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A SURVEY ON DECISION SUPPORT SYSTEM TOOLS

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Abstract — Decision Support System (DSS) is a specific class of computerized information system that supports business and organizational decision-making activities. A properly-designed DSS is an interactive software-based system intended to help decision makers collect useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and to make decisions. DSS belong to an environment with multidisciplinary foundations, including database research, artificial intelligence, human computer interaction, simulation methods, software engineering, and telecommunication. In this paper, techniques and tools for decision making based on decision support system are compared.

I. INTRODUCTION

DSS- Decision Support system is a computerized program used to determine the perfect decision with the given data. A decision support system decision needs to be accurate than the manual decisions. When getting the decision based on the software, that to be editable and reformulate the decision to get expect the output and if need to re-process data. A DSS contains both of hardware and software that form the different organizational decision-making processes.
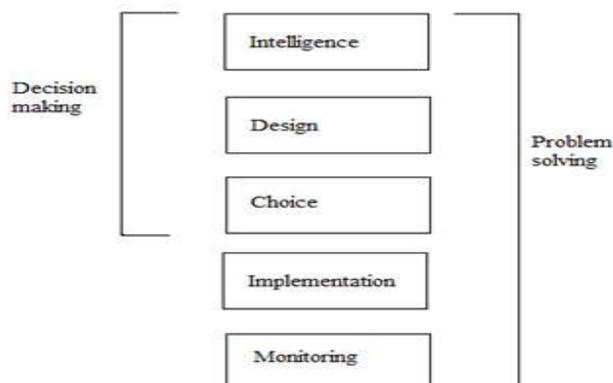
Communication Driven DSS→It supports on a shared task of more than one user.

Data-Driven DSS→It is based on the times series of manipulation with external data also.

Document Driven→ It is used to manipulates, manages unstructured data (or) information.

Knowledge Drive DSS→ It solves the solutions specifically to be stored as rules, procedures.

Model-Driven DSS→ It defines the statistical, financial, simulation or optimization model. These four are to be manipulated in model-driven DSS.

In the decision support system, the user is to make a decision quickly with more accuracy. There are various open-source tools are available. If the organizations or individual users to define a better decision, they have to choose the best tool to build an optimal decision. The problem is that the user has to work with all the tools to find which tool is best. So, it takes much time to decide the best tool.

This survey paper helps to know the details of the tools and their working process. In the comparison table, all the features and the advantages of each tool is described. Based on the table, the user can easily know the idle process of each tool. The main advantage is that it reduces the process of identifying the right tool.

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2.1 Decision Making Helper

It is very useful in supporting the user in a very easy way for the decision-making process. The user would produce understandable, rational, clear, and comprehensive decisions while accessing the decision-making software. By using this the process of making the right decision would become a very non-complex process. By the time of presenting the decisions, which were taken transparent and comprehensible, the presenter would become confident in-front of partners and third parties. Its benefits are useful when making sound decisions, in that the decisions would be made a structured and object way rather in a pure gut feeling. The structured approach helps the user who is indulging in decision making by bestowing detail thoughts about the decision which he wants to decide. This software tool saves user's time while accessing.

2.2 Analytica 5.3

Lumina Decision System developed Analytica, a visual software package which used for communicating, analyzing, quantitative and creating decision-making models. Analytica design, uncertainty treatment, and most importantly influence diagrams derived from the decision analysis field. All the models in Analytica are put together as influence diagrams. By this, a single module node in a diagram would represent the entire sub-model. The significant trait of the modelling process is to manage the structure and organizing the large model, this process would be aided by the influence diagram's visualization. Analytica has been widely used as an application in many areas. For example, in the field of business modelling, risk and policy analysis and also the area of pharmaceuticals, emission policy analysis, technology, and defence. The users who are interested in building models are purchasing this software which runs on Microsoft windows specialized with three editions namely professional, optimizer, enterprise. All these editions are attributed to many functions.

2.3 Paramount

Paramount decision works on the basis of a lean decision-making system by using Choosing By Advantages (CBA). Its structured approach predominantly reduces the time of accessing simultaneously and it also improves the quality of group decisions. This software allows companies to develop auditable, data-driven, transparent decisions. And also it has been a major function of any organization such as non-profit organizations, governments, and even daily businesses employing this software. Another advantage is the quality of the decision could not be affected by a formal process. Organizations were guided by several easy steps by this paramount decision platform. It would help the organization by employing a structured approach in order to communicate delicate decisions with multiple stakeholders. Organizations were benefited by these types of decisions, for instance, choosing which product to buy, person to hire, projects which

are eligible to fund and also employing different business strategies.

2.4 Medical Tests Analyzer

Medical Test Analyzer used in the medical field for clarification in a patient's complex laboratory test to attain specific information to make quick decisions also an interpretation for a blood test. It also assist to understand the medical lab results. Medical Test Analyzer is a report tracking system and also it could explain which cause each test was taken and what would be the result. It keeps track of patient laboratory tests with respective dates and times. It was considered the best way to associate with your doctor in the respective hospital. This medical test analyser is a valuable analysis tool because blood test result tools employed here aid you in interpreting the real mean of the lab test which were taken to track down your health and medical status. It enables the user to insert patient short demographic data and also to update the information. By using this tool the user would be able to change the reference ranges and measurement units of the patients and retain it for a long time.

2.5 Decision pad 4

The theory of decision matrix and multi-attribute utility is subjected to a DECISION PAD. It has been successfully used by small and large scale businesses, government organizations for over 50 years. In 1987, the original DOS version was introduced. It was re-introduced in 2018 to make sure the management technology the software possesses, accessible to everyone, helps to gain focus and clarity in their decision. It is an advanced tool that gives clarifications to eliminate complexities in the document. The accessibility of the software is very easy so that even a new user would access it by using a decision worksheet. It is very simple who has reader consumer product evaluation articles. The process of accessing a Decision Pad 4 comprises some steps which are initiated by creating a decision matrix and adding of criteria and alternatives, third dimensions for multiple evaluators that are employed version four. The prominent step is generating decision documentation and professional reports. The final step is exporting or importing matrix data as .CSV files.

2.6 Weka

Weka-Waikato Environment of knowledge analysis. It was developed by the University of Waikato, New Zealand. GNU-General Public License licensed this software as free software and also established as companion software to the book "Machine learning Techniques and Tools". It holds tools of visualization collection and provides some algorithms for prediction analysis and data analysis. Tcl/Tk was an original non-java version of Weka. This exact version was aimed to design as a data tool analysis from agricultural domains. It also contains with many

advantages that are available under GNU General public license free of cost. Because of its complete implementation in Java programming language, it contains a portability feature. Due to its graphical user interface, all the processing was found to be easy. It also includes many data mining analysis include data pre-processing, classification, clustering, visualization, regression, also feature selection. By using this the user would able to access SQL databases by using java database connectivity also the result would be processed and returned as database query. Explorer is the weka's main user interface. It contains a large number of classification tools and regression.

2.7 Decision Explorer

The end users offered by a powerful mapping tools in the process of decision making by Decision Explorer software. The type of tools provided by this software would able to analyze the results further. It used to comprise many uses such as structuring interview data and also it supports strategy formulation process. The software at an initial stage portrayed as a recording under facilitation tool for ideas elicitation and also to communicative and structure qualitative data. The user would able to analyze and gather qualitative data as well as they would access in a way to arrive a coherent solution of the problem. This software decision explorer using the casual mapping technique which is actually under the Kelly's theory of personal constructs. In the process, all the information and ideas can be connected and also connections between variables to be established. In identifying the alternative course of action, the resulting model would be aided.

2.8 Decision Quest

A decision frame is a limited description of a decision opportunity that filters out what is irrelevant or immaterial. The perspective of decision frame is the content that the stage of a decision. Characteristics of a good set of alternatives are Creative, Doable, Significantly different comprehensive and compelling. Each alternative should be fully described to remove ambiguity. The major uncertainties that affect the performance of each alternative should be thought of and noted. The strengths and weaknesses of each alternative should be clearly stated. Also, there are some steps in logical reasoning which are Develop a methodical approach to evaluate the identified alternatives using the value measures defined by the decision-makers and characterized uncertainties. Perform a probabilistic analysis where each all variable varied between their low, base and high values and observe the mean results for each value measure. If there is a need for a model to determine the output of the model when all uncertain variables at a time are set to its low and high values. This provides important insights 6about the drivers of value and the drivers of risk.

2.9 VisualDx

This software design aids to improve diagnostic accuracy, patient safety, and therapeutic decision and also won the award for the best diagnostic clinical decision support system. By implying this clinicians could search specific patient's information by using search functions and also they would build custom differential diagnoses. It also used for front line health care workers who expect accurate information about patient's health. In recent survey, it has been reported that the diagnostic accuracy of visualDx improved by 120 % and also 97% of physicians recommended that visualDx improved patient care. This software was widely used by clinicians for every 26 minutes per day. It was trusted and accessed by over 20,300 clinics, hospitals, and medical schools. It ensures accurate diagnosis faster and safer decisions in emergency situations. And also it would manage complex variations and face challenges directly as well as engage with patient's reports by reviewing it. It also qualifies risk CME accreditation. By providing this software to the hospital could improve diagnostic accuracy to reduce the risk and to improve patient health care.

2.10 Skyscape

Skyscape software is aimed to provide tools and medical information to make a decision at a critical time. This software also comprises of skyscapeRX and Medical calculator. It also helps the user in finding an answer in a faster way so that the user would feel confident about the clinical decisions and could spend more time with their respective patients. It consists of hundred medical references from many publishing partners which are optimized for iPad, Android, iPhone, smartphones, and tablets. This skyscape medical library app supports diagnostic flowchart and interactive calculators. Skyscape clinical consultation is a customizable solution also dynamic that holds eight essential clinical resource also holding all the tools which would set in your mobile devices. It consists set of description that showcases the best resources which is available to clinicians who are all subjected to provide primary care. There are fifteen aspects of criteria is identified. They are type of application, open-source (or) commercial, supported file formats, domain specification, unique feature, visualization, Multi-criteria decision making, decision category, explore in cloud, achieving optimal solution, security, model, content structure, code or data(manual), sequential or random and version. It describes for what type of application the tool is exist, it is an open source or not, what are all the file formats the tool supports, which domain the tool is executing, whether the tool supports multiple criteria decision or single criteria decision making. Decisions are divided into five categories by which they are communication, model, knowledge, data and document-driven. Identify which category the tools are supported, it accepts code or manual data, it is executed linear steps or random steps and providing any security or not.

Decision Support System tools	Decision-making helper	Analytica	Paramount	Medical Tests Analyzer
Type of application	Standalone	Standalone	Standalone and Web Application	Standalone
Open-source /Commercial	Open source for trial-	Open source for trial	Open source for demo	Open source for demo
Supported File Formats	*.dmh, Export in .txt	*.ana (or) All files. Export in *.jpg, *.jpeg, *.png, *.BMP, *.TIFF	It does not have any extensions	Export in word when register the demo version
Domain Specification	Business domain	Business domain	Business domain/Personal	Medical domain
Visualization	Charts and Tables	Graphs, Tables	Percentage	Tables, Charts
Unique feature	Based on the criteria the different products were analysed	It supports different models (Ex: Enterprise model, project portfolio planner, txc risk analysis and some other basic models.	It can easily define a solution. Edit and summary of the decisions can be made at any period of time	Three different colors are showing the levels
Multi-Criteria decision making	Yes	Yes	Yes	No
Decision Category	Knowledge-driven, model-driven, Communication and document-driven	Knowledge-driven, model-driven and document-driven	Document, knowledge and model-driven	knowledge-driven
Explore in cloud	Not supported	Not supported	Partial support	Partial support
Achieving optimal solution	Minimal	Minimal	Maximal	Minimal
Code or Data	Manual data	Manual data	Manual data	Predefined data
Content Structure	Structured approach	Structured approach	Hierarchical	Hierarchical
Static or Dynamic	Dynamic	Dynamic	Dynamic	Dynamic
Sequential or Random	Sequential	Sequential and Random	Sequential	Sequential and Random
Versions	Version 1.34, Version 1.22	Version 5.3	It's a web application	Version 4.1.9 , Version 4.0.0.4
Security	Security disabled	Security disabled	Security enabled(Email id and Password)	Security disabled
Model	Market analysis, Sales decision, Profit, Cost model	Market analysis, sales decision, Profit, Cost model	Market analysis, Sales decision, Profit, Cost model	Analysis of the medical report

COMPARISON TABLE 3.2

Decision Support tools	Decision Pad	Weka	Decision Explorer	Decision Quest
Platform	Standalone	Standalone	Standalone	Android
Open source/Commercial	Open source for trail	Open-source	Open source for trial	Open-source
File Formats	*.dp4, Export in .csv when buying the software	JSON Knowledge flow (*.kf)	Decision Explorer Models and Decision Explorer Models (binary). Export in .xml , .spreadsheet etc.	There are no extensions. Decisions are stored in Decision tab
Domain Specification	Business domain	Business and Education domain	Business domain	Personal, Business and Government
Visualization	Charts, Tables	Image Viewer, Strip Chart, Chart, Graph Viewer, etc.	Flow diagrams	Percentage
Unique features	Decision JumpStart, Provides percentage to analyze a decision	It contains different machine learning algorithms	The flow diagram shows the clear analysis view for decisions	It is an app. So it can be accessed anywhere
Multi-Criteria decision making	No	Yes	No	Yes
Decision Category	Knowledge and Model-driven	Knowledge-driven, model-driven and document-driven	Knowledge-driven	Communication, Data, Knowledge-driven
Explore in cloud	Not supported	Not supported	Partial support	Partial support
Achieving optimal solution	Minimal	Maximal	Maximal	Minimal
Code or Data	Manual Data	Manual Data and Predefined Data	Manual Data	Predefined data
Content Structure	Structured approach	Structured approach	Hierarchical Structure	Unstructured approach
Static or Dynamic	Dynamic	Dynamic	Dynamic	Dynamic
Sequential or Random	Sequential	Sequential	Sequential	Sequential and Random
Versions	Decision Pad 4, Decision pad 2.x	Version 3.8, Version 3.9	Version 3.5.0, Version 3.3	Version 2.0
Security	Security disabled	Security disabled	Security disabled	Security enabled(Email id and Password)

Model	Market analysis, Sales decision, Profit, Cost model	Market analysis, Sales decision, Profit, Cost model	Market analysis, Sales decision, Profit, Cost model	Market analysis, Sales decision, Profit, Cost model

COMPARISON TABLE 3.3

Decision Support tools	Skyscape	VisualDx
Platform	Android	Android
Open source/Commercial	Open-source	Open-source
File Formats	It cannot provide the extensions	It cannot provide the extensions
Domain Specification	Medical domain	Medical analysis
Visualization	Text and Images	Images and description
Unique features	Easily get a result through the formula	Already stored images and description helps to know about diseases
Multi-Criteria decision making	No	No
Decision Category	Knowledge-driven	Knowledge-driven
Explore in cloud	Not supported	Not supported
Achieving an optimal solution(Accuracy)	Minimal	Maximal
Code or Data	Manual data and Predefined data	Manual data and Predefined data
Content Structure	Structured approach and unstructured approach	Unstructured approach
Static or Dynamic	Static	Dynamic
Sequential or Random	Sequential	Sequential and Random
Versions	Version 3.1.2	Version 17.11.0.2
Security	Security enabled (Email and password)	Security disabled
Model	Medical analysis. Not comes under the decision models	Medical analysis. Not comes under the decision models

IV. RESULTS AND DISCUSSION

The comparative table presented the analysis of ten different open source tools for decision making. The identified criteria by which the comparison was carried out are the features, model, versions available, content structure, etc. Each tool achieves minimal optimal solution and easy decision making based on personal, government and commercial. Many of the open-source tools provide the demo version of 30 days or else to register the demo version to continue for additional use. The best tool is WEKA among the ten tools. Today the technology is moving towards the concept of Artificial Intelligence that would produce more data, called big data.

It is a Windows platform. It is a completely open-source, not a demo. It is used for business and education domain. The different diagram are also been supported. They are image viewer, strip chart, chart, graph viewer, text viewer, attribute summarizer, model performance chart, data visualizer, boundary plotter, scatter plot matric, cost-benefit analysis. Different in-built tools are available. There are four tools available; they are sorter, substring replacer, substring labeller, and execute the process. The familiar algorithms are available to work on it for analyzing. They are Classifiers, clusters, and trees. In each of these, some of the important algorithms are located. Once the analyses is done, the decision process is completely easy to achieve an optimal solution.

V. CONCLUSION

Techniques and tools for decision making based on decision support system are presented in this study. This survey paper analyses the ten different decision support system tools. The Pros and cons of each tool is described clearly, that is working and the unique features. From the description the researchers can get some insight about the tools. With the use of a comparison table, it is easy to know the functionalities and the supporting features of each tool. Overall the paper will help the researchers to choose an appropriate tool to make decisions quickly.

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