ISSN : 0974 - 7435 Volume 10 Issue 11

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(11), 2014 [5624-5632]

Study on applying the computer network technology to construct the enterprise information system

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ABSTRACT

In this paper, it utilizes the computer network technology to construct the enterprise information system (EIS). By researching the current development and collecting the leading-edge information of computer network, it determines to apply the computer numerical control (CNC) technology and the CNC system to construct EIS. During the study process, it introduces the TRIZ theory to resolve the contradiction between the design of EIS and CNC system, in addition, it uses BSC (a tool used for performance management and evaluation) to analyze the development of enterprise strategy and make the EIS satisfy its development. Results: firstly, it proves rather practical to apply computer network technology to construct EIS: secondly, the object of the EIS conforms to the development object of enterprise strategy, which propels the development of enterprise and enhances its core competitiveness.

KEYWORDS

Computer network technology; The construction of EIS; The enhancement of enterprise's core competitiveness.

INTRODUCTION

Enterprise Information System (EIS) is an information platform that can apply computer network technology to interact with customers, issue advertisements, look for market resource, manage and decide information and transact with other customers online. By constructing this system, enterprises can promote its image, issue the commodity information and classify their category and search the relative commodity from market to realize the e-commerce service. And the system is also an effective tool to manage the customer information, look for the market resource to realize the marketing decision, expand the market share and promote the production efficiency[1].

The construction of EIS has been discussed by many scholars in and abroad, including Guo Hu and Jinsong Li. In 2010, Guo Hu researched the construction of EIS in mineral enterprise and studied its information organization and structure based on the research results of EIS construction and finally construct the EIS of mineral enterprise from the following aspects: users, environment, content and function. In 2004, Jinsong Li studied the construction of EIS on the e-commerce platform and finally provided a frame to construct EIS, found some problem it had met and put forward relative solutions as well[2].

On the basis of premier research theories and with the rapid development of computer network, through applying the computer network technology, the study in this paper wants to find a practical and effective way to construct EIS.

THE CONSTRUCTION OF EIS UNDER THE BACKGROUND OF COMPUTER NETWORK'S DEVELOPMENT

The Structure of computer network system

Computer network is a new emerging discipline that referred to many knowledge and regions. It has a close relationship with other disciplines and they depend on each other. With the rapid development of computer network technology, this discipline has applied this technology to organize an internal scientific network system as described in Figure 1.

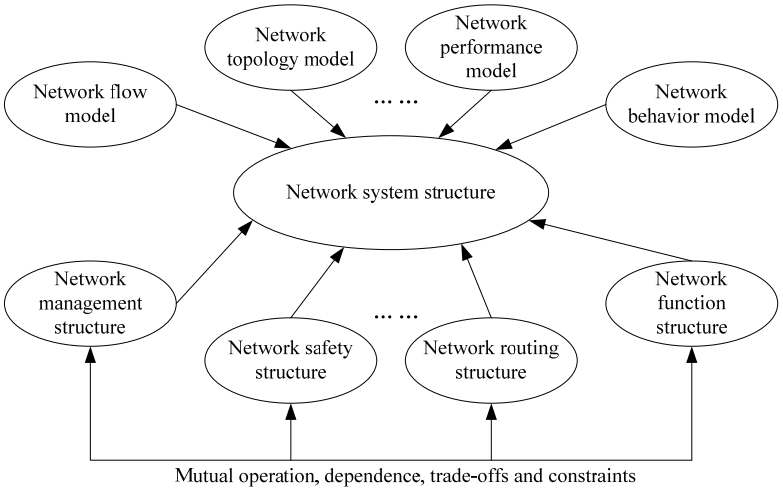

Figure 1 : The structure of computer network system

The construction of EIS needs to apply the computer network technology and also needs the introduction of the computer network's structure[3].

Hierarchical analysis about the function of EIS

Applying the computer network technology to construct EIS, which can be divided into three levels and the bottom network of which is Web-CNC as described in Figure 2.

Web-CNC is used to control the working spot of enterprise and the top is ERP that functions as determined factor while the middle is MSE that functions as middle management institution, including monitoring, management, allocating and other internal control mechanisms. The purpose of the construction of EIS is to deal with the enterprise problem in an integrated way and realize the integration and utilization of information inside each level and among different levels. Generally, we define the exchange of information among levels as vertical integration and the interaction of information inside one level as horizontal integration[4].

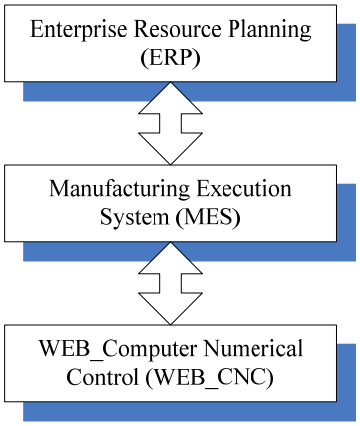

Figure 2 : Hierarchical function of EIS

Supply chain consists of suppliers, manufacturers, distributors and retailers and customers. Supply chain management (SCM) is applied to manage the information flow, commodity flow and capital flow and at the same time plan and coordinate them to closely connect supply and sale. Supported by supply chain, Enterprise Resource Planning (ERP) is applied to integrate production system, financial system, sales system, engineering system, purchase system as an integrated system. In EIS, product data management system (PDM) is mainly used to deposit, withdrew and control all product data and manage the information about product structure, development process and development personnel at various stages in the whole life cycle of products to ensure the integrity, security and consistency of data and let all structure layer efficiently and easily obtain relevant data[5].

THE METHOD OF CONSTRUCTING EIS BASED ON THE COMPUTER NETWORK TECHNOLOGY

The application of TRIZ theory and BSC tool

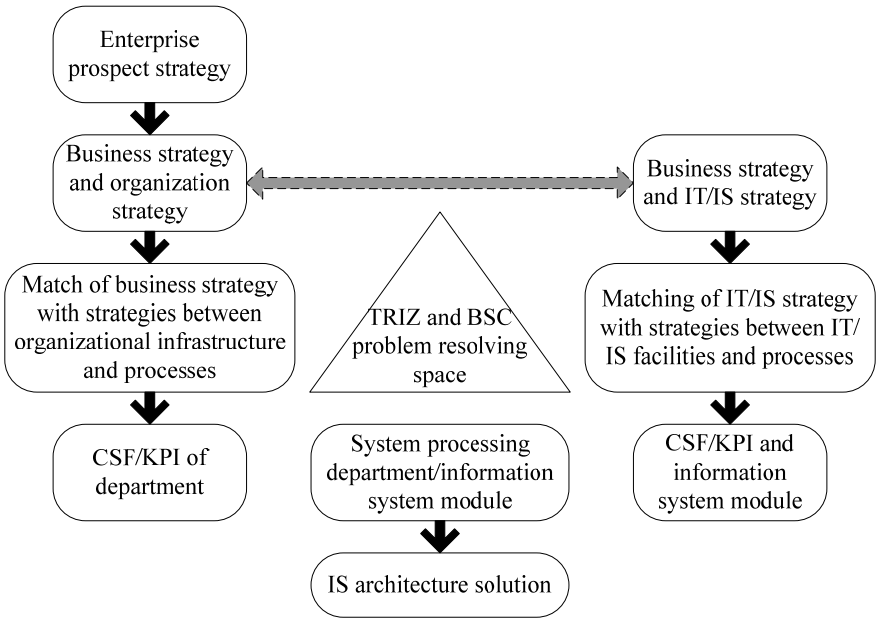

Figure 3 : The construction map of EIS based on TRIZ theory and BSC tool

The study applies the TRIZ theory to analyze the problems the planning process of constructing EIS has faced, build EIS theory model and according to various stages choose different methods to make progress goal. Meanwhile, it applies the BSC tool to discompose the strategy and process of enterprise to obtain the critical successful factor (CSF) and key performance indicator (KPI). By doing so, it can combine the business strategy, infrastructure construction, information system construction with IT/IS infrastructure strategy to construct mathematical model. Taking an aircraft manufacturing enterprise as an example, it applies the TRIZ theory and BSC tool to realize the computer simulation of information system's architecture design[6].

THE CONSTRUCTION OF EIS MODULE BASED ON THE COMPUTER NETWORK TECHNOLOGY

The design concept of constructing eis by applying TRIZ theory

Innovation is a process to apply the creative thinking to look for problems unknown and put forward the solution. TRIZ theory, a theoretical innovation that includes technical system evaluation theory, ideal final result, 40 principles of invention and innovation and conflict solving principle, can provide systematical theory and method to help mankind find even resolve problems in a creative way and be helpful for the construction of EIS[7].

Technical system evolution theory in the construction of EIS

In TRIZ theory, the evolution of technical system has gone through four phrases-infant, growth, mature and declining, of which with the development of technology, the EIS will be more perfect. Furthermore, the theory can provide scientific guidance and assistance for the planning and developing of EIS. By seeking help from the system evolution model, evolution rule, evolution route and application model represented in technical system evolution theory, the designers can rapidly determine the original concept of innovative design and according to the evolution discipline, propel the structure and process of information system at various stages to develop from simple to complex, junior to senior and single to multiple system[8].

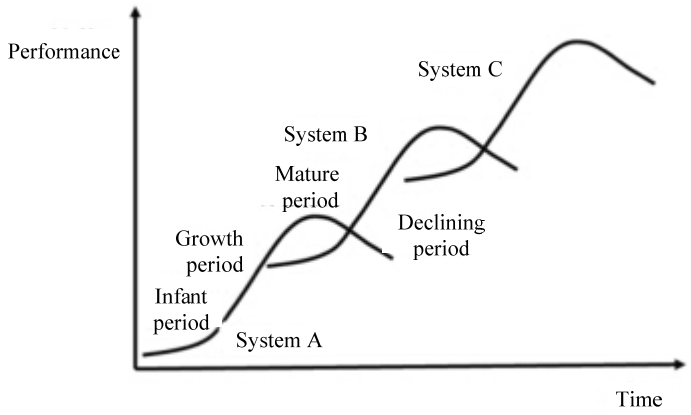

Figure 4 : The technical system evolution graph in designing and constructing EIS

The Figure 4 above shows that the development model of three systems is from A to B, then to C, that is, A→B→C. During the renewal process of system, to realize its sustainable development and ensure enterprise's productive efficiency, the enterprise should spend time investing new system before the declining of the old system. With the changing of enterprise's development and strategies, EIS will change relatively and keep pace with the development of enterprise to closely link with the former system. EIS has developed from birth to growth to maturity, finally to declining and then replaced by new system. By regarding the identity as the measure indicator to evaluate the technical system performance and dividing the evolution stages, the enterprise could implement different informational strategy in various stage and the construction of EIS should keep pace with its development[9].

The ideal final result of the construction of EIS

In TRIZ theory, the ideal result obtained by system is called ideal final result (IFR), which is to be reached by the improvement of all techniques and products. Identity stays in a level close to the ideal state. The external expression form of function realization, judged from positive and negative aspects, is the technical system.

$$\text{Ideality} = \sum UF / \sum HF \quad \textbf{(1)}$$

In Formula 1, identity is equal to dividing the amount of harmful function (HF) by the amount of useful function (UF). The competitive ability of products and enterprises rises along with the increasing of identity. HF represents the amount of costs and harms while UF represents the amount of benefits.

$$\text{Ideality (IS)} = \max(\sum \text{Benefits}) / \min(\sum \text{Costs} + \sum \text{Harms}) \quad \textbf{(2)}$$

In Formula 2, ΣBenefits represents the total amount of benefits, ΣCosts the total amount of costs, such as the material cost, time, space, resource, the complexity, energy and weight, ΣHarms the total amount of harms, such as waste and pollution. From the Formula 2, to keep the identity in a maximum state, we should keep the function and benefits in maximum and control costs and harms to a minimum state. If the ideal final result can not be reached, we can adjust and calculate the low-level solution. For example, because it states in the early development phrase, the enterprise will not realize the complete construction of EIS, it had better set a suitable goal and choose to construct an incomplete information system[10].

From Formula 1 and 2, we know that the IFR of IS planning could be classified into three aspects: firstly, viewing from the benefit it obtained, it can realize the expected object and implement all functions the enterprise asked to keep pace with the development of enterprise and match with the

enterprise's strategy in a safety and stable way; secondly, viewing from the costs it needed, it needs the lowest operational cost and research investment; finally, viewing from the harms it produced, there will not be harmful for the constructional and operational process, including the production of waste, noise, electromagnetic radiation. However, this ideal information system does not exist in reality, but we can take it as the final goal of the development of EIS. The following Figure 5 shows the process of technical evolution that sets n goals for the development of system, of which n is the final goal to realize IFR and if we can not reach n, then adjust the goal as n-1, doing so continuously until we find the matched phrase goals.

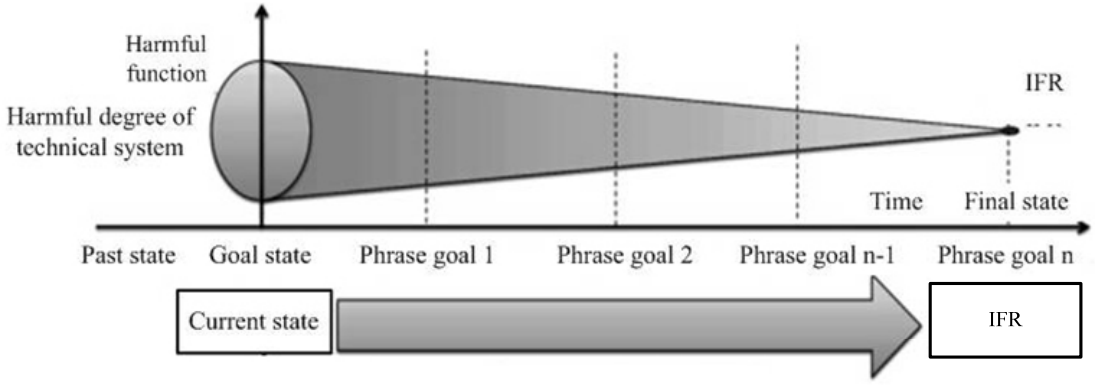

Figure 5 : The ideal development process of technical system in EIS

EIS that applies the computer network technology must be constructed on the basis of the complete information of enterprise and its development process evolves from low level to high level until arrive the highest ideal result. According to various development phrases, enterprise should adjust the implement strategy to complete the matching from incomplete to complete then to the ideal state between EIS and its development, to construct the structure from no information to complete information then to the ideal information structure among the construction processes, to realize the integration from no information to integration then to the highest level of integration. For the degree of information determines the enterprise's ideal level and the higher the ideal level is, the strongest the enterprise's core competitiveness.

Methods of resolving the conflicts and contradictions in the process of designing the construction of EIS

The nuclear principle of TRIZ in resolving the conflicts is to provide solutions to solve the problem rather than ignore it. To solve the main contradiction in the process of constructing EIS, the conflicts can be classified into particular problems, problem description and principal contradiction. The solutions put forward by applying TRIZ theory can be seen from the following TABLE 1.

TABLE 1 : Solutions to resolve contradictions in the process of designing the construction of EIS

Particular Problems	Problem Description	Principal Contradiction	Solutions
Matching of business strategy with strategies between organizational infrastructure and processes	How does the business strategy play roles in different departments and such processes as manufacturing and management ?	The final performance reflects the low efficiency in business strategy, organizational infrastructure and processes and the unbalance distribution of benefits and resource in various departments.	Dividing the enterprise strategic goals into several steps and applying BSC tool, KPI, CSF and BSP to reflect the business characteristics of enterprise in manufacturing and management.

Matching of IT/IS strategy with strategies between IT/IS facilities and processes	How to apply and implement IT/IS strategy in different departments and processes and how to resolve the management contradiction	IT/IS strategy can not match with its facilities and processes and the development of information technique. And the technique and management of it lag behind as well.	Establishing IT balanced score card and relative KPI evaluated indicator and the suitable information strategy. Meanwhile, establishing, improving and updating the information module data dictionary.
Mismatching of business strategy with strategies between organizational infrastructure and processes and mismatching of IT/IS strategy with strategies between IT/IS facilities and processes	How to choose the information system module to realize the business strategy and match with each other among various departments and management processes.	IT/IS infrastructure and process can not match with the real application and incomplete information system will devote to the information island.	Establishing the information system module that suits for various department and processes. Applying CSF, KPI, BSP as intermediate variables to establish the information system structure of enterprises.

From the Figure 3 and TABLE 1 described above, we utilize 40 inventive principles and physical analysis model of TRIZ theory to design the construction process of EIS.

EIS can effectively match with business infrastructure and process. Applying SWOT and 5 force model to analyze the strategic environment of enterprise and combining with enterprise's development situation and objective to analyze the internal and external environment of enterprise to predict a scientific strategic goal of the next few years. Applying BSC tool to analyze enterprise's strategy and construct mathematical model to form a strategic model. Meanwhile, utilizing value chain module to determine BP, CSF, KPI of all departments and by analyzing, comparing and assessing these indicators to conclude all department information needed and provide reference for the construction of EIS.

Application of TRIZ theory: firstly, the first principle of 40 principles is segmentation principle, that is, segmenting the object into several independent small parts so that at any time the object can be disassembled to several parts and when needed, it also can be quickly combined into a whole object. During the constructing process, we should consider the corresponding relation between enterprise's strategic development and EIS and apply BSC tool to segment enterprise's strategic vision into concrete KPI indicators; secondly, the second principle is the extracting principle, which is used to extract the critical and useful "negative parts" or the part we needed from objects. According to the requirement of different KPI indicators and the characteristic of extracting parts, to achieve the indicators of enterprise and extract the most useful KPI indicator to combine CSF. There is one point to notice that we should deal with negative or unimportant parts separately.

Matching of IT/IS strategy with fundamental structure. Under the guidance of IT/IS strategy, we construct the relation model of EIS fundamental structure and at the same time apply the evolution route of technical and identity to decide the current development of information and establish information system module data dictionary. IT/IS module data dictionary can be utilized to ensure the possible useful EIS module and CSF/KPI can be applied to determine the possible applied information system module.

Application of TRIZ theory: it refers to the fifth principle of 40 principles, the combination principle, which is used to combine the adjacent or auxiliary operational objects in space, combine the same or similar in time and combine EIS module. By using combination and case, we make a classification about the information combination of EIS to form data dictionary that convenient for information management and searching. After comparing the performance of EIS module with CSF/KPI, we combine the module that function matched to form a new information system.

Matching of IT/IS fundamental structure with organizational facilities and process. Taking the indicators that reflected the operation of enterprise as intermediate variables, such as CSF and KPI, to establish multiple assessment matrix as "enterprise business strategy-enterprise organizational structure and process-CSF/KPI-structure module of EIS-IT/IS strategy". According to the IS changing module,

determining the useful information system module in different departments to get the basic solution of EIS construction.

Application of TRIZ theory: The twenty-fourth intermediate principle of 40 principles is used intermediary to transfer objects and temporarily combine an object with another easy-removal objects. To establish the relationship between EIS modules and departmental or business process, we should take CSF/KPI as intermediary to establish multiple assessment matrix and apply relation operation and extraction evaluation to construct the framework of EIS.

The evaluation and implement of EIS. We should check, revise and assess the construction plan to ensure the strategic objective of EIS can match with the development objective of enterprise and to realize the expected objective of EIS. Finally, after being scientifically testified, revised and ratified by experts, the plan can be put into practical.

CONCLUSION

Applying computer network technology to construct EIS, during which the key point is to match the enterprise business strategy with IS strategy. To accomplish this objective in the construction of EIS, in this study it applies BSC tool to segment enterprise strategic vision and uses CSF, KPI and BP to build a close relationship. In the planning of IS structure, it puts forward the ideal enterprise development objective that should be taken as IFR of enterprise development. On basis of the previous research performance, the study focuses on the following two aspects.

Application of computer web-CNC technology. Successfully integrating the construction of EIS with the computer web-CNC system to construct EIS based on web-CNC system and applying the latest computer network technology to the construction process, which breaks the traditional limits.

Theory innovation. It successfully applies TRIZ theory and BSC tool to construct EIS. The data analyzed by BSC tool can be used to make plans for the construction and IFR is also introduces into the development objective of enterprise and the establishment of information system route. Thus applying TRIZ to eliminate the contradictions in planning and using BSC tool to segment business strategy, CSF and KPI to construct the information system structure of departments. All of these above are new research methods in theory.

Because the research studies the emerging region of computer network, the prospect is very broad. With the development of computer network technology, the research value will make further improvement. In the future, under the guidance of innovative thought and broad horizons we should focus on the application of computer network technology on the construction of information platform and explore more economic value of this technology.

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