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EXAMPLES OF SOFTWARE TOOLS FOR DECISION SUPPORT SYSTEM (DSS) BASED ON MODERN TECHNOLOGIES

Summary: *Application of modern manufacturing philosophies (CIM, EMS, JAT, JIT, PLM, SAT, TPM, TQEM, TQM etc.) in manufacturing conditions, demands greater speed and accuracy in information movement, which can not be done without modern system for decision support (DSS). Today, under modern DSS system we imply a system which is supported by powerful computer technique, which is more acceptable from the aspect of price, as of performance it offers. And its goal is to create good information that can be managed and to make a decision based on that information. In the paper is given examples of software tools for decision support system (DSS) based on modern technologies (knowledge-based systems, Web-based systems, neural networks, fuzzy logic and etc.) and analysis and information about TAPS and TACDSS software tools for decision support system (DSS) for special applications.*

Key words: *information, data, **I**nformation **S**ystem (IS), **D**ecision **S**upport **S**ystem (DSS).*

1. INTRODUCTION

DSS (***Decision Support System***) system is based on computer which in given opportunity enables managing in way that it takes different information about organization and predicts effect of possible decisions. It is based on set of procedures that are used for processing data, managing informations, and decision making, supporting complex and hard decision making, and have begun to develop by appearance of program languages of fourth generation and so called application generators [1-3, 6, 13-19, 23-26, 28].

Unlike MIS (***M**anagement **I**nformation **S**ystem*) DSS system provides greater help in analysis and decision making.
Beginning of development of Decision Support Systems (DSS) is tightly involved for theory development and quantity method and model (linear programming, network planning, simulation, dynamic programming, theory of lines etc.) during 1970. In middle of 1980 a concept appeared of GDSS i ODSS systems. During 1990 concepts OLAP and KB-DSS, and by the end of 1990 and beginning of 2000 concept WB-DSS.
Basic goal of DSS system is to secure quality information for process of decision making in cause of increasing decision efficiency and to help decision makers to solve unstructured or weakly structured problems (decision making).
Main characteristics of these systems are:

- Orientation to decision making,
- Orientation to solving weakly structured problems decision making and orientation on end user,
- They give help in decision making on all levels of decision, but are of special importance for higher levels, and unlike MIS systems who mostly simplify horizontal flow of informations, DSS systems support vertical informational flows and by that help information integration that are used on different organization and managing levels.,
- They ease sintesis of informations from certain subsystems for strategic decision making and contribute automatisation of strategic planning and prediction,

- Easy to use, languages of communication are very simple, and structure of system is made that way that enables easy access to the data in interactive work etc.

Basic components of DSS system are:

- Users with user interface,
- Databases,
- Models of decision making and bases of prediction, planning and decision making,
- Communication components and

Special software which links users with data and models.

On figure 1. [10, 23] is shown a conceptual model of DSS system, and on figure 2 [10, 24-26] a modified version of this conceptual DSS model, which is shown to give an accent for focusing onto interfejs of knowledge management.

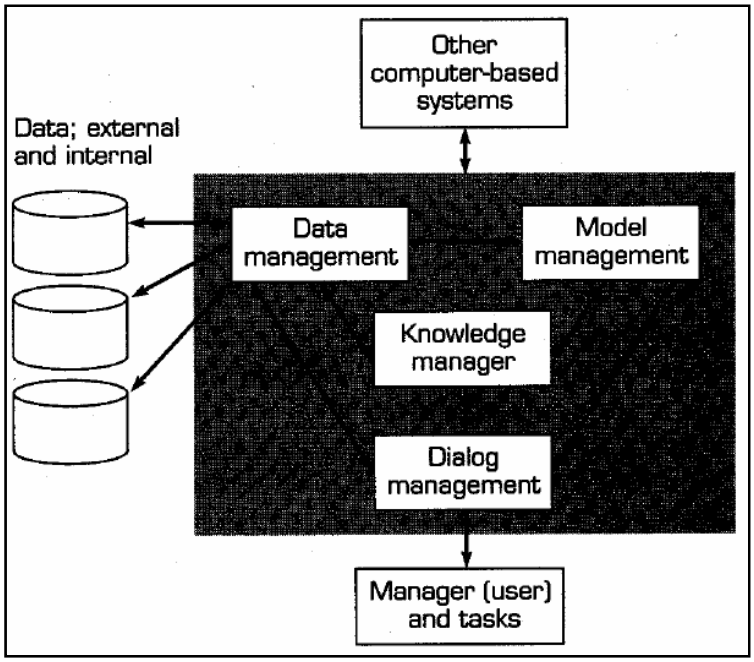

Figure 1: Conceptual model of DSS sistem [10, 23]

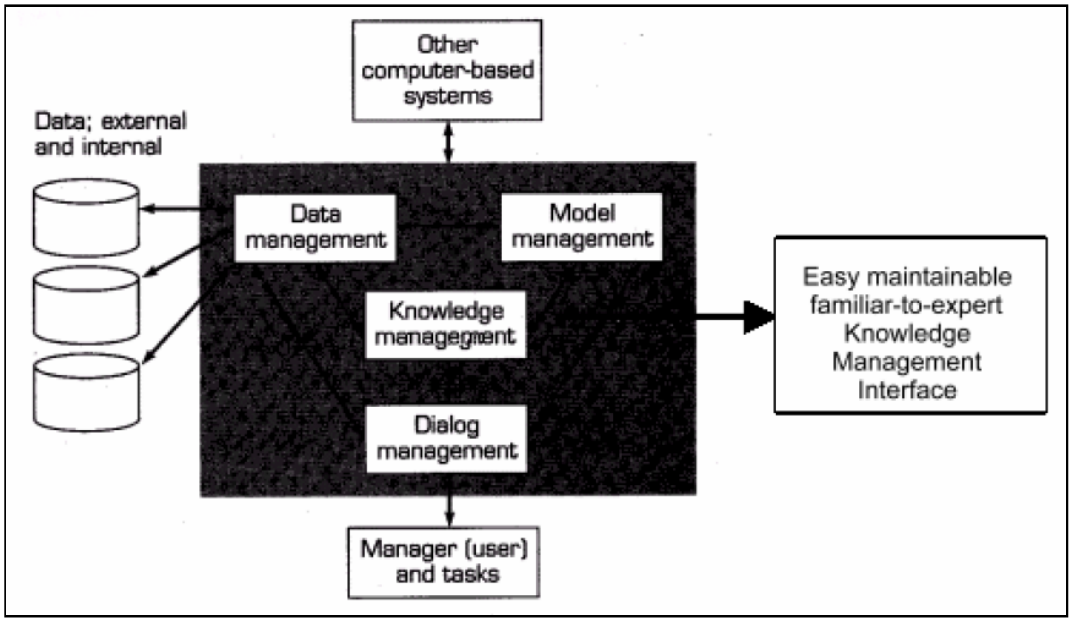

Figure 2: DSS model modified, to include focus on interface of knowledge managment [10, 24-26].

2. CLASSIFICATION OF DSS SYSTEMS

Different authors suggest different classifications. In the paper will be applied classification of DSS to [4]:

- Classification of DSS systems according to user level,
- Classification of DSS systems according to conceptual level,
- Classification of DSS systems according to system level,
- Classification of DSS systems according to according to way of realization
- Classification of DSS systems according to according to concrete realization and etc.

2.1. Classification of DSS systems according to way of realization

DSS systems, according to way of realization split to [3-5, 9, 10, 13-15, 17, 23-25, 28]:

- EDSS (***E**xpert **D**ecision **S**upport **S**ystem*),
- KB-DDS (***K**nowledge-**B**ased **DSS***) or IDSS (***I**ntelligent **DSS***),
- GDSS (***G**roup **D**ecision **S**upport **S**ystem*),
- MADSS (***M**ulti-**A**tribute **D**ecision **S**upport **S**ystem*),
- MCDSS (***M**ulti-**C**riteria **D**ecision **S**upport **S**ystem*),
- MDSS (***M**ulti-Participant **D**ecision **S**upport **S**ystem*),
- NSS (***N**egotiation **S**upport **S**ystem*),
- ODSS (***O**rganizational **D**ecision **S**upport **S**ystem*),
- PDSS (***P**lanning **D**ecision **S**upport **S**ystem*),
- TDSS (***T**eam **D**ecision **S**upport **S**ystem*),
- WB-DDS (***W**eb-**B**ased **D**ecision **S**upport **S**ystem*).

2.2. Classification of DSS systems according to concrete realization

Concrete realized DSS systems, according to sort of given services, for wider geographical area are for example [2, 3, 5, 7, 11, 12, 20, 27, 28]:

- CDSS (***C**onsumer **D**ecision **S**upport **S**ystem*),
- EDSS (***E**nvironmental **D**ecision **S**upport **S**ystem*),
- GSDSS (***G**roup **S**patial **D**ecision **S**upport **S**ystem*),
- IDSS (***I**nteligent **E**nvironmental **D**ecision **S**upport **S**ystem*),
- LADSS (***L**and **A**llocation **D**ecision **S**upport **S**ystem*),
- MC-SDSS (***M**ulti-**C**riteria S **D**ecision **S**upport **S**ystem*),
- SDDS (***S**patial **D**ecision **S**upport **S**ystem*),
- TDSS (***T**actical **D**ecision **S**upport **S**ystem*),
- WebSDDS (***W**eb-**B**ased **S**patial **D**ecision **S**upport **S**ystem*) and etc.

3. SOFWWARE FOR DECISION SUPPORT (DSS)

Most known software DSS tools and package are:

- Software for strategic decision,
- Software for financial simulation and modeling (FINANSEER, Budget Expres, Micro SIMPLAN etc),
- Statistical and econometric software (SAS, Forecast Master Plus, ESP etc.),
- Software for building matrices and tree of decision (Expert Choise, Decision Aide, Decision Pad etc.)
- Software for special applications (PROMCALC, GAIA, TACDSS, TAPS) etc..

Examples of development software for KB-DSS are:
- CBISA (***C**omputer-**B**ased **I**nformation **S**ecurity **A**nalysor*),
- CDP (***C**riterium **D**ecision **P**lus*) v.2.0 from firm Infoharvest Inc., available on Web site: http://www.infoharvest.com/,
- ERGO firme Arlington, available on Web site: http://www.arlingsoft.com/,
- Expert Choice for Win firme Expert Choice Inc., available on Web site: http://www.expertchoice.com/,
- Decision Pro firme Vanguard, available on Web site: http://www.vanguardsw.com/,
- KnowMan Designer SR3 firme Intellix, available on Web site: http://www.intellix.com/,
- Business Rule Studio firme Rule Machines Corp., available on Web site: http://www.RuleMachines.com/,
- Visual Rule Studio firme Rule Machines Corp., available on Web site: http://www.RuleMachines.com/,
- AgentOCX firme The Haley Enterprise, available on Web site: http://www.Haley.com/,
- Jess (***J**ava **E**xpert **S**ystem **S**hell*) firme Distributed Computing System, available on Web site: http://berzberg.ca.sandia.gov/jess/,
- ILOG JRules firme ILOG, available on Web site: http://www.ilog.com/ etc.

Examples of development software for KB-DSS are:
- Arcplan, available on Web site: http://www.arcplan.com/,
- Business Objects, available on Web site: http://www.businessobjects.com/,
- Cognos, available on Web site: http://www.cognos.com/,
- Comshare MPC, available on Web site: http://www.comshare.com/,
- Databeacon, available on Web site: http://www.databeacon.com/,
- Gentia, available on Web site: http://www.gentia.com/,
- Hummingbird, available on Web site: http://www.hummingbird.com/,
- Hyperion, available on Web site: http://www.hyperion.com/,
- InterNativity Inc., available on Web site: http://www.internetivity.com/site/ products.html/,
- Micro Strategy, available on Web site: http://www.microstrategy.com/,
- Retrieval Ware, available on Web site: http://www.convera.com/Products/ rw_arch.asp/,
- Speedware, available on Web site: http://www.speedware.com/ itd.

Examples of development software for EDSS are:
- BIOMASS (***B**esòs **I**ntelligent **O**peration and **M**anagement of **A**ctivated **S**ludge*);
- DAI-Depur (***D**istributed **A**rtifficial **I**ntelligence - **Depur***);
- DCHEM (***D**istributed **Ch**emical **E**mergencies **M**anager*);
- GESCONDA (***Ges**tión del **Con**ocimiento en Bases de **D**atos **A**mbientales* or english language *System for Knowledge Management in Environmental Data*), available on Web site: http://www.lsi.upc.edu/~webia/KEMLG/projects/GESCONDA/;
- OntoWEDSS (***Onto**logy-Base **W**astewater **E**nvironmental **DSS***);
- STREAMES (***St**ream **Rea**ch **M**anagement an **E**xpert **S**ystem*), available on Web site: http://www.streames.org/;
- WaterSHEDSS (***Water**, **S**oil and **H**ydro **E**nvironmental **DSS***) and etc.

3.1. TAPS

TAPS (***T**he **A**ssessment **P**rofiling **S**ystem*) [3, 8] is multy-level self-reporting visualization for support in any program for management of environment. TAPS is designed to make decision, giving analysis in real time, status and situational conscious. TAPS is a command-level visualization which is being started with multiple attribute logic engine.

TAPS system is a advanced graphical visualization combined with area state of logical engine in order to make Web based informational service for real time assessment which contributes decision

making. Goal of TAPS system is to enable decision making in centralized situational awareness (***S**ituational **A**wareness* - SA) of main with relevant information which are needed for effective processing of complex situations.
TAPS access for evaluation of high level organization mission is an operational approach and method of analysis of decision making for expressing measures of efficiency in conditions of quantified measures of characteristics and other essential importance. TAPS Web based graphical service is translation of data model state into dynamic display which can be often changed.
On figure 3 is shown graphical visualization of menu of TAPS system.
Benefits of TAPS system is seen in:

- User defined data model;
- Goals;
- Attribute difficulty;
- Data sources;
- Results in real-time;
- Permanent format of reporting;
- Web based data processing and reporting (TAPS Web service enables fast gathering of data from multiple sources, their processing and data distribution);
- Flexible modes of data gathering and
- Adjusted frequency of evaluation.

TAPS process goal is to support manager in fast achievement of desired goals for any complex operation or project. Steps are described which are needed for creation of functional program for management of decision system.:

- Development and adding of detailed information about program management;
- Production and processing of specific project state of area data model;
- Loading and performing checks of program management;
- Administration and management of TAPS Web based program service during start up phase of implementation
- Giving complete support in training condition, documentation and technical support.

OODA (***O**bserve, **O**rient, **D**ecide and **A**ct*) diagram of decision making in TAPS system depends on information control problem (Col John R. Boyd′s OODA Loop, 1995) and is shown on figure 4.
More information about TAPS available is on Web site: http://www.taps-vss.com/taps/.

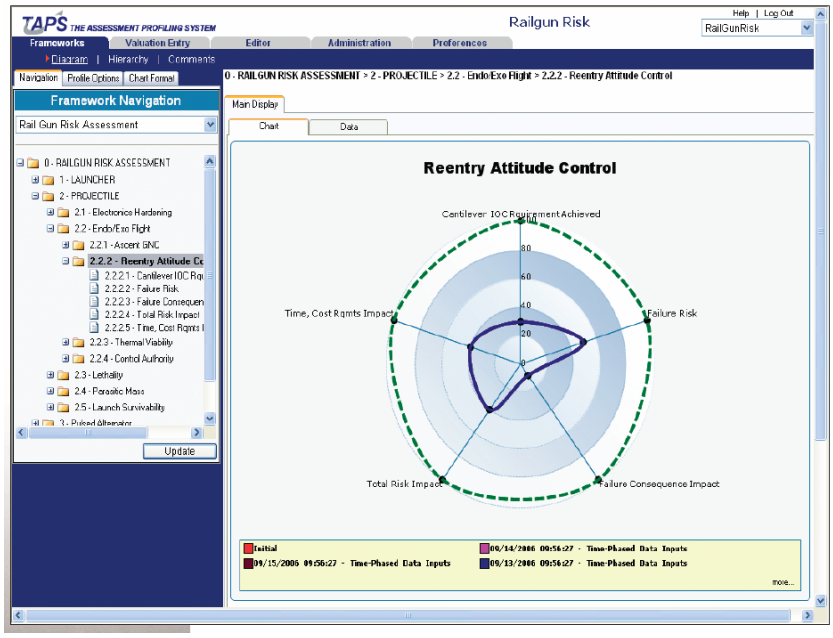

Figure 3. Graphical visualization of menu of TAPS system [8]

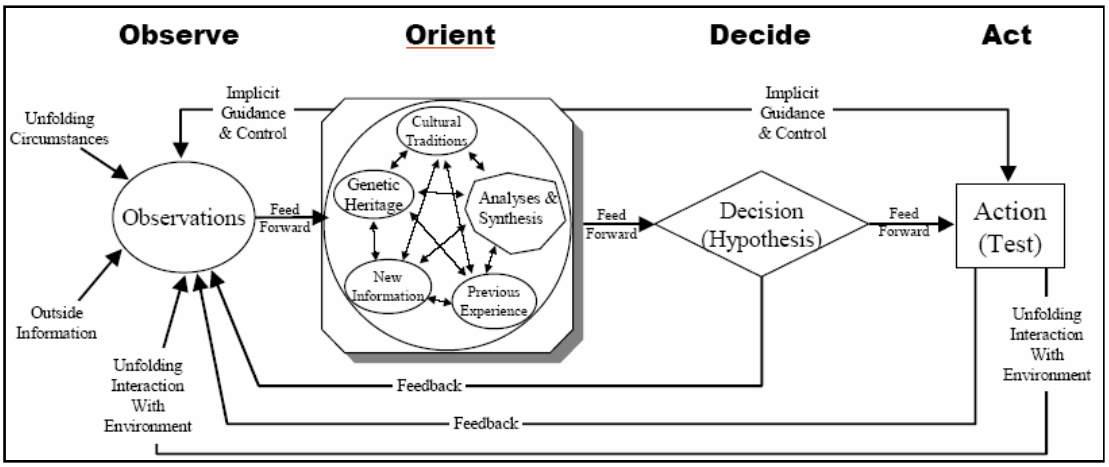

Figure 4. Decision making diagram in TAPS system which depends on information controle problem (Col John R. Boyd's OODA Loop, 1995) [8]

3.2. TACDSS

TACDSS (***T**actical **A**ir **C**ombat **D**ecision **S**upport*) [21, 22] represents implementation of reliable system for decision support which includes two important factors: gathering and analysis of previous information and assessment of solution. Data should be picture or form, real number, binary code or natural language textual data which depend on object area. Object of decision problem is also known as factor of decision. This objects can be expressed mathematical inside decision problem as a universal set. Factor of decision is sub-set of problem decision.

For optimal decision making, system should be able to adaptively process information's given by foreign word or description of problem area of any natural language.

For developing TACDSS system based on Takagi-Sugeno fuzzy interface system is used ANFIS (***A**daptive **N**etwork Based **F**uzzy **I**nference **S**ystem – adaptive network based phase inherent system*) system. Six-layered architecture of ANFIS system is shown on figure 5.

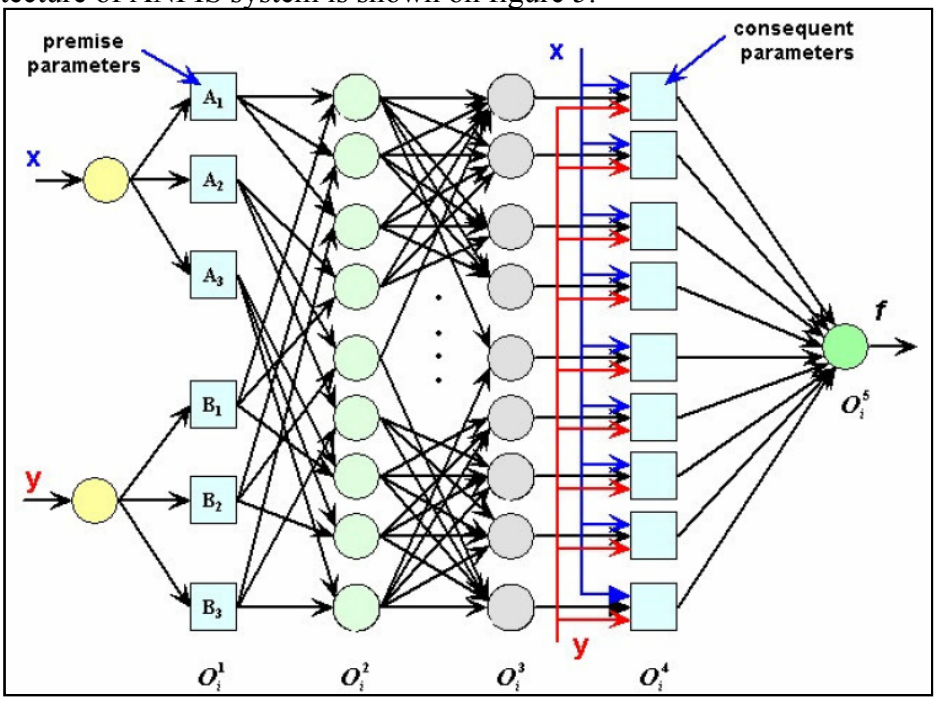

Figure 5. Six-layered architecture of ANFIS system [22]

3. CONCLUSION

From stated comes basic conclusions:

- Modern business demands more and more speed and accuracy with information movement, which can not be done without modern IS,
- For one quality informational system is necessary to comply with more conditions, and some of most significant are quality hardware (mechanical part) and software (program part). However, it should not be forgotten the most important factor, and that is organization itself, that is algorithm of occurrence, starting from occurrence to processing and information flow. There have been cases in our area to perform supply of modern equipment and solid program, but all of this never lived. This means that we have to accurately define algorithm of occurrence, which we would have to have before supplying of information system, but we also have to have able staff to which application of this modern system is not foreign,
- Parallel with development of IS a need is put for training of staff for its use, which can be accomplished by personal engagement or with help of adequate courses,
- In area of IS there is no some common methodology of IS classification, so that different authors can differently classify, but there is a large number of developed IS system, among which according to plan of realization: TPS, MIS, OAS, OLTP, ES, DSS, EIS, OLAP, KB-DSS, IES and WB-DSS or to sort of given services: CDSS, EDSS, GSDSS. GSDSS, LADSS, MC-SDSS, TDSS and WebSDSS, AcIS, ATIS, AVIS, BIS, BIS, CGIS, CVISN, CWIS, EDI, EDIFACT, EELCIS, EFTPOS, EIS, EnvIS, EUDISED, EUNIS, EUNIS, GIS, HIS, IEIS, INIS, IRIS, MIS, PIS, POS, PROMIS, QIS, SIS, SITA, SWIFT, TIS, TRIS, WAMI, WHOLIS, WHOSIS, WISE, WSIS,
- In area of IS there is no, some common methodology of DSS classification, so different authors can differently classify, but there is a large number of developed DSS system, among which according to plan of realization:: EDSS, GDSS, MDSS, ODSS, PDSS, TDSS i WB-DSS, or to sort of given services: CDSS, EDSS, GSDSS. GSDSS, LADSS, MC-SDSS, TDSS i WebSDSS,
- Information system based on application of KB-DSS, WB-DSS and ES system, in difference of DSS systems, offer user alternative, response so that other experts could solve similar problem,
- It is listed a lkarge number of developed system for DSS system and
- Explained are TAPS and TACDSS systems.

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