

Developing a Decision Support System (DSS) for Utility of Power Supply Organization

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Abstract

DSS provides a set of opportunities which improves the effectiveness and productivity of managers, professionals and rationalizing the process of decision making. In public sectors, mainly the aim is to get accurately, timely and relevant information to help managers to cope with the competitive environment with private organizations. This paper proposes an innovative use of data mining, visualization and OLAP techniques for decision support in services related to electricity connections and regional level of management of case company. Case company is a public organization. The main contributions of the paper are to be developing visualization methods, analysis methods of large and complex data that can be used to facilitate knowledge management and decision making process.

Keywords: Decision Support System, Information System, Online Analytical Processing

INTRODUCTION

DSS is a class of IS, which is a computerized manner and supports the process of decision making. It is developed for aid in better, efficient and effective decision making as it provides the solution of management problems. Integrated DSS is a concept in which more complex problems could be solved and it helps in making decisions in such a complex environment. Now-a-days people are using web technology to support decision makers in completing their tasks. In early 1990', mainframe based DSS shifted to client-server DSS, where server is linked to the user's computer by a network with the TCP/IP protocol. Now web is the platform of choice for building DSS, because of its flexibility of expansion and easy availability of Internet. WWW is used to communicate decision information and computation. It is platform independent and provides universal access to DSS applications. Public sectors also initiating, encouraging and supporting informatics projects so that they could accelerate managerial and technological development. This supports customer's participation in decision making and new way of working with technological environment to cope with private

sectors. This paper describes an application of DSS of the case company, which describes the process of electricity connection approval, dis-connection, re-connection, name change, weight change, connection shifting etc. It also includes data mining, OLAP and visualization methods to enhance the efficiency of decisions. Data mining is typically applied to knowledge discovery in large and complex databases, which results model. In this paper we integrate all these approaches with DSS which lead to improved solutions and decision process.

DECISION SUPPORT SYSTEM

DSS is the area of IS discipline which is focused on supporting and improving management decision making process [1, 2]. It can also be explained as a class of IS, which is a computerized manner and supports the activities of decision making. It is especially developed for aid in better decision making as it supports the solution of a non-structured management problems while the process of decision making is invisible [3]. DSS is a balanced mix of development technology, process and outcome studies. In paper [2], author says that DSS is not a technology, It is a philosophy of IS development and use. DSS is not a homogenous field. There are a number of different approaches, each of which represents a different philosophy of support, system scale, level of investment and potential. They all use quite different technologies and they support different managerial aspects. DSSs are a specific class of computerized IS that supports business and organizational decision making activities. DSS is a interactive software based system, which has the intention to help the decision makers by processed raw data into useful information, prepare models to solve problems and make decisions [4, 5].

Paper [6] emphasizes that DSS is a CBIS that helps managers to provide better solutions among different alternatives. DSS is a collection of models, people, procedures, software, database and devices, which helps to solve a problem efficiently.

In paper [7] author gives a new name of improved DSS i.e. "Integrated DSS". It says that traditional DSS has some challenges. IDSS overcomes those. This paper also defines DSS as computer based IS which is designed to support solution of decision problems. Now-a-days decisions have

become more complex and decentralized, so the concept of IDSS is expected to come, which is more scalable and interoperable in network based business environments.

Paper [9] notifies that from last decade new DSS area is focused, i.e. “Web Based DSS”. In which DSS runs in a network structure, locally or worldwide. Web technologies have provided new ways to share information and new ways to deliver decision support capabilities. This is a modern computerized system support, which provides wide range of capabilities like information gathering, model building, alternative evaluation decision implementation etc. IDSS can be more scalable and interoperable in network-based business environment by using web [7]. Venders have been introducing combined information portals, knowledge management, business intelligence etc in an integrated web environment [9]. According to paper [10], IDSSs are very helpful to doctors and nurses in diagnosis and treatment of patient. DSSs are customized and adjusted to user needs, but these include technological, economical, social and behavioral challenges too [9, 13]. Web based DSS was defined as a computerized system that is a tool of decision support to managers/business analyst using any browser like Netscape Navigator or Internet Explorer. Web based DSSs provide decision aid for employees as well as customers. It has been assist customers configure product and service according to their needs. Latest advancements in DSS like data mining, OLAP tools, data warehousing, knowledge management etc. provide more efficient decision making process [14, 16].

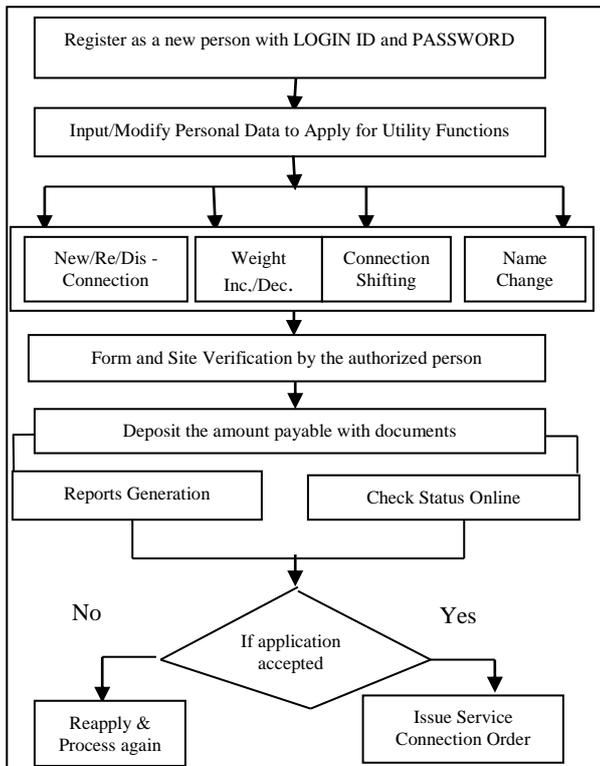


Figure – 1 (Existing DSS for Customers-based Organization)

TYPES OF DECISION SUPPORT SYSTEM

A. Personal Decision Support System (PDSS)

PDSS is basically developed for one manager or a small number of independent managers for one decision task. It is a small scale system [3, 7]. It is suitable, when management focused in central control, efficiency and integration. PDSS empowers individuals and democratization of decision making. PDSS only supports managers other than attempting to support the overall organization [2, 3]. The major contribution of PDSS is evolutionary system development with user friendly software application [3].

B. Group Support System (GSS)

GSS is developed for the number of managers and they all will be involved in the decision process and decision responsibility is shared by the all [2, 3]. GSS are implemented typically as electronic meeting systems. GSS contains the characteristics like group history, group size, leadership behavior, group cohesiveness, level of decision making, type of task, organization size, time frame of decision making, level of decision making etc [2, 3, 15].

C. Negotiation Support System (NSS)

NSS, operates in a group context, it involves the application of computer technology [2, 3]. NSS basically supports GSS. It has two basic approaches- first Problem Oriented- In this, it provides negotiation support for specific problem types and second Process Oriented-. In this, it focuses on providing general support of give and take process of negotiation [2, 3, 12]. In paper [3], author says NSS could be considered as a branch of GSS.

D. Intelligent Decision Support System (IDSS)

When Artificial Intelligence has been applied to decision support, then this system is called IDSS. Using AI with DSS replaces human decision makers, but DSS itself defines that it supports in the process of decision making rather than replacing humans in decision task [2, 3, 15]. Intelligent DSS are used to improve the quality of the system [10].

E. Data Warehouses (DW)

As the organizations become large, the need for continuous high quality data about the operations of an organization and their need to integrating data are the main reasons of the birth of Data Warehousing. It is a set of databases to provide information to decision makers so that they could be able to make efficient decisions. Large sets of data could be managed in ways that are meaningful to managers only by using different methods of Data Warehouses. These methods are very easy to understand and analyze [3].

F. Knowledge Management based DSS (KMDSS)

For any organization, knowledge is vital to increase innovation, competitive advantage and support decision making. Knowledge Management affects the entire organization and involves the management of several areas including IT, organizational behavior, organizational strategy etc. It can support decision processes and decision makers [15]. Knowledge Management aid knowledge storage,

retrieval, transfer, supporting individual and organizational memory, group knowledge etc [3].

PROPOSED MODEL FOR APPROVING CONNECTION TO A CUSTOMER

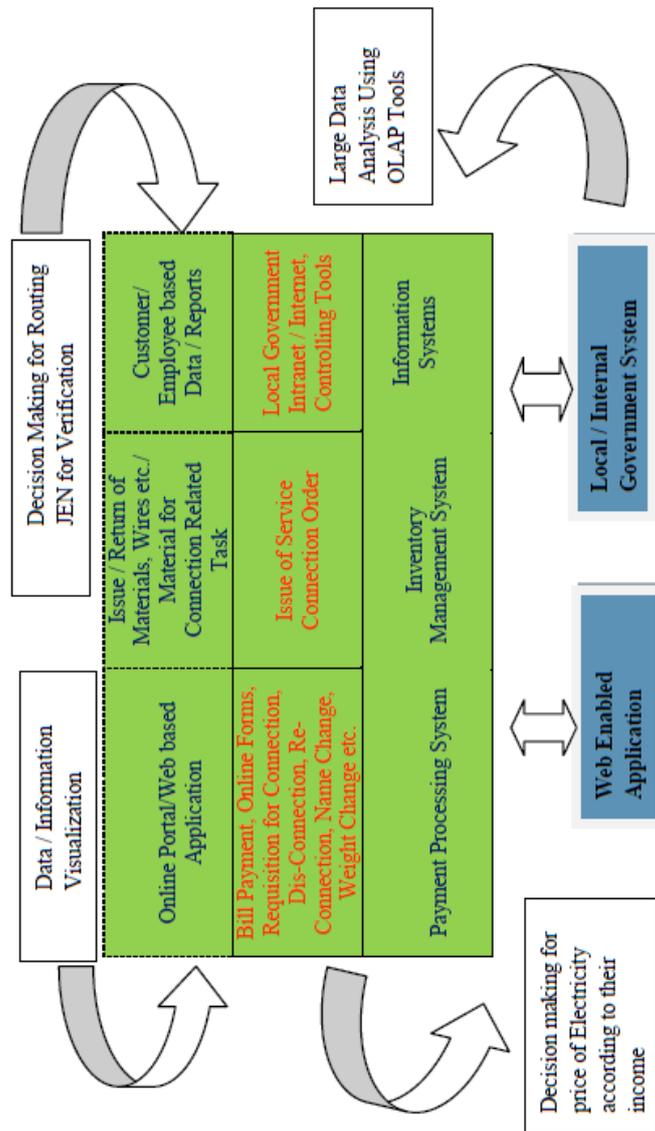


Figure-2 (Conceptual View of Proposed Model with Advanced DSS Features)

This model is proposed to the case company for the overall task and it includes decision support system with new advancements. It includes three main systems- 1. Payment Processing System- This system includes all the payments like Bill Payments, Payments related to the requisition for connection, disconnection, name change, connection shifting etc. For this purpose a web portal is developed and user wise entry is possible by unique User_ID and Passwords. 2. Inventory Management System- This system will work when the connection requisition is accepted and a unique customer_ID is given. After issuing SCO (Service Connection Order), all the material (Wires, Meter etc.) related to the connection is issued and maintained in the issue register online. Similarly, if the requisition is for dis-connection, then

all the material related to the connection would be return to the inventory. 3. Information Services- It includes local government Intranet/Internet based internal system, where for each transaction there is a form. These include the controlling mechanism, where some reports could be generated based on customers or employees.

This is a model for Customer Oriented Connection Process (COCP). This is customer centric government process, which is a web based online application. This proposed system would allow customers to fill various forms for different applications. This would have a complete payment process, including bill payments, fee payment for any requisition.

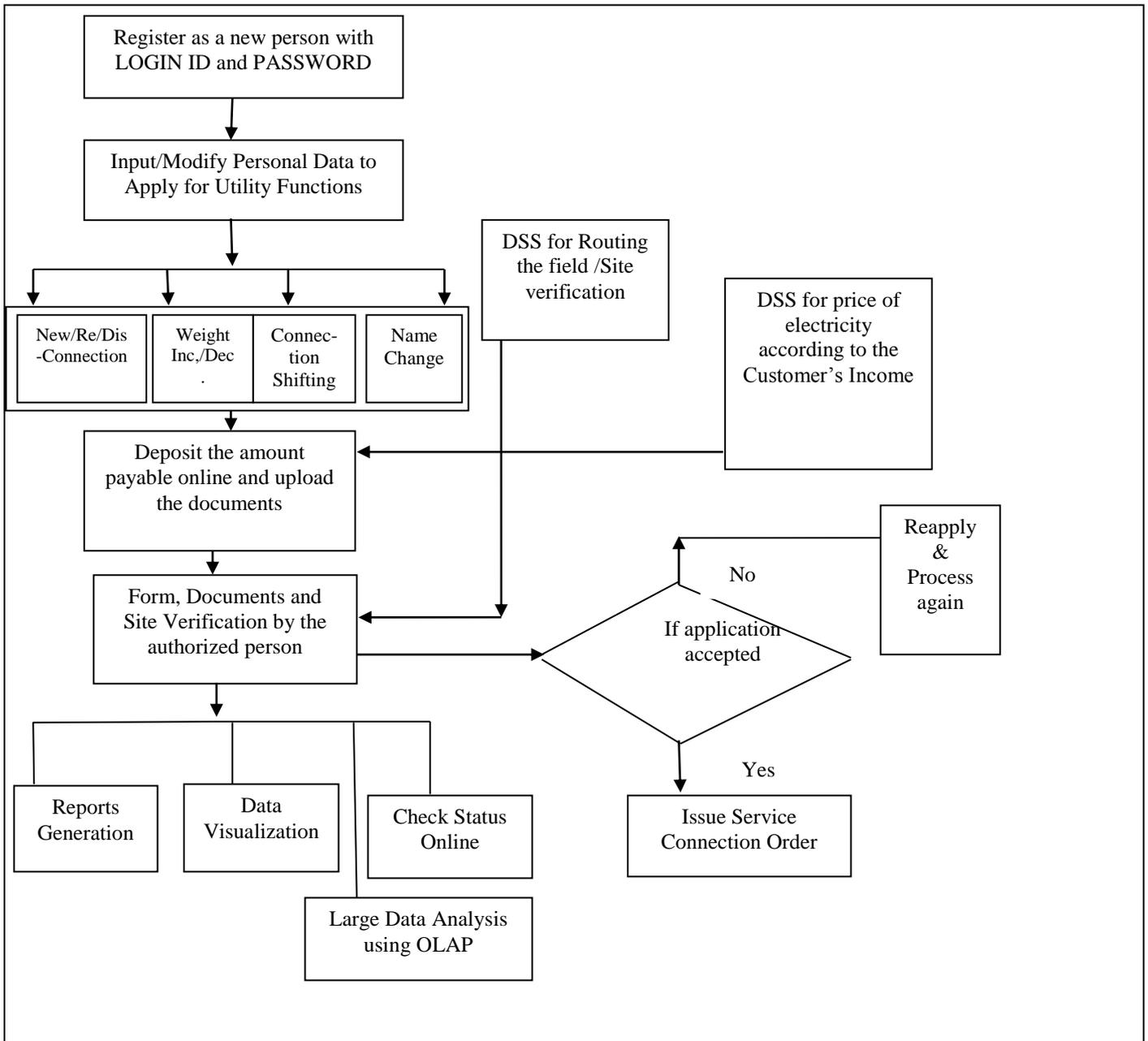


Figure – 3 (Pictorial View of Proposed Model)

This process would lead to cheaper, more accurate and timely dissemination of information. Afterwards Inventory could also be managed after completing the process and issuing a Service Connection Process (SCO). Some forms for issue of material and return of materials would be included. So that a complete inventory status could be managed, this could show some reports regarding the inventory and control the inventory too. This would also help in making decisions for inventory also.

This COCP comes with the whole electricity connection process which includes New Connection, Disconnection and Re-Connection. By using this process consumers can now

apply for the connections online. They can upload all the required documents to the portal. The consumer now can check the status of the form from anywhere and can proceed further by using their Transaction ID which will be given to him at the time of application submission. If the application

has an error, consumer can reapply after completing the formalities.

This will help with the internal staff also. They also can check their routine assignment online and their site work. Different type of reports will be generated; this will be helpful for managing people. This DSS will be helpful in taking decisions related to work. In this model every employee involved in the process, need to update the status of his daily task; management can check their routine work status by daily reports. The work is streamed line in this manner that one employee will complete his task then the other can proceed. This will give them a force to work on time. These some controlling effects will improve the face of the government organizations. This will work in two manners- First; it will improve the working manner of the employees, their technology knowledge and data handling. Second consumers' technology knowledge will improve and consumers will more aware about their rights.

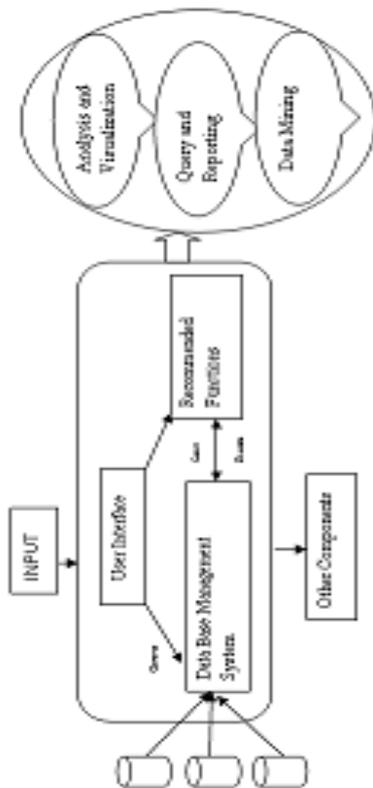


Figure – 4 (Environment of the Model)

After the issue of the Service Connection Order (SCO), inventory work starts. The issue and return of the products will be done after receiving SCO. By using Inventory Function management can also have different reports related to stock. Apart from New Connection, Re-Connection and Disconnection this model also works if a consumer wants to increase/decrease weight of electricity and if a consumer

wants to shift his connection and wants to change the name of the connection.

There is a fixed manner to follow up an application as FIFO (First In First OUT), but if there is some necessity then admin can process that application first or in-between.

After all, the process each and every consumer will get a Customer ID, which will be unique. Further consumer can follow up his identity by this ID.

Further new advanced techniques have been added to this model. Visualization, OLAP and decision support for JEN for routing etc. are the enhanced feature of this model.

1. DSS and Visualization Techniques

Information Visualization is a process of constructing a visual presentation of related data. Humans recognize the visual perception more efficiently than text data. It improves the understanding of the reports, hence improves decisions. The vast amount of information emphasized visual tools in decision making. With the increase in data availability and data volume, it becomes increasingly important to extract information from data. Information visualization helps the decision makers to understand data. DSSs and visualization, both fields share a common need for understanding interface between the computer and the human. Even the author of paper [19], recognized 3 V's, to define Big Data concept- 1) Volume, 2) Variety and 3) Velocity. In the above model we have added advanced features too, which includes **visualization**. Visual representation provides the pathway to humans to be able to see, explore and understand large amount of data [20]. In this data related to customers and employees could be visualized in simple reports format or some visualization techniques like charts, graphs, trees etc. Data visualization can also:

- Identify areas that need attention or improvement.
- Clarify which factors influence customer behavior.
- Predict sales volumes etc.

Using these techniques to visualize large amounts of complex data is easier than poring over spread sheets reports. It enables decision makers to see analytics presented visually, so that they can grasp difficult concept. This could be called as Visualization Driven Web Based DSS (VDWBDSS).

2. DSS and OLAP

OLAP is essential element of decision support, which has become a focus of the database industry. Operational databases would result in unacceptable performance if it joins OLAP features in it. OLAP can produce queries on multidimensional data [21]. OLAP features help managers to analyze, understand and creatively thinking of large data. Use of OLAP changes the data in a relational database into

multidimensional cubes that could be observed from all or many perspectives simultaneously [22]. For data collection and analysis, OLAP is one of the best ways where the main aim is to support decision making tasks. By using OLAP data from different sources could be summarized. User can run queries on a cube and queries could be completed in much less time. Paper [23] also explains the benefits of OLAP and three different manners of storing- a) ROLAP (Relational OLAP) b) HOLAP (Hybrid OLAP) and c) MOLAP (Multidimensional OLAP). In paper [24], author also explains that Multidimensional data mining (OLAP) provides facilities of pivoting filtering, dicing, and slicing on a data cube and provides results.

3. DSS for routing JEN

According to the case company, JEN needs to go for the physical verification on daily basis. He has to verify the connections daily as many as he can. In our model, we propose a method by which JEN could decide the better path for verification so that he could check all the locations in a shortest manner. For this purpose, we include Decision making algorithm for routing JEN. When JEN would go for the physical verification for a day, which route he should take for the verification that could be the shortest. Travelling salesman problem algorithm would be the best way for getting the shortest path.

4. DSS for connection charges

In our proposed model, we will include a new algorithm for approving connection charges according to the customer's income. For this, we need to prepare different income slabs, and according to those slab we will charge electricity bill. So that low price electricity could reach to those people who are below poverty line. This will help in deciding the rate of electricity according to the customers. Case company is a government organization where the main motive is to provide electricity to each and every person at optimum prices.

5. DSS for due bills

According to the previous study of data, many pending bills are there to be paid. To get rid of due bill payments we include a new approach for the bills. This include Prepaid Bill, which is similar like prepaid mobile bills, if customers will not pay in advance they will not be able to continue their services. How much they pay for the electricity in advance, they will consume this amount as they need. This will surely remove the due bills yet and increase the profit of the case company. This would help in making the organization as profit making organization, which is about to go for privatization according to the historical data.

A. Algorithm

- Step – 1 Register with the portal as a new person by generating LOGIN ID and PASSWORD
- Step – 2 Input personal detail to apply for any utility function or modify data if register already
- Step – 3 User \can apply for **New Connection/ Re-connection/ Dis-Connection, Weight Inc. / Dec, Connection Shifting, Name Change etc.**
- Step – 4 Deposit the fee amount as per the application and upload the documents online as required. Fee amount could be calculated according to the income of the customers like per unit price will be vary according to the income slab of the customers
- Step – 5 JEN could verify the forms, documents and after he satisfies, he could verify the site also by using routing algorithm which could help him to find the shortest path to verify the site for a day, so that maximum verification could be done.
- Step – 6 If all required verification done and application would be in accepted mode then he would issue a "Service Connection Order".
- Step – 7 This application will go to the store keeper and line men, they may issue/receive required material and complete the process.
- Step – 8 Else If application would be in rejected mode then the customer could check the status online and reapply again after fulfilling the required status.
- Step – 9 Employees could see different report according to their authorization. They could visualize some reports too and large data analysis could be done using OLAP tool.

CONCLUSION

The main aim of public sectors is to get accurately, timely and relevant information to help managers to cope with the competitive environment with private organizations. The capability of computers are enhancing with time. Problems could be solved in faster speed. Computers can solve mathematical terms with complex models at a high speed. Solving large and unstructured problems are difficult and time consuming, when solved manually. This paper involved some techniques which could enhance the efficiency and effectiveness of decision support systems. As OLAP tools help to analyze large data, as data visualization help to analyze large data with the help of charts, trees etc. If new approaches or advanced methods are used with DSS, then case company could achieve their goals and could have better decision making power.

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