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COLLABORATIVE DECISION – MAKING PLATFORM FOR PARTICIPATORY STRUCTURES AND GROUP DECISION – MAKING BODIES

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Abstract
The first part of the paper addresses the issue of group decision making, in the context of theoretical and methodological conceptualization of the main approaches for developing and using collaborative platforms, as well as those related to deployment of GDSS (Group Decision Support Systems). The second part of the paper is focusing on a business development model and a set of IT support functions for collaborative activities, consisting both of collaborative tools (online accessibility, communication facilities in remote, interactive exchange of information synchronously – like chat, brainwriting – or asynchronously – like forums, project management -) and the automation of computer algorithms for identification and analysis of decisional alternatives, evaluating the status of decision-makers, ranking of decision alternatives and selection of optimal decision alternative.
Keywords: Group decision support system, Collaborative platforms, Participatory structures, Group decision making bodies.

1. INTRODUCTION

The approach of group decisions from the perspective of their development by using remote communication technologies and GDSS tools, has its origins in *the mathematical theory of communication,* namely the first *mathematical model* that describes the operation of a communication system, related with a set of rules and instruments which can be used as an analytical tool of the behaviours of group decision bodies (Shannon, 1949). **Shannon** is a linear model**,** constitute of three components: a transmitter (source), a communication channel and a receiver (destination), including also the mechanisms of encryption and decryption of information. By interpreting communication channel components, given a group decision and considering the source that transmit information to other members of the group, with a certain rate and a set of probabilities that govern the frequency of their occurrence, we can put the issue of the amount of information needed to be produced by such a process. Therefore, we can consider that **an important part of a successful group decision-making techniques is given by their capacity to produce ideas,** some of them even under very restrictive conditions related to the time factor (Cioc, 2008).

At the same time, given the fact that information changes the uncertainty of the receiver, preferably by reducing the uncertainty, we can conclude that in practice, **information content can be measured through uncertainty.** *Uncertainty* status was defined (Chaitain, 2003) as *that situation where there are several variants of realization of an event and we do not know which of these will be* **followed.** It is intuitively obvious that, with increasing the number of alternatives considered by a group decision making, falling in the set **S** (denoted by **ISI),** the uncertainty grows. In a group decision process, we can consider that we need at most **n** tests in order to find the optimal alternative, where $2^n=m$,, which means that $n = \log_2 m$ It follows that, given a system **S** with **ISI possibilities**, we can describe the amount of uncertainty **h (ISI)** by the formula $h(|S|) = \log |S|$ (Chaitain, 1992). **The uncertainty analysis is related to the concept of entropy, which is related to a given decision situation**, at different stages of the group decision process. This correlation allows estimation of risk associated with a particular decision, and also the selection of relevant information, thereby countering the **effects of group thinking,** which describe *the situation where the desire to reach a consensus is more powerful than the motivation to investigate, in a realistic manner, all the rational decision alternatives* (Janis, 1977).

By the evaluation of uncertainty and entropy, it can also be optimised the multi-criterial problems related to **group decisions,** which occurs when choosing a decision alternative is achieved by considering simultaneously several objectives, which are often contradictory. In such situations one can distinguish two types of decision problems (Philip, 2002), respectively *problems with limited number of discrete alternatives* **(multi-attribute decisions)** and *problems with continuous spectrum of alternative* (generated by an algorithmic mechanism for identifying and evaluation of decision alternatives), which give rise to **multiple objective decisions**.

Especially in recent years, scientists have examined how **fuzzy logic** can be applied in the field of group decision theory. It was found that decision makers are often faced with the situation of selecting from a set, usually finite, possible alternatives, an optimal alternative able to simultaneously satisfy a set of criteria or objectives, and also a lot of restrictions. Bellman and Zadeh (Bellman & Zadeh, 1970) had the main contribution to the conceptualization of this type of decision situations, which demonstrated that **a decision, in order to be considered optimal, must satisfy both the objectives and the limitations of the group decision-making process.** Such an multi-dimensional analysis requires *high accuracy of the method* approved by *decision makers*, namely the use, on the one hand, *triangular or trapezoidal fuzzy numbers* (Tanaka, 2001), and on the other hand, of a specific decision-making method such as *Fuzzy Delphi technique.* The applicability of this last method is very large, being successfully used for estimating the duration of a project, broken down on stages, phases and activities (Seong Chang, 1999), or in order to aggregate the risk of software development (Shyi-Ming Chen, 2001).

Applicability of mathematical economic models described above, according to criteria of rationality of group decision is subject to the use of a **complex computer infrastructure,** consisting both of collaborative tools (online accessibility, communication facilities in remote, interactive exchange of information synchronously – like chat, Brainwriting – or asynchronously – like forums, project management -) and the automation of computer algorithms for identification and analysis of decisional alternatives, evaluating the status of decision-makers, ranking of decision alternatives and selection of optimal decision alternative.

2. ANALYSIS OF GROUP DECISION SUPPORT SYSTEMS

The literature reveals an important number of comparative studies between traditional models of management and non-traditional, issuing various theories about the validity of each type of organisational management. The developments in recent years, regarding the business environment, have imposed a reconsideration of traditional methods and techniques of organisational management, along with a **growing recognition given to the human resource as the only resource that has unlimited potential to solve problems and make decisions** (Cioc, 2008). Under these circumstances, the performance of an organization is dependent on the overall level of knowledge of its members, and how each component of the organization's knowledge is made available to others. In response to this problem have appeared a number of organisational methods, specific to collaborative participatory management processes, both across the whole organization, and alosi at every decision level within it.

Given these conditions, in addition to the widespread tendency to use collaborative processes in organizations, recent evolutions characterized by the appearance of virtual organisations and their interconnection in **EDI networks (Electronic Data Interchange),** have caused the appearance of virtual teams (Godar & Fexis, 2006), along with increased frequency and importance of decision-making meetings, but with a parallel decrease in the availability of decision makers. Whatever the chosen collaborative platform, by implementing such a system, it is necessary for the group decision members to have the opportunity to participate in the process of exchanging ideas within workshops or discussion groups, *without affecting the interactive exchange of ideas.* Such a system has, typically, a number of functional features (Cioc, 2008), such as self control, structures adapted to the specific group of users, dynamic management of all ongoing projects, and also the use of mechanisms basis for effective decision group, such as voting or brainstorming.

The limits imposed by the disadvantages of using methods of group decision making, together with the fact that considering the organizational environment, decision-making process should be increased flexibility, imposed the necessity of using information technology to eliminate errors due to human factor and, simultaneously, to automate decisions making process. The development of such software requires collection and real time processing of large volumes of data, using complex mathematical models for economic analysis and their interpretation, and also correlations between the variables in order to make relevant analysis by members of the group of decision makers.

The number of entities involved in a decision-making process and the nature of relations between them are dependent on the complexity of decision-making and other organizational or technical factors. Because the potential of a group is clearly greater than the sum of individual contributions, decision alternatives resulting from the debates are more consistent. In this situation, in which decisions are the result of collaborative processes between participants which are widely geographically dispersed, a methodological solution for effective decision process consists of **collaborative platform features integrated with GDSS (Group Decision Support Systems).**

Generally speaking, such a system is a collaborative work environment that provides support for activities aimed to improve participatory decision-making. However, there are opinions that consider that, *although on the one hand ensure a high quality on decisions, on the other hand, traditional GDSS systems creates a low impact among participants' satisfaction.* Anyway, we believe that a well designed GDSS can enhance positive group dynamics, only with the condition of facilitating the whole cycle of making a decision: generation, analysis, organization, categorization and ranking decisional alternatives. Achieving this main objective requires that GDSS system to meet the following classes of functions (Cioc, 2008)*:*

1. **Generate decision alternatives** through unstructured methods such as brainstorming, brainwritting, Philips 66, etc. In general, the collaborative activity that provides ideas is coordinated by a facilitator who can control the process depending on the time or the minimum required number of ideas. These can be generated on various topics and entered by participants using their own workstations. Also, the facilitator monitors the software and is responsible for saving and processing the result. As a rule, each user may use one interface divided into two windows: one private (to generate their own ideas) and one public (as the ideas generated by group are shown). Generating ideas can be done also in a structured form, using questionnaires (e.g. Delphi survey). The feature that allows anonymous ideas is often useful, and this fact involves a number of advantages (facilitates equal participation, cuts out

the pressure wield by some of group members, etc.) and disadvantages (eliminates the satisfaction associated with social interaction, reduces the possibility of assessing the degree of involvement of group members, etc.).

2. **The organization and categorization of ideas.** To be useful to a decider, the results of a brainstorming process should be clear and structured, so that later it can be prioritized. Group coordinator must be involved in discussions, and also in changing and reorganization of the list of ideas, in order for all the participants to reach consensus on a final set of ideas expressed. An important priority seeks to eliminate redundancies by merging similar ideas. The group is stimulated to create categories of ideas and ideas to indicate membership in these categories.
3. **Assessment and prioritization.** Ideas are evaluated according to the importance given by each group member using various methods and assessment scales: simple ordering of the list, scoring on a scale from 1 to 10, True / False system, Yes/No system, approve / disapprove etc. The results are then centralized into tables. Ideas are ranked using one of the classical methods: fuzzy technique, method of evaluation matrices, Bayesian analysis, etc.
4. **Planning activities.** Due to restrictions which arise in using such a system, related to the different status of participants in the organization, time zone differences and other limitations relating in particular to use the time factor, there is required a project management software to allow planning of each type of collaborative activity. An important role is played here by the time management component which is available to the facilitator, who can then manage the number of minutes allocated to each sequence of the decision during a meeting.
5. **Organizing data.** For GDSS systems, the use of relational databases, although effective in terms of how to store and refresh data is not appropriate, as the recommended technology of data warehouse containing (Adelman & Moss, 2005) *both operational and optimised data*.
6. **Structuring user interface.** This class of functions refers to two main components (Baron & Kerr, 2003): *the communication approach (which* allows interaction with the GDSS through various tools: menus, command lines, procedural languages, etc.) and the *presentation approach* (which allows presentation of data in a variety of formats: reports, tables, graphics, icons, etc.).This last component allows sending commands and informations to the GDSS system. In this context, interface design must take into account a number of factors associated with human interaction: accessibility, level of training in using software within this class, seeking errors and reporting, etc.

Structuring GDSS application in relation to the six classes of functions described above proves also a *particular interest into including in the context the version and operational system design methodology.* It should also be mentioned that, due to rising complexity of participatory activities and rapid decision-making requirements, **methodology design chosen must be an iterative, incremental and firmly anchored in user needs.**

3. CONSIDERATIONS REGARDING THE DEVELOPMENT OF A NEW MODEL OF COLLABORATIVE PLATFORMS INTEGRATED WITH GDSS FEATURES

Incremental development of Group Decision Support Systems, takes different forms in the theory and practice specialty, such as *JAD (Joint Application Development), ISM (Performing Structural Modelling), SSM (Soft System Methodology) technique or prototype development methodology.*

Much of the above techniques are based on design engineering **CASE tools** used for planning, analysis and logical design of decision support systems and also used with many structured design methodologies (e.g. SSADM, MERISE, etc.), making data modelling by entity-relationship diagrams, flow charts and process modelling in structured design through structured diagrams. Each modelling technique supports a component of the GDSS system (Cioc, 2008). For example, arrays are used very effectively to highlight the binary relationship between two entities. Also, a number of additional functions are used by CASE technology that facilitates the definition and monitoring of specifications, in terms of consistency and completeness.

Most methodologies are using CASE technology, but the designer does not provide explicit mechanisms to facilitate the organization in order to work in project teams.

Linking technical approach (focused on the use of IT tools and models for analysis, design and implementation of similar techniques mentioned above) with the management approach (focused on the practical usefulness of these tools to organize and coordinate decision-making), allowed the shape of a new model of a collaborative platform integrated with GDSS features, presented in Table 1.

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TABLE 1 – DEVELOPMENT METHODOLOGY OF A NEW MODEL OF COLLABORATIVE PLATFORMS INTEGRATED WITH GDSS FEATURES

No.	Stage	Overview
1.	*Develop system requirements of GDSS*	The development of system is necessary to start from the phase of developing a set of general requirements of GDSS, in the perspective of integrating collaborative online platform-specific functionalities and also requirements for providing support services. Simultaneously, it should be scheduled the process that integrates GDSS features with the specific features of collaborative online platforms.
2.	*Integration methods, techniques, models and methodologies underlying the group decision*	At this stage, all phases implicated in the group decisions process are analysed within the main types of decisions adopted in corporate management. In parallel, for each method and each phase it is necessary to identify informational needs and ways of satisfying them using IT&C, in order to correlate with GDSS application functions. The planning process of methods, techniques, models and methodologies underlying the group decision, it should be done in the context of linking these elements with a set of support services in order to facilitate decision-making.
3.	*Develop specific GDSS requirements*	In the category of specific requirements there are included three classes of requirements: a) *Functional requirements:* developing requirements towards the storage and handling of software application as like the mathematical and economic support used to rank alternatives according to preferences of decision makers; b) *Non-functional requirements on the interface:* developing interface application requirements, as like the structure of menus, reports and other items of software ergonomics; c) *Non-functional requirements of coordination:* modelling phases of group decision making based on their inheritance relationships, validation rules and reporting mechanisms.
4.	*Develop managerial GDSS requirements*	Management requirements include four categories of requirements: a) *Organisational requirements:* developing managerial requirements towards structural organization, for the main types of decision-making structures, as those appear, formal or informal, in the company; b) *Decision requirements:* developing managerial requirements on group decision-making, structured according to the specific structure and participatory elements such as frequency, importance, number of decision makers involved, coverage etc.; c) *Information requirements:* the development of supporting information management requirements necessary to support group-making decisions; d) *Methodological requirements:* development of requirements arising from specific management methods and modern management techniques that involve the large-scale, participatory decision-making structure (eg project management, management by objectives, management by budgets, etc.).
5.	*Develop specifications for design and software development.*	This stage involves the transformation of non-functional requirements into functional specifications for design and development, appropriate development and implementation of software functions.
6.	*Development of GDSS system functions*	The development phase stipulates seven categories of functions: a) *Online collaboration functions* (automatic data exchange, online synchronous and asynchronous communication, collaborative work and project management*);* b) *Functions for the evaluation of decision alternatives* (input functions, evaluation and prioritization of decision alternatives relative to a decision situation, according to a set of decision criteria); c) *Functions for the evaluation of preferences* (input functions, evaluating and prioritizing the preferences of decision makers on alternatives,

No.	Stage	Overview
		according to a set of criteria for assessing the decision-makers: the decision-making level owned, the status they hold in the group, experience level, competency etc.); d) *Consensus functions* (functions of aggregation of preferences makers to achieve consensus: most simple, restricted by a simple majority leader, most approximate etc.).; e) *Benchmarking functions* (development of performance indicators to assess the quality of group decision processes modelled with the software); f) *Reporting functions* (development of reports on different levels of aggregation and access, for both application users, that decision-makers and coordinators / moderators of decision-making groups).
7.	*Testing GDSS system*	During this stage, testing of functions within online collaborative platform features integrated GDSS is accomplished by simulating typical decision-making processes (programmatic decisions, multi-criteria decision under certainty, decisions under risk or uncertainty, etc.).
8.	*Progressive implementation and reassessment of GDSS system functions*	This phase represents the last phase of incremental development, in which is completed the revaluation of software functions based on explicit requirements of the first GDSS clients. This last phase is preparing the software for a complete commercial policy. Typical actions are: choosing the type of license under which the software distribution will be purchased (per workstation / per user policy shareware, modularity, etc.), users manuals, training manuals, management and promotional documents, etc.

Applying the previously proposed methodology has some **advantages over** other methodologies used for semi-structured or unstructured problems, such as reducing development time and the required cost, permanently changing requirements based on user feedback and the iterative nature which determines a better understanding of the system functions. Of course, the main **disadvantage** relates to difficulties in maintaining the system, due to the fact that many times, implementers focus on immediate functionality and less on system maintenance issues in accordance with the design standards.

In terms of choosing *in-house* development, opinions drawn from the literature on this type of design are contradictory (Cioc, 2008).There are points of view which consider that the beneficiary's ability to develop such systems is much higher than the case of an software integrator, because he is unable to perceive the characteristics of group decision-making processes. Clearly, there is the disadvantage that the beneficiary usually lacks experience in developing decision support systems and assisting in their integration with other computer subsystems of the organization. It can also be appreciated that the **lack of a coherent design methodology, successfully tested in similar situations can lead to failure** due to the ambiguous forms of the functional requirements and the improper correlation of the GDSS functions with the developed specifications.

4. CONCLUSIONS

The proposed model has broad applicability for any organization in which participatory management works, whether they are formally regulated (boards of directors, executive committees, management boards, etc.), or are found in informal structures (working groups, development groups, project teams, etc.). The implementation of GDSS system also allows building a database of expertise to manage the multitude of experts involved in decision making group, in their different stages (identification of decision alternatives, evaluation of alternatives decision, choosing the optimal decision alternative) and a mechanism for the structuring and ranking of the decision-making groups. Parameterization of the decision-making process through modelling specific algorithms, according to the specific of decisions (frequency, phase, the importance of the decision, the number of decision makers, the importance of decision-makers, etc.), allows greater control over management relations, and simultaneously creates the conditions for the correct application of the delegation principle.

Not least, through the system of performance indicators such as the benchmarks integrated into the model, whose values will be calculated automatically in the application, with a certain frequency, will faithfully convey the performance of the group decision-making system in the organization. Senior management will have the opportunity to view the current values, development and conformity with standards, in terms of benchmarks such as: the average decision-making productivity index , the satisfaction of the decision makers index or the rate of absorption of participative management techniques.

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