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A Comparison Study between Intelligent Decision Support Systems and Decision Support Systems

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Abstract

This paper is one that explored intelligent decision support systems and Decision support systems. Due to the inception and development of systems and technological advances such as data warehouse, enterprise resource planning, advance plan system & also top trends like Internet of things, big data, internet, business intelligent etc. have brought in more advancement in the operations of decision support systems. This paper gives a systematic review on all the various applications of IDSS based on, knowledge, communication, documents etc. with also heading further to describe and differentiate two DSS methods which are Analytical Network Process (ANP) & Decision-Making Trial & Evaluation Laboratory (DEMATEL)

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1 Introduction

Decision support systems became a topic of interest from the year 1970 whit a lot of fields and section such as economic, math, management sciences, information science etc. adopting the concept. A lot of authors have developed different types of systems to help in solving decision support issues by the integration of different types of subjects with the combination of artificial intelligence, networking, communication and other technologies. The concept of Decision support systems (DSS) is based on the development and also deployment of ICT centered systems in other to assist with the provision of support for the decision making process [1]. Throughout the era of the 70s a lot of authors put a lot of efforts into the developing of IT based systems that well assist in solving the complex and strenuous problem of decision making. Since from the last decade till now a tremendous improvements have been experienced a tremendous improvement in the development and advancement of the information technology (IT) sector [2]. It is obvious that this era the growth in information systems have reached a remarkable height with an uncontrollable speed. In these days, most of the top notch BI systems where originated or upgraded from DSS systems and its concepts.

In general we can say that a DSS system is one system that helps to resolve organizational issues to help in reducing uncertainty and improve decision making. A lot of authors have done research on DSS systems and their performers; an example is [3] that showed massive improvement in organizational performance by increasing productivity. It was seen that artificial intelligence, networking, cloud computing and so on are transforming traditional production systems into intellectual based systems. Most of these current functions are requirements in creating or making an organizational system in other to ensure high produc-

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tivity, sustainability and advantage. The creation of a DSS system in in stages in that involves the combinations of systems such as ERP [4]. After the data's have been put in place then the system components can be arranged in such a way that it will process the data a bring forth solutions that will help in solving the problem and will end up creating a decision design that twill handle the case of solving the issue. In this project, my focus will be reviewing of literature's that have worked on the past and also current several designs on DSS systems that upgrades in manufacturing. I made this project into different sectors where sector 2 contains an overall explanation on the concept and application of DSS [5]. It also goes on in explaining DSS uses, and applicability with explanation on the structural parts involves in the process of decision making. The sector made more focus on the new, trending and loading trends in the process of automated decision making. Then I went further also to describe the latest intelligent decision support system (IDSS) with laying of more emphasis on cyber physical productions system (CPSS) as well as IDSS. As a hint, we can say: knowledge management guidance the decisions that affects the position [6].

2 Decision Making Process

For the last decades, there has been a constant and consistent development of the process of decision making some of the authors that have worked on this that have made tremendous progress includes [7]. The opportunities for organizations in making strategic decisions are almost limitless. The process of DSS involves the spotting of several options for a rising unstructured problem. DSS is not based on bringing out all the alternatives ongoing, but the selection of the best one based on the goals and objectives. There are several processes, which this decision system undergoes includes the identification of the problem and determination of the stakeholders that are in the process of the decision-making [8] [9]. Figure 1 illustrates an up to down process.

Stage (1 and 2) : the stage consist of defining , generating alternatives in such a way that when the system recognizes a problem, it will first start by defining the discovered problem. Stage (1) give an elaborate explanation of the current condition of the problem and highlight the desired state. It then moves to the determination of requirements that will bring out their desired goals and objectives. The requirements derived is the terminate for the behavior of the problems solution [10].

Stage (2) : This is where alternatives are been created in other to handle all or any uncertainties in decision making. This stage in the decision making process is referred to as the intelligent phase, in which

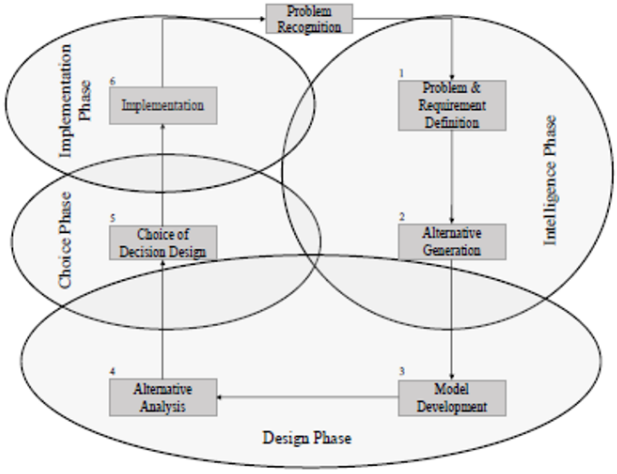

Figure 1. Decision Making Process

a potential part of it is that all the alternatives much reach d set requirements. In this stage the system must find, identify and formulate the solution to the problem. The result that will be gotten from this stage is always in form of a decision statement [11].

Stage 3 and 4 – This has to do with developing Model and Alternating Analysis. The next in the DSS that the alternation of various alternatives and development of models, the next stage will be the development of models. The models are created in other to weigh the performances of the various alternatives. The model that will be referred to as the best is the model that will be able achieve the desired objective with the least amount of time [12]. After the creation of the model, then one will move in to the analysis of alternatives in which the evaluation are concluded against the criteria, choosing of the tool of decision such as the analysis of pros and cons. A lot of trending research if giving more focus on which of the technique is deemed more effective in handling what type of problem, with also weighing the pros and cons of the different methods. There is also validity dealing with the problems solution that is been identified. The face is called the design stage in which aims and objectives are created and linked together as the decision model [13]. Stage 5 and 6: This handles the style in which the design will be implemented. This stage is dependent on the model called choice phase. This stage deals with selecting alternatives which has been developed via the design stage. The final stage here has to do with the implementation of the decision which in reality or real life environment that has been extracted from the implantation stage. This solution should handle the desire of managers in need of decision support [14].

As there is a few of issues relay precisely to the risk assessment, such as the possible for harm, to

buildings or the environment, in this case, they should frame some portion of an assessment of risk strategy to decide the improvement missions sustainability and the positivity or negativity of value.Going in the sense of Organizations logic, when the decision that is intent to be made has more effect on the part of the organization, the managers or top managers should encourage greater use of rationality in the decision-making process. Making the right decisions to ensure excellent business performance remains a challenging task because of the variety, complexity, uncertainty and dynamics of decisions [15].

3 Classification of DSS and Intelligent DSS

Decision support systems and intelligent decision support systems can be classified to many classifications that based on the different definitions of decision support systems. Hogenboom et al (2016) gave their of definition of DSS systems as an information system with class which handles systems that processes transactions and have an interaction with other components of the entire information systems to help with the process of making of decision for managers and also other employees in a firm [16]. While Ren(2002) defines intelligent decision support system (IDSS) as the act of combining DSS together with Artificial Intelligence (AI). IDSS is a DSS that helps to provide solutions to hardcore complex problems based on knowledge via the perfect combination of AI & DSS Via the application of expert technologies [17].

Bonczek et al (2014) gave his own definition of DSS as a computer based interactive system that assist individuals in handling computer for the process of communicating, data processing, insight gaining etc. in other to tackle down problems and create decisions [18]. There is a separation of the regular desktop DSS and also the enterprise system DSS in which power is the identifying gap between them while according to Rikalovic (2018) IDSS in the aspect of handling qualitative issues has more focus on the features of expert systems through reasoning via knowledge, usage of DSS features in handling quantitative issues with calculation via core model, combination of analysis & by enhancing the problem solving abilities [19].

A desktop DSS is one that is seen in a single pc with one operator but an enterprise wide DSS system is own that is seen in a large organization, which can be accessed and operated by several managers. Making decision is an integral part of human nature and assisting in the decision making process been a pivotal interest to researchers from various research fields such as psychology, statistics, computer engineering and so much more over the years. In the 1960s the concept of computer support systems with the use of decision support systems coming out in the 1980s According to Druzdzel (2002) one can't give a specific definition to both the aspects and IDSS as a whole with further explaining that the closest definition one can give to decision support system has to be when one is giving the explanation of decision support. Nevertheless lots of literatures have proven the that theory wrong with most of them giving DSS a clear definition without defining DS [20]. Nižetić (2007) lay emphases on human decision as the key pillar of DSS which is clearly different from machine decision making. Decision support is a term that that is generic and can be used in every aspect that concerns decision-making.It is also links highlights of decision support systems with some highlights of expert systems (ES) and executive support systems (ESS), which make it unparalleled system [21].

3.1 Decision Support Systems and Intelligent Decision Support Systems Application and Development

There are many models of DSS and IDSS are used with different applications and with different development features.

3.1.1 Model-driven

A DSS model pioneered by the use of algebraic decisions simulations and optimization of several models parameters through the system operator in other to help in their decision making while managing any type of situation. The components of DSS are to usually data intensive, it has no requirement for a huge database for DSS that is model driven, and they may need to be extracted depending on the reason on ground Usually they are not data intensive. The major parts of the architecture of a model pioneered DSS are more or equal to two qualitative models, which brings the functionality. Tools of analytics used in models that are algebraic allocate a level in elementary functions. A lot of times while in the creation of an application which is model driven, by default the development of algebraic models is done in spreadsheets [22].

3.1.2 Data-driven

This type of DSS is one that gives the system the ability to manipulate structured data with the option of handling time series of both external and internal data as well as data dorm the company and also the firms real time data. One thing that distinguishes data driven DSS is its functionality, While less complex an less intensive can be managed by basic tools and elementary techniques in handling

the firms information a lot of enterprise applications such as Data Warehouse, enterpriser source planning, which handles data manipulation through processing computerized equipment's in other to bring up more effectiveness. Another Data driven DSS system can be said to be Business Intelligence (bi) which contains powerful insight creation tools such as online analytical processing (OLAP) which brings about more and more ease in getting viable insights from information thereby making decision making more needed [23]. A lot of organizations are helped by BI systems through its ability in generating effective reports and also analysis of data. In a nutshell, it is seen that BI systems pioneers decision by instigating, modifying and amputating data that was stored in the organization memory or maybe real time data. BI systems have a specific objective, which is linked with the increment in the validity and quality of data that is made accessible to the firm to assist them in making decisions. The major formula of a data driven DSS has to do with having the link to a massive amount of data, and also called and reliable data. DSS success is dependent on its access to data that is structured and organized well. If these requirements are not met, there is a high likelihood that the DSS system will not be very effective [24].

3.1.3 Communication-driven

Electronic communication & hybrids networks technologies are the pillars of communication driven DSS helping in connecting decision makers and making sure that there is a reliable connection between communication and collaboration resources among set of decision makers. A subset of decision-making that was invented over time can be seen in [25] as team decision-making, which then grew to become Group decisions, supports systems (GDSS). Collaboration Decisions supports system (CDSS) can be said to be another Communication driven DSS which is based on inter -activeness of computer based system in which individuals making decisions work together in other to get solutions, find alternatives for the problems on ground [26].

3.1.4 Document-driven

The use of documents has become an integral and pivotal part of businesses and companies. There is a constant and steady increase of the files (audio, video, pictures document and hypertext document) that are been saved in different types of systems. There are lots of documents database in the current world today with trending document driven DSS technologies in the internet. Some of the web based document driven DSS are Alter Visa & Web Crawler. There is usually no standardization of document in a uniformed manner. Due to this issue, of the large amount of stored information been in an unstructured form the extraction of information from systems such as Lexis Nexis (an information extraction system) structures the information or document in a way that will make decision making better. Text extraction systems help in filtering and standardizing the documents in an insightful format that will be of benefit to the organization [27].

3.1.5 Knowledge-driven DSS

Artificial Intelligence is the main pioneer or generator of Knowledge driven DSS. Knowledge driven DSS can be said to be computer based in their reasoning's with a unique Technology of AI, management's experts system, data-mining technology & communicating techniques are integrated. A DSS that is intelligent is classified into 2 evolutionary development. The other categories of this system is based by rules experts system. That is globally been use to schedule in systems of production. The operational concept of expert systems is based on application of heuristic that is conceptualized as strategy that helps in solving problems. In the proper utilization of these systems, the use of human expert knowledge that has been retrieved into the database in other to solve issues is needed. Neural network is been used by the second generationwhich has a lot of similarities linear programing model & do lots of experiments that are random with the selection of variable excluding identifiable values [28] [9].

3.2 Characteristics Of DSSVS IDSS

Due to the fact there is no unique conclusion on DSS, there is also unease in setting out the characteristics of DSS. While due to the uncontrollable and constant increase in information technology, the rise of IDSS is inevitable with increase in more concept and ideas. According to various articles of DSS& IDSS, I have been able to select some characteristics of DSS which are shown in Table 1.

3.3 The Architecture of DSS

There are a lot of pivotal parts to a DSS system. Some of the components includes the database, which is a storage system that is responsible for the safekeeping, manipulation and processing of information and data. Another component is the model management system (MBMS) which performs powerful simulations by utilizing different analytical and mathematical techniques in other to present advanced or complex information together with an easy to understand user interface which manages the interacting of the system

Table 1.

DSS	IDSS
Gerber (2014) Decision makers get assistance from functions of DSS at unstructured and Semi structured situations through the combination of data and human judgment	Bourouis(2014) It consist of an self-directed skill to learn in which maker of decisions have the permission to to adjust & expand knowledge which makes it more better in solving problems
There should be fast response in DSS in other to quickly sort out the fast changing needs of decision makers.	Druzdzel (2002) Its deals with stimulation of the reasoning process of maker of decisions making it more of a reasoning technique applying important knowledge to protect makers of decision to select the best model for their decision.
DSS systems are meant for process support and to automation	It has a strong function In managing intelligent models by adjusting and handling models in the form of knowledge architecture & simplifying interfaces inbetween different sub systems.
Gerber (2014) DSS systems integrates both models and information	Yao & Azam (2014) IDSS formulates a professional structure to help in supporting decisions and also expands the adaptability of the system into various fields.
The effectiveness and efficiency of decision making is enhanced by DSS	Bourouis(2014) IDSS has a pillar of AI ad DSS
Ferretti & Montibeller (2016) There is a direct interactivity between DSS and the system user in other to make the process flexible and easy	Druzdzel (2002) Yao & Azam (2014) It is the perfect tool to handle solutions for complex problems
Gerber (2014)Decision making process is facilitated by DSS	Yao & Azam (2014) IDSS operations works solely with expert systems.

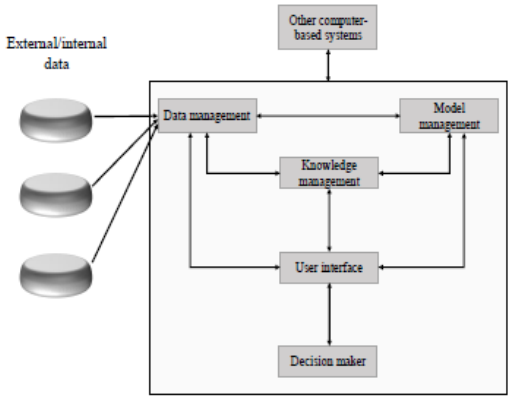

Figure 2. Schematic view of DSS components

and user [28]. As in Figure 2

3.3.1 Complexity of implementation of DSS and IDSS

There are many issues that increase the complexity of implementation of DSS and IDSS such as the following:

(1) You should realize what makes Intelligence decision support system application unlike from a traditional decision support system so that you can evade overpriced mistakes.
(2) You should recognize the substructure mechanisms of your new intelligence decision support system application as the tools obtainable for development, access and analysis.
(3) You should be able to identify items that could destruction the success of your new intelligence decision support application.

The process and interactions & recursions is basically used by IDSS to build models which is been utilized by users in several applications and systems. IDSS also makes uses of knowledge base, traditional, database model etc. IDSS also contains a structure for natural language management in addition to man machine communication system [27].

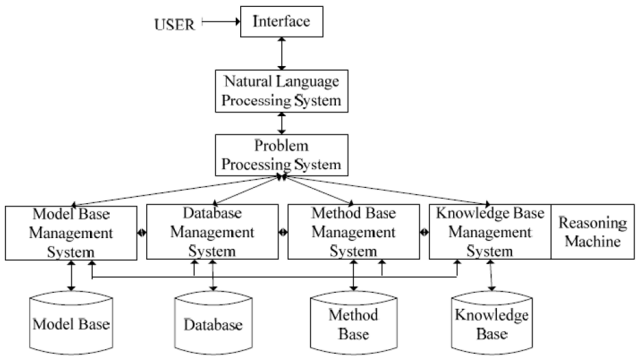

Figure 3. IDSS architecture

3.4 DSS & IDSS Decision Making Methods

There different decision making methods for DSS and IDSS.

(A) AnalyticalNetworkProcess(ANP)

One of the most popular IDSS is the ANP, which is the global AHP that has the capability of making unidirectional ad static connections between decision problem components. Never-

theless, the complexities and the several interactions at different levels between the elements of the problems in the real world makes it very difficult for hierarchical structures to handle. ANP can be said to be a realistic equipment in solving complicated decision structures with the use of super matrix structure [29]. ANPs generalization can be said to be from the super matrix which gives far much more flexibility in handling difficult interaction between the several elements that are considered. The steps in ANP includes:

Step 1: Defining variables & establishing a measuring scale, which deals with brainstorming through the assistance of literatures in other to handle the complex systems.

Step 2: Generating a matrix that is direct and relational.

Step 3: Calculation of normalized matrix direct relation.

Step 4: Calculation of the straight up relational matrix.

(B) Decision-Making Trial and Evaluation Laboratory(DEMATEL)

Battelle memorial institute of Geneva created the DEMETAL technique when they were researching on the understanding complex issues in the real world, which includes famine, energy and environment. The DEMATEL technique has subjective opinions in account of people & takes note of key unique insights from analyst in the complex issues at hand. The major focus of DEMATEL is to expose any relation or link between system variables [30] [31]. The steps involved here includes

Step 1: Defining variable and establishing a scale for measuring

Step 2: The construction of a directs relational matrix.

Step 3: calculation of the normalize directs relational matrix

Step 4: calculation of the relational matrix

3.5 Differences between DEMATEL and ANP

The differences between DEMATEL and ANP are illustrated in Table 2.

4 Conclusion

This project consist of DSS & IDSS features in which a systematic review was conducted with many references from several papers. This study gave IDSS system operations and its several applications and types ranging from document, data, model, knowledge & communication driven DSS where the applicability of DSS was discussed in all those areas. I also went further in in explaining two types of DSS techniques, which are Analytical Network Process (ANP),& Decision-Making Trial & Evaluation Laboratory (DEMATEL) and then gave a tabular difference between the two techniques gotthen from their characteristics in different literatures. DSS have evolved from supporting individual decisions to supporting groups and then to supporting organizations wide decisions.

Acknowledgment

We have adopted most of our decision on the traditional decision support system in our educational institutions (international Brayan primary private school). We have noticed that this system is detrimental to the achievement of positive results, but the tremendous information revolution and the availability of a large number of information and the compatibility of knowledge and in the field of communication. Other systems help to make decisions on time. One of the most important points on which we are based on decision-making is the real time. Therefore, we decided to conduct research on the role of the intelligent decision support system and the addendum to the decision support system.

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Table 2. Differences between DEMATEL and ANP

DEMATEL	ANP
DEMATEL process involves locating average matrix	ANP gives a detailed description of the problem and its objective and the possible result of the decisions
It normalizes the initial average matrix	ANP determines thecontrol criterion and sub criteria in the 4 stages with one for benefit, opportunity, cost and risk of decisions & get their priority from comparing matrices
Calculates the entire relational matrix	ANP decides the generic network of component with their element that's applied to the whole control criteria
It has inner dependence matrix & relationship	In ANP the criterions determines the feedback systems clusters connecting them appropriately with their dependencies
Achieves the total dependent matrix	ANP determines what approaches that will be followed in the analysis of all of the clusters elements thereby influencing every other cluster according to their criterion.

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