, the supplier

Graph 1 Process of CI integration from qualitative to quantitative

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

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", "Synthesization and Integration", "Hall for Workshop". In the following part, we will focus on the analysis of the "Synthesization and Integration" and "hall for workshop".

3.1 Realization of Synthesization and Integration

Synthesization 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 graph 2). 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 synthesization 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.
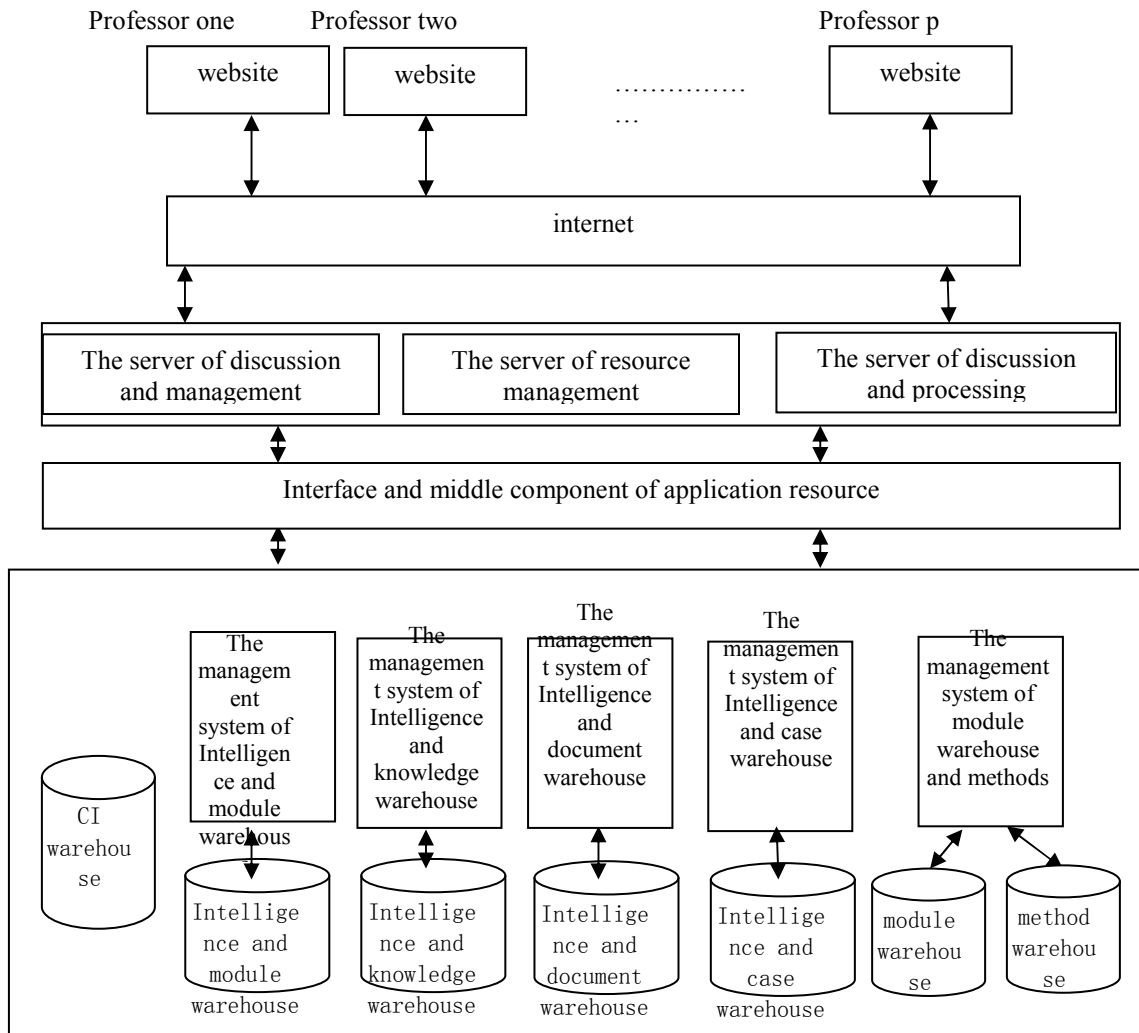
Graph2 Data Integration Model of CI Hall for Workshop of Meta-synthetic engineering

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 protection can manage the experts centralized.

3.3 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. Roles in the Hall for workshop include the host and participants. Different roles are entitled to different authority. 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 graph 3).
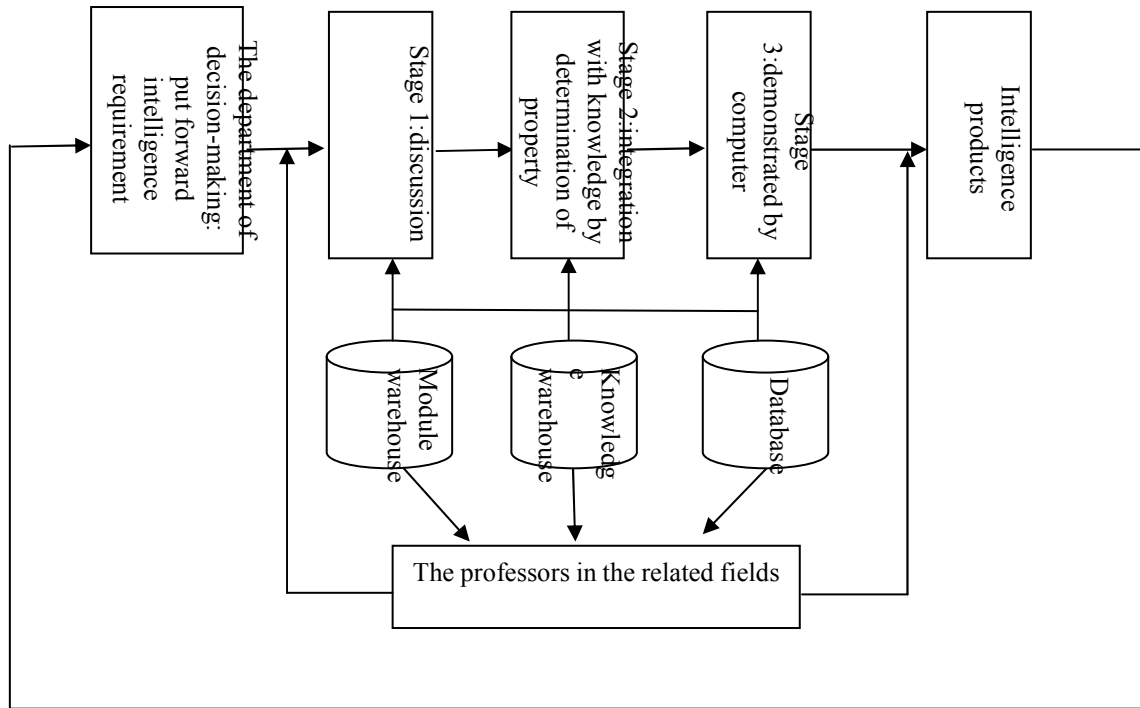
Graph 3   Structure of Prototype System for CI Hall for Workshop of Meta-synthetic engineering

Specifically, the experts can complete the whole workshop process with the browser, and can visit all resources in the system through resource management server including competitive intelligence knowledge warehouse, competitive intelligence data base, competitive intelligence file base, and the competitive intelligence case bank. The system accomplishes control on the status and process of the workshop, and generation and restructuring of the universal template through workshop management server. Besides, the system accomplishes data transfer, data transform 、

calculation and process of models between the intelligence template and model bank through workshop management server. Meanwhile, among servers, isomerous connective interfaces are offered by through mid-components among different resources to realize the interactive and connective in different sorts of data. The main purpose of building Prototype System Hall for Workshop is to prove that Hall of workshop for Competitive Intelligence Integration from Qualitative to Quantitative analysis is an effective way to solve complex problems. The prototype system can be gradually expanded to

realize an extensive CI Hall for Workshop of Meta-synthetic engineering with complete functions and larger scale covering the entire enterprise and broader scope.

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.

References:
[1] Dai Ruwei, Cao Longbin. Research of hall for workshop of metasynthetic engineering. Journal of Management Sciences in China,2002 ,5(3) :10～16
[2] Qian Xuesen. Creatng Systems Science. Taiyuan: Shan Xi Publishing Company of Science and Technology.2001
[3] Michel·baud. Competition. Beijin: Zhong Xin Publishing Company,2003
[4] Dai Ruwei, Cao Longbin. On Metasynthesis and Decision Making. Journal of Computer Research and Development,2003 ,40(4) :531～537
[5] Bao Changhuo, Xie Xinzhou. Developing Enterprise Competitive Intelligence System. Competitive Intelligence. Beijing: huaxia Publishing Company,2002
[6] Leonard M. Fuld. Intelligence Software Report 2003—AReview of Twelve Software Offerings in the CompetitiveIntelligence Arena. Fuld &Company ,http :PPwww. fuld. Com.
[7] M.E.J. Newman. The structure and function of complex networks[J]. SIAM Review, 2003(45):167-256.