J. Basic. Appl. Sci. Res., 2(7)7370-7376, 2012
© 2012, TextRoad Publication

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

Using Data Envelopment Analysis Software in Selecting Softwares Suppliers of Electronic Factories

Mansour Soufi

Department of Industrial Management, Rasht Branch, Islamic Azad University, Rasht, Iran

ABSTRACT

This paper aims to describe the application of data envelopment analysis (DEA) in relative evaluation of components of electronic factories. Therefore, the tables which were set up in methodology of electronic factories roadmap, dissected to mark the most important decisions needed to build factories in the third millennium and also describe the significance of these decisions in the success of factories. Among techniques of data envelopment analysis models, modeling without input or individual fixed input model were selected as a beam model of DEA for performance evaluation of components in these factories, the relative performance of factories and the introduction of the test factory. The concept of performance measurement in electronic factories, electronic factory roadmap, scenario and tables of electronic factory roadmap were described to present a proper model of performance evaluation. As the electronic factories are stractured and CCR model without inputs actually is meaningless; also according to the CCR model with constant input or output individually is consistent with its corresponding BCC model, all models of BCC including without the input and output or radial DEA models can be used. All BCC model including without inputs and outputs can be changed to models with a less variable (Radial or beam efficiency score) and models with a lower limit (convex constraint). Therefoe, the only model that is consistent with this condition is the output-oriented BCC model without input.

Keywords: Electronic Factories, Data Envelopment Analysis, Roadmap, Senario.

1- INTRODUCTION

Globalization is a term that despite its growing, applications is difficult to define and has not a precise definition consistent with scientific standards. It is integration in economics, politics, environment, and social development (eilbeigi asl & et al,2012). Globalization is meaning to unlimited competition, development, inefficient loss of boundaries between countries, cultures and organizations in the areas of public and private (Soufi & Gilaninia, 2011). In today's global market, a company's success will depends heavily on its coordinate ability to a complex network of business relationships among supply chain member (Keebler &et al, 1999; Anvarirostami & et al, 2004,Zarezadeh & et al,2012).Generally, the approach of globalization oversees a wide range of phenomena which includes economic aspects, culture, trainingstructure, technology even everyday preferences. In the information age, we are witnessing the formation of space in which various activities such as information, tillage data, services, control and communication through electronic mechanisms and virtual in the name of “information exchange space” (Cyberspace) has been done. We all know that the world is moving from industrial society and entering the "information society". Information technology (IT) has weak foundations of industrial society to set up information society columns. As the transition from the agricultural age to industrial age created the challenges and problems for human, stepping into the information age also is with some problems. Passing the challenges ahead that is deeper and more powerful than the previous transition, needs fast, flexible, innovative oganizations. Today's, business environment has been highly competitive for industrial units and is becoming more complicated every day. Sooner or later all the production units have to accept this complex and competitive environment; therefore essential capabilities to expedite the implementation of its terms with changes that occur in their business should be obtained. Obviously, any company that can provide faster and more successful with their implementation is under development and that is why the concepts of knowledge management, fast learning organizations (FLO) and fast-responding organizations (FRO) are discussed to complete the concepts of learning organizations and organizational learning.

As management thinkers have suggested the only success factor for organizations in the information age are employees and managers. the industry has developed (Gilaninia & et al). They confort the challenges with their intelligence, expertise and broadervision to the issues and create proper devices in this way (Knox Lovell, Jesus, Pastor,1999)

Technology is a key element in competition (Alipour & et al,2012). Electronic factory is a modern and evolving phenomenon. Drawing the roadmap is helpful for the optimal planning and decisions about choosing the best technologies and processes of electronic factory creatation. Many factors affect the design of electronic

***Corresponding Author:** Mansour Soufi, Department of Industrial Management, Rasht Branch, Islamic Azad University, Rasht, Iran. Email: soufi@iaurasht.ac.ir

factory and many decisions must be made to select the best tools. The problem can be analyzed and decisions can be optimized quickly and accurately by selecting a right solution set. Selecting the software for components and overall performance evaluation of electronic factories is one of the most important decisions in these systems. This paper aims to introduce the road map of millennium factories and explore questions and identify the best methods for evaluating its performance, and professional with regard to the characteristics of these emerging systems get this question that whether the current methods are responsible for their performance evaluation or not? Whether a modification or even invention of a new method is required or not?

2- Concepts

2-1- The concept of performance measurement in an electronic factory

Considering that developing countries will find to increase its production during next few decades (Kiani & et al,2012). Current era is called post-industrial or information era (Gilaninia & et al,2012). Real time control in electronic factories in addition to the correct technology needs a proper performance measurement strategy. Dynamic organizations are against organizations static (soufi & panahandeh,2012). Performance measurement is required for product line, manufacturing facilities and corporate-level control. The best performance measurement systems use the activity indices. In other word, management use devices that the process evaluate on the basis of activities. These systems make decisions based on time and performance not budget and forecasting. For instance, using this system to measure cost, make easier the understanding of the effects of some decisions on the usefulness and also customer satisfaction. Using this measurement system can provide information that could be used to feedback control. Activity assay and performance to cost the modeling, quality, reliability and production efficiency can be converted into monetary units.

Generally, there are four levels of cost on activity centered: The first level is unit level. Costs of this level associated with establishing a production unit, including direct and indirect activities which help to create this unit. All resources (including human, machine, material and services) are in this level. The second level is the founding and establishing which is included the costs of establishment, dissolution of a unit, process of trade and other expenses. The third level is the level of support and maintenance of products. Cost of this level is associated with developing and enhancing products and production process and also include activities related to before and after production that help planning and creating a unit. The fourth level is the level of facilities. The costs of facility level is used to make easier the public and indirect activities. These include overhead costs, and funds which are not directly related to the production.

Key performance criteria must be included the material entered, quality, cost, productivity rates, capacity, capability and availability. Criteria of material include the output per unit of time, meaning the amount that can be achieved through a process, time cycle of operation, types of material and its overall size. The quality of performance includes the effeciency of first grade products, work levels and features control process. Such rules must be used at all levels of the hierarchy, at each stage of processing and in each cycle of supply chain. Basic steps to improve productivity are the efficiency in the main sources of equipment, human resources and facilities. standards of facilities provided in the performance includes identifying access to capital stock, human resources, capable of current production and future capacity issues and list. (Charnes, & Cooper, & Rhodes, ,1978). Standards capacity of existing facilities make clear that how much you can scale up and down the board? Whether additional resources are needed? and whether existing resources can be mobilized for new applications again or not?

2-2- Electronic Factory Roadmap

The method presented is to facilitate the mapping of virtual factory. Accordingly, using structured systems analysis approach (SSADM) is very easy to create electronic factory roadmap. Fundamental and key component of this approach is scenario analysis. Another important component of this approach is data base technology. Both components of decision making and planning options for organizing data into information should be considered to make decision easier. Starting performance of this approach by these two methods is a team formation for mapping road. The team must collect needs in an interative process with internal processes members, customers and suppliers courses.

The third step is an initial approach of the electronic factory. Drawing roadmap based on several steps, one or several scenarios is written for describing the work flow, materials and information in electronic factory. Number of scenarios must be included all key processes and their variety. After writing scenarios, appropriate senarion is selected by using solution sets of decision-making process. This decision sets received the data. The roadmap is draw with expert analysis and landscape integration of teams' members.

These decision software use the spread sheets technologies and the database technologies which are available on the market such as Microsoft Access and Oracle 8.

The main challenges when calculating the efficiency of electronic factory are as follows:

1- What are method or methods for data collection and classification of different sources of supply chains?

2- What are methods and techniques for data analysis and allocation decisions about the structure and content of the roadmap of a factory?

This methodology uses the scenarios for 1) the relationship of the required equipment, processes and technology, 2) the result of the decision tree to adopt the best decisions, 3) the requirements of customers, suppliers and internal processes 4) support system in both top-down bottom to top as interactive. After defining the scenarios, the database select the best combination of technologies set of matrix solutions (Solution sets) and also organizational processes and designs are put into operation.

The tables which are set in the roadmap methodology are including:

1- Table of defnation of scenarios: In this table all kinds of scenarios, and status differences of opinion whether they should be written is characterized to describe the nature of electronic factory.

1- The table of scenario production: contains the reasons certain activities performed, specific objectives and requirements necessary to develop scenarios and key parametric markings other scenarios (such as cycle time, cost, etc.)

2 - Cost schedule of activities: shows the costs of each activity in each scenario.

3- Defining the requirements: shows the list and definition of the needs of customers, suppliers and internal processes.

4- Definition of activities: includes the list and definition of the activities in each scenario incorporate.

5- Table of affairs definitions: is the list and definition of the matters that are included in all scenarios.

6- Table of the capabilities of the solution components: shows a list of the capabilities of solution set components which needs in scenarios.

7- Map of the solution set: is a diagram that is used for picture of the solution set map and its members in each scenario.

8- Definition of value needs: defines criterion value of requirements.

9- Table of the cost value definition: list and definition of criteria cost value

10- Table of the time value definition: contains of list and definition of criteria time value.

11- Table of the solution set evaluation: is a summary of how to effect of each member of solution set that achieve a need and provide the cost and time of cycle.

12- Table of set-up needs: shows list and definition of the basic steps of solution set installations in an electronic factory.

13- Table of roadmap solution set: identifies the best steps through the process to operate on the basis of sequence and requirements of solutions set installation (Banker and Morey, 1986).

2-3- Scenario overview

Setting different scenarios is a key part of the mapping methodology in electronic factory, because this scenario describes the way and methods that organizational processes must pass to meet the requirements, materials and information.

The method of scenario writing was created when systems analysis to describe the functions of a system. Scenario writing method can be put into operation by other techniques that have maps, drawings, process diagrams, data flow diagrams and tables of different activities. Because these techniques were always used and have significant growth over time and can be helpful to describe the subject with simpler and more understandable way beside the scenario. It is documented that the visual learning, such as the use of charts, maps, models and are much easier than theoretical training in training process. In simulations, one is completely in a similar situation of the main condition and decides in the same conditions and tests the comprehension and learnings by this way. In recent years computer-based technologies based on management objectives and results have had significant growth as a method for designing a system. Because, it has better logic for definition of interactions between man, machine and environment or ergonomics. According to "*Eddington* ", the base of system approach has been occurred for defining this communication. In fact, analysis of systems has occurred for understanding and how communication. Systems analysis is to understand and recognize the relationship between the processes governing the system and the relationship between organisms and machines within the manufacturing processes and systems, resulting continuous efforts to improve methods and make more effective communication and ultimately a more efficient system(Adolphson, Cornia and Walters, 1991).

For example, a target (either human or machine data) is base that encompasses behavior or data. These goals are the relationships and interaction with each other. Identifying targets, data relationships and interactions between them are the subjects that identify how goal-based technology can be used for modeling business processes. The best way to define clear goals and the relationship between them is writing a "scenario". Standard maps of organizational processes contain several different pathways; Selecting a way dependes on the initial conditions and the decision-making process that should be done at key points. During mapping organizational processes, especially in the "step by step" method, alternative ways or process scenarios are known. After that, the scenario on which to establish the optimal organizational processes is selected. A scenario offers a definition of alternative ways of activities and interactions between objects (Russell & et al,1986).Therefore, the scenario

provides a structure for determining the goals, defines the necessary data and expected output data at each stage, estimates resource consumption and identifies the data flow that is a basic requirement between the objectives to calculate the efficiency.

Correct understanding of "scenario matrix" is necessary for knowing what information is created during the mapping process of scenario. Scenario matrix has been established a series of activities that will be led to a scenario map. The scenario defines the relationship between the different activities and each component of activity and shows interactions between the process and interactions in-process.

Generally, the interactions can be between work flows, materials, data and internal processes of factory. For example, column related to information sources shows information that exists in the data flow diagram and the human resources, containing information on maps is a process. In techniques based on goal suggest that for creating the model, goal-oriented tools should be used for managing and optimization of maps and matrices of scenarios. One of the benefits of using this software is to create data flow diagrams, process mapping and simulation of the processes used in the same database-driven target scenarios. Also it causes that the "information systems" plan be consistent with the plan process. These advanced tools increase the effectiveness of a process model, speed of both the system and work flow. One of the features of these software packages is power of process analysis from high levels to low levels and finally to the level of activities constituted in the process. This method of analysis allows the process designer to complete first the prospects of the process and then focus on the definition of specific objectives of secondary processes. Analysis system enables organizations to continuously improve methods and reengineering processes as slow and steady with a holistic perspective (this prospect is known as Hoshin Conry of a gradual and continuous change).

Flexibility and speed are characteristics of goal-oriented organizational process model. The designer can use this method of alternative models based on "what - if" and provides that in any situation when the diagnosis is changed, modified or replaced by another process or processes even be re-used. Speed is the opinion that this can change the machinery used quickly so that to produce another product or a combination of system solutions that support the process change solutions. Organizational goal-oriented process model is growing, because the goal-oriented executive of institutions and systems. Emergence of various software is increased the flexibility of production systems by techniques based on the purpose and designing a process that uses a purpose-driven technology and simultaneously performs designing the system. Using the result oriented and target oriented models makes the best solutions set that provides the best strategies of the operational process is used for achieving custom solutions. While the trend toward delivery of the software, the speed is increased.

As scripting is a useful method for defining and organizing large data structures that reflect the needs raised by customers, suppliers and internal processes. The most essential information of an institution is the information about the list of activities constituting a process. List of activities explains material flow, information and tasks and responsibilities in an organizational process.

After information about process of forming activity, the most important information about relationships is a process component. The interactive elements include people, machines and tools of information technology (IT) such as database, system and application software and network resources.

The third batch of important information is about the inventory. This relationship shows that inventories are what number in each activity, what are the communication with, what to do with raw materials and generally what needs it provides.

This is the beauty of the scenarios that they define and organize the various organizational processes, products and premises, a process of transition of a system or writing system of boundary conditions. It means that to describe the different situations of an organizational process, the scenarios can be developed. Because, the needs to advance the electronic are very variable and increase very fast.

The point is that many of the needs that there isn’t now but there is the possibility of creating them should be predicted like chess game. Then the issue and hypothesis should be made for such these situations and scenarios can be developed and the solution can be determined when to face with such situations that may not have any previous experience about them. A practical guide should be for such situations. Given the sensitivity of the issue and our role in continuing and moving toward success, a professional team should measure and analyse conditions of the position accurately, after a clear definition of the situation, how to organize resources to continue moving should be developed in a specific scenario.

As approach of writing the scenario is goal-oriented technology, it can be developed for graded components of the target. For instance, a flow chart of work process through a set of strategic objectives that is the first steps of the working place can be defined. For the transition to a low level of activity, each step of a work flow is divided to the main tasks, the main activities is divided to sub-activities, the sub activities is divided to main activities and finally the main duties are assigned to other duties. As lower-level tasks and activities are explained in more detail, new goals may be defined and established in objectives set. In other hand, the new definitions, goals or objectives should be defined.

When goal-oriented definition comes to the high-level processes and consists of a greater levels of process details, it causes changes in the process flowchart. In this flowchart, different targets like a database, and

controller are defined to describe the data and be more specific. In fact, this new scenario has been done so that the relationships between all animate and inanimate objects would be defined; subsequently, the nature of electronic factory is explained and also interactions between machine automation technologies and human processes are described and assessed better than before. Different options of sloutions set also can be compared with the same scenario and can be selected; thus, with the valuation of various options, each option is intended for a specific position and put into operation. Here the techniques of data envelopment analysis (DEA) can be utilized.

If simple process is related to company producing fire machines toy; process can be divided into three basic steps: The first step is to build metal parts of machines. The second major step is painting. Assembling all parts and providing the item is the third step. This seemingly simple tasks can be faced with many changes and flexibility, for example, the fire machine can be produced in different colors, different sizes or additional accessories and light bulbs. It means that different kinds of scenarios can be developed for this work and regarding to the different situations of different indicators such as income level customers or customer and market share can be produced.

For example, one of the scenarios can be mass-production strategy; in this strategic, regard to senior managers decision, product would be produced in a wide range and placed in the storage . Then, it can be paid to marketing and sales using various methods of advertising such as use of media and catalogs. In mass production, a scenario could be so that instead of using sales force and product catalogs can be put in the "Web Site" as part of the internet (on line) and take orders and deliver them. In third kind of scenario, we do not have mass production; so that first the order would be taken and after production it wil be sold trough the net. In this scenario there are no other items of inventory and order materials needed to supply materials. After receiving the material, the order should be provided as soon as possible while the observance of standards and good precision(Soufi, 2005)

An independent company can be defined for each of the above scenarios. Providing these needs with three different factories is not cost effective and a factory should be ready to implement three scenarios in its production system. In the other word, factories should be ready for mass production and customization in different situations or conditions. This flexibility makes external changes that affects the environment. For example, factory automation changes the marketing methods and come in the form of electronic marketing. In this case, the electronic systems suppliers in the supply chain must link with the electronic factory system that make complex the evaluation of the new factory.

2-4- Data Envelopment Analysis

According to what was stated, various important decisions should be taken for establishment of an electronic factory. Successful of an electronic factory also depends on enhancement of these decision. Theses decisions are applied using heuristic methods that depends on personal power of the decision makers. Of course if we get enough data in a way that can be converted into linear programming models, decisions will be easier and more reliable. Considering the wide range of application of data envelopment analysis, it seems that these techniques and models are the most appropriate tools for valuation inputs and outputs and covering collective data. Therefore, the best option and even the best factory as a benchmark can be choosen using mathematical methods of different designs and determineing the priority options. As described, in all components of an electronic factory roadmap, a choice should be between different options that portfolio model without the input or output and models with a single fixed input or output can be used for this work. The most popular technique of data envelopment analysis or DEA models are 1) CCR model with multiple forms and envelopment 2) BCC model with multiple forms and envelopment 3) ADD model with multiple forms and cover 4) combination model.

Considering the electronic factories is structured and CCR model without inputs is meaningless, also the CCR model with input or constant output individually with its corresponding BCC model is consistent, thus BCC included in all models without the input or output or radial DEA models can be used. The BCC model including without inputs and outputs can be converted to the model with a lower variable (beam or radial efficiency score) and models with a lower limit (convex constraints).

DEA by Charnes and others (1978), CCR and BCC by Banker and others (1984) with were introduced to evaluate similar production systems relatively. However Adolphson and Associates (1991) indicated that DEA can be used to evaluate all aspects of systems with multiple homogeneous or multifactorial turns.

This approach was used by Thompson and others (1986) for the first time to determine the optimal position, "the cloud above the conductor" in the Texas area. The six sites with three factors including facility costs, user fees and cost of environmental degradation were considered. As outputs of all the sites are cloud above the conductor, the input-oriented CCR model were used.

Adolphson and others claimed that interpretation of these result as a system of economic production is possible but not useful. Therefore, they concluded that the results of CCR model requires such this interpretation. For the optimal solution of "above cloud conductor", the input-oriented BCC model was used. They believe that

convex constraints in the BCC model has positive effect on beam performance scores, they also found the same results and were not able to explain this. Later it was found that the CCR model with constant input or output individually and its corresponding BCC model are consistent.

Due to the unique characteristics of factories of the third millennium and author's familiarity with various models of data envelopment analysis, it seems that if we concider the radial efficiency score in a certain range and modelize with a lower limit (convex constraints), it can be get more favorable results in various ways of the factory. Each of the beam DEA models should be solved as a single-stage or without supplementary variable in objective function. In other words, to solve the beam DEA model using two-stage method, the first satge should be chacked and in such discussions it is better not to enter the unstable variables.

The main goal of article is to introduce electronic factory and software to evalute the relative of performance of similar software, therefore the mathematical foundations has not been provided here. Hence, the beam model without the input could be operated in electronic factories. Although it is difficult to accept DEA model without inputs, but Lovell and Pastor (1997) used this model for evaluating the performance of such administrative departments to target regulation in a large Spanish banks. The output of their study was " the precentage of target covering" including a set of 17 different target that no sources were considered as input. So the review was carried out with output model. From the manufacturing point of view can be argued that each branch office had an input and a "single fixed input". Therefore, the only model that is consistent with this condition is the output-oriented BCC without input.

All DEA software packages are performed by BCC model with constant input. Furthermore, since this model is the corresponding to CCR model, shadow price 1 can be assigned into a fixed input and got and relative prices in the output.

Due to the prices are relative, output prices can be easily checked with the BCC model without input and similar information about the more complex output model can be collected.

4-Conclusion

After forming team of roadmap and providing view and vision of electronic factory, operations of roadmap design of electronic factory are begun. Fundamental step of road map design is to gather information on needs, supply chain, suppliers and internal processes of electronic factory.

Another important step is to develop scenarios. Scenario is a set of goals and activities that defines the interaction between objects, materials flows and information in business processes. After or in parallel with formulating scenarios, components of solution set for domestic and foreign issues of electronic factory should be chosen. Solution set can be more than one component that is related to the electronic factories issues. To choose different solution sets, scenarios should be developed to help optimizing the decision selection. The objective of the roadmap development of voluntary solution set is to evaluate the inhuman goal in organizational processes by a component of the solution set.

After developing scenarios of each solution set components, roadmap of each set are evaluated to provide better solutions based on requirements and minimum cycle time and cost. The results of these calculations and evaluations should be led to choose the optimal solution. Operational and administrative needs can be determined for the roadmap design so that resources, time and cost shoul be organized in a multi-stage timetable. If the cost and time of operations are considered as evaluation criteria, how to set up the solution set so established for any component of this complex set can be evaluated in in parallel computing to be used for final decision of solution set. The best set of evaluation strategies would be selected based on different table, if only one table of roadmap solution set should is provided. Objective of the roadmap methodology is to ensure a well-defined electronic factories so that its operations is organized based on changing environment. In roadmap methodology many factors should be taken into consideration to resolve many issues of electronic factory.

This methodology should be able to quickly organize the issues, needs and provide alternative solutions and determine value of important factors. In other word, the roadmap methodology should be led to best decision.

Due to the unique characteristics of the third millennium factories and being familiar with various models of data envelopment analysis, it seems that if the performance score is concidered as radial and in the certain range and the issue modelized with a lower limit (limit convex), more favorable results in selecting solution can be get. Each of the beam DEA models as a single-stage or without suplementary variable should be solved in target function. In other words, to solve the beam cover DEA using two-stage DEA, only the first stage should be checked, beauese it is better not to matter unstable variables.

5- REFERENCES

Alipour,H;Gilaninia,Sh;Mousavian,S.J.(2012). Explanation New Channels of Services Distribution in the Banking Industry, *J. Basic. Appl. Sci. Res.*, 2(3)2901-2908.

Anvarirostami,Asghar, Alimohammadlou, Moslem .(2004). "Bank Service Quality from View Points of Customers and Employees: An Empirical Study in Bank Refah," 17th Australasi Finance and Banking Conference, Sydney, Australia.

C. A. Knox Lovell, Jesus T. Pastor.(1999). "Radial DEA models without inputs or without outputs" ,*European Journal of Operational Research*118, 46-51.

Charnes, A. & Cooper, W. W. & Rhodes, E.,(1978). "Measuring the efficiency of decision making units," European Journal of Operational Research, Elsevier, vol. 2(6), pages 429-444, November.

D.L. Adolphson, G.C. Cornia and L.C. Walters, A.(1991). Unified framework for classifying DEA models, in: *Operational Research '90*, pp. 647 – 657.

Eilbeigi Asli,Sh; Gilaninia,Sh; Mousavian,S.J; Taghinejad,M;Daneshvar Ghorbani,N;Seyedin,K;Dehban,M; Zadbagher Seighalani,F.(2012). Application of Information Technology in Increasing Exports (Case study: Iranian official customs), J. Basic. Appl. Sci. Res., 2(3)2708-2816, 2012**.**

Gilaninia,Sh; Taheri,O; Mousavian,S.J;Nikzad,H;Mousavi,H;Zadbagher Seighalani,F.(2012). Information Security Management on performance of Information Systems Management, J. Basic. Appl. Sci. Res., 2(3)2582-2588.

Gilaninia,Sh;Mousavian,S.J;Tayebi,F;Panjtanpanah,M;Ashouri,S;Touhidi,R;Nobahar,R;Azizi,N;Zadbagher Seighalani, F.(2011). The Impact of Information Technology Application on Supply Chain Performance, Interdisciplinary Journal of Contemporary Research In Business, VOL 3, NO 8,489-496.

Keebler, James; Manrodt, Karl; Dutsche, David and Ledyard, Michael.(1999)."Keeping Score: Measuring the Business Value of Logistics in the Supply Chain", Council of Logistics Management, Oak Brook, IL.

Kiani,E; Mo Enayati Shiraz,M.A; Ramezani,E ; Gilaninia,Sh; Mousavian,S.J.(2012). Determine Comparative Advantage of investment in Different Industries through TOPSIS Technique, J. Basic. Appl. Sci. Res., 2(1)802-806.

R. Banker and R. Morey, (1986).The use of categorical variables in Data Envelopment Analysis, Management Science 32(1986)1613 – 1627.

Russell G. Thompson, F. D. Singleton, Jr., Robert M. Thrall, Barton A. Smith and Meg Wilson,(1986).comprative site evaluations for locating a high –energy physics lab in texas, Interfaces Vol. 16, No. 6 (Nov. - Dec., 1986), pp. 35-49.

Soufi, Mansour.(2005). Electronic factor, The third millennium of thought; First Edition; Tehran.

Soufi,M;Gilaninia,Sh,Mousavian,S.J.(2011). Management in Global Class, *J. Basic. Appl. Sci. Res.*, 1(12)2997-3001.

Zarezadeh,m;delafrooz,n;gilaninia,sh.(2012). Survey of Relationship between Supply Chain Management Quality and Product Quality (Case study: dairy products in Ardebil province), J. Basic. Appl. Sci. Res., 2(3)3054-3060.