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Collective Strategy Formulation: An Experimental Research Assessing the Positive Impact of Group Decision Support System on Work Group

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ABSTRACT

Since the formulation of organizational strategy has been recognized as a collective process, several studies have assessed the usefulness of group decision support system "(GDSS)" inside the collective process of strategy formulation. This research evaluates the impact of GDSS on the collective process of strategy formulation. The competing values approach (CVA) model "CVA" was used as a theoretical basis and framework to evaluate the group's interaction and work. The research model includes one independent variable, two controlled variables and eight dependent variables. Eight research hypotheses were defined and empirically tested. Experimental laboratories with predefined procedures were conducted. 60 participants were randomly defined in groups of five peoples. The results indicate that the group supported by a GDSS perceives the best perception of the collective strategy formulation process comparing to groups supported by manual structure and control groups.

Keywords: Group Decision Support System, Collective Strategy Formulation Process, Competing Values Approach Model, Adaptive Structuration Theory, Group Interaction Process
JEL Classifications: O33

1. INTRODUCTION

Since the process of formulating strategy has been recognized as a collective process (Henry et al., 1998; Johnson et al., 2008; Elbeltagi, 2002; Sastre-Castillo and Ortega-Parra, 2013), the need to develop approaches for efficient strategy formulation emphasizing on effective group work is becoming a priority. A few studies have investigated the impact of GDSS on the collective process of strategy formulation (Wotto, 2016). Using a theoretical framework noted "CVA" for "competing values approach" (McCartt and Rohrbaugh, 1995), this research investigates the impact of GDSS into collective strategy formulation process.

This article is articulated in five parts. The first part, presents the conceptual framework of the research as well as the research model. The second part is reserved to describe the methodology used. The third part concerns the presentation of statistical results as well as the test of the hypothesis. The fourth part presents a qualitative analysis of the different results of the research. The fifth part presents a conclusion and a reflection on the integration of GDSS into the strategy formulation process.

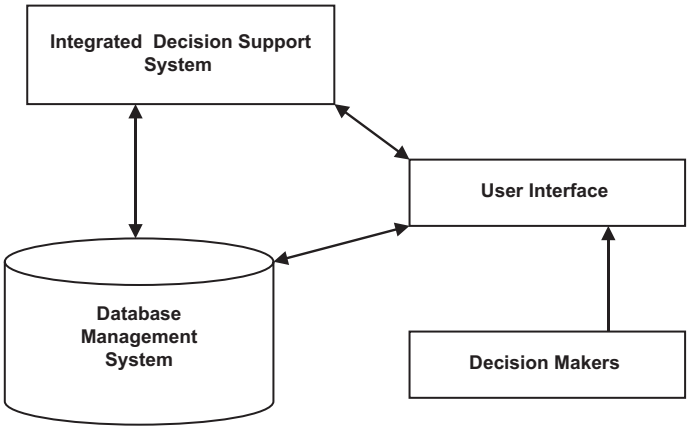
2. GROUP DECISION SUPPORT SYSTEMS: DEFINITIONS AND STRUCTURES

A GDSS is an information technology that supports group work and interactions. A variety of terms and acronyms are used to

design this type of technology. These terms include "EMS" for "electronic meeting systems" (Nunamaker et al., 1991), "GSS" for "Group Support Systems" (Jessup and Valacich, 1993), groupware (Favier 2002). The most popular term for these technologies is "GDSS" for "Group Decision Support System" (DeSanctis and Gallupe, 1987). Several definitions in the literature review have been given to the GDSS. We retain in this research a definition which seems to us more complete. DeSanctis and Gallupe (1985) have defined it as follows: "A GDSS is an automated, interactive system that helps a group of decision makers working in groups to solve structured or unstructured problems." Figure 1 shows the general structure of GDSS. Several studies show the positive impact of using a GDSS on group work process and interaction. Thus, Favier (2002), through a research using a groupware and an experimental device, compares groups working face to face and groups working asynchronously and geographically dispersed. Different criteria (participation, consensus, cooperation, influence, satisfaction, time and quality) of group work were compared.

The results of the research show overall an improvement in the decision-making performance of the working groups using a decision support system. Al Shishany et al. (2017) investigates the reason why there is a lack of GDSS use and comes up with suggestions to enhance the use of GDSS in both private and public sector. Several research programs have demonstrated the value of GDSS in improving the group decision-making process. The most important of these programs comes from the University of Minnesota under the direction of Professor DeSanctis (2008)

Figure 1: General structure of a GDSS (DeSanctis and Gallupe, 1987).



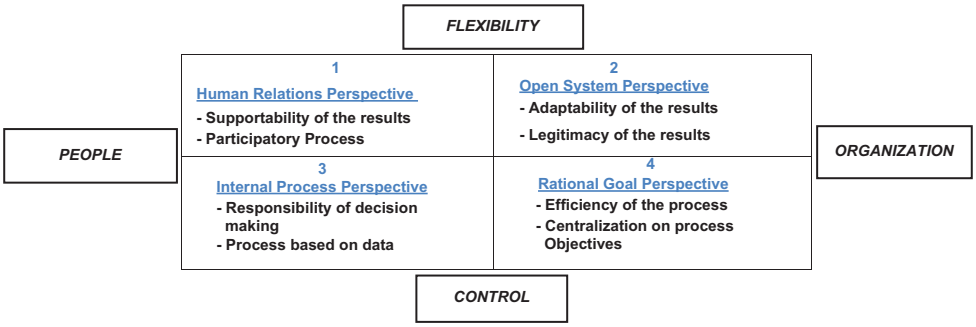
3. THE THEORETICAL RESEARCH MODEL: USING THE CVA MODEL TO ASSESS THE GROUP INTERACTION PROCESS

The majority of the studies evaluate the group interaction process based on the results that the group members have achieved and do not investigate the interaction process itself (Aiken and Janette, 1990; Pinsonneault and Kenneth, 1990, Damart et al., 2007). In fact, Interaction that occurs while a group completes a cooperative task describes how the group work and reach a decision and results (DeSanctis, 2008; Martin, 1993). Reagan and Rohrbaugh (1990) suggest that evaluation of the decision-making process in the group cannot be done only on the basis of results, except in fully controlled experiments. Much more attention must be given to the interaction of the group rather the assessment of group's outcomes (Desanctis, 2008, Hare, 2003; Hybels, 1995). The theoretical research model used in this research is based on a "CVA" (McCartt and Rohrbaugh, 1995; Reagan and Rohrbaugh 1990, Quinn 1988). This model has four perspectives for analyzing group's interaction process. They are grouped in matrix and referenced by two axes of analysis. The first axe indicates the degree of structure imposed to the group's members, ranging from flexibility to control. The second axe concerns the degree of participation and involvement of group's members. This model has been used previously in several studies to analyze the group's interaction process (McCartt and Rohrbaugh, 1995; Reagan and Rohrbaugh, 1990; McCartt and Rohrbaugh, 1989; McCartt and Rohrbaugh, 1995). Figure 2 shows the different components of the CVA model.

3.1. Research Model

The design of the research model is mainly supported by the CVA matrix. Thus, the model contains one independent variable, two controlled variables and eight dependant variables. The independent variable in this research is the decision support tool provided to the group's participant. It is operationalized by providing three types of support for the different types of groups involved in the collective process of strategy formulation. The first type of group is supported by a GDSS. The second type works with paper and pen using a manual structure. The third type called control group works without technological support and without manual structure. Both groups GDSS and MANUAL are invited to follow the same steps in order to control the structure imposed on the group interaction process. The purpose of this design of the decision support variable is to assess, on the one hand, the impact of the structure on the process of collective

Figure 2: Components of competing values approach model (McCartt and Rohrbaugh, 1995)



strategy formulation, and on the other hand, to differentiate the impact of structure from that of technology on the group's interaction process when it comes to strategy formulation. Throughout this research, we will adopt the following notation to reference the different types of groups involved in the research. Type 1: GDSS, Type 2: MANUAL, Type 3: CONTROL. Figure 3 shows the structure of the research model including variables and hypothesis.

3.1.1. Controlled variables

Two controlled variables are used in this research: Group size and task. Each group in the research has five individuals involved together in the process of collective strategy formulation. These individuals are grouped together and act as decision makers. Likewise, each group participating in the research is subject to the same task. These two control variables are consistent with the guidelines prescribed in the majority of studies investigating the group decision process and using an experimental design as an empirical approach (Benbassat, 1993; Al Shishany and Adams, 2013).

3.1.2. Dependent variables

The eight dependent variables used are drawn from the "CVA" model to evaluate the process and group interactions process. Table 2, shows the evaluation perspectives and their corresponding variables as well as their measurement constructs. All dependent variables described in the research model are evaluated on a six-point Likert scale (1: Strongly agree, 2: Moderately agree, 3: Slightly agree, 4: Slightly disagree, 5: Moderately disagree, 6: Strongly disagree). These items measure the subjective perception that each participant values during the collective strategy formulation process. The reliability and validity of the items as measurement constructs for each variable has been verified and validated in other studies (McGrath, 1984; McCartt and Rohrbaugh 1989, Reagan and Rohrbaugh 1990). The Table 1 shows the values of construct's reliability.

3.2. Research Hypotheses

The argumentation for elaborating the hypotheses of the research is based on two main points. A GDSS incorporates a structure that helps improve the group's decision-making performance (Poole and DeSnactis, 1989; Anson et al., 1995, Rigopoulos et al., 2007; Amabile et al., 1990). Favier 2002, Kraemer and King 1988, Susan and McGrath 1994). According to the AST for "Adaptive Structuring Theory" (Poole and DeSanctis, 1992), the first goal of collective action in a group using a decision support system is to adapt to the situation. This adaptation is manifested by the use and appropriation of group members of a structure represented in the various tools of the system. Thus each member of the group adapts those tools to his own needs for the accomplishment of the task. The term appropriation was defined by Poole and DeSanctis (1989) as "*... Fashion in which a group uses, adapts, and reproduce a structure...*". The appropriate tools for group work such as (electronic brainstorming, voting, categorizer.) are considered

Table 1: Measurement of dependent variables and construct's reliability

Evaluation perspective	Dependent variables	construct reliability
Rational perspective	1. Centralization on the process	0,78
	2. Efficiency of the process	0,75
Political perspective	3. Adaptability of the process	0,76
	4. Legitimacy of results	0,79
Consensual perspective	5. Participatory process	0,80
	6. Supportability of the results	0,76
Empirical perspective	7. Data-driven process	0,85
	8. Responsibility of the results	0,82

Table 2: Content of the task

Concerned about the fierce competition experienced by our company's industry, the general management gathered all its managers in this room today. Your presence today is not a coincidence. You are chosen among those managers whose suggestions and comments will be valuable aids to formulate the strategy. The purpose of the meeting is to generate (collectively) and categorize the various strategic options for the development of our company. These strategic options will be a valuable help in formulating our company's strategy for the next 3 years.

Figure 3: Exploratory model of the research (variables and hypothesis)

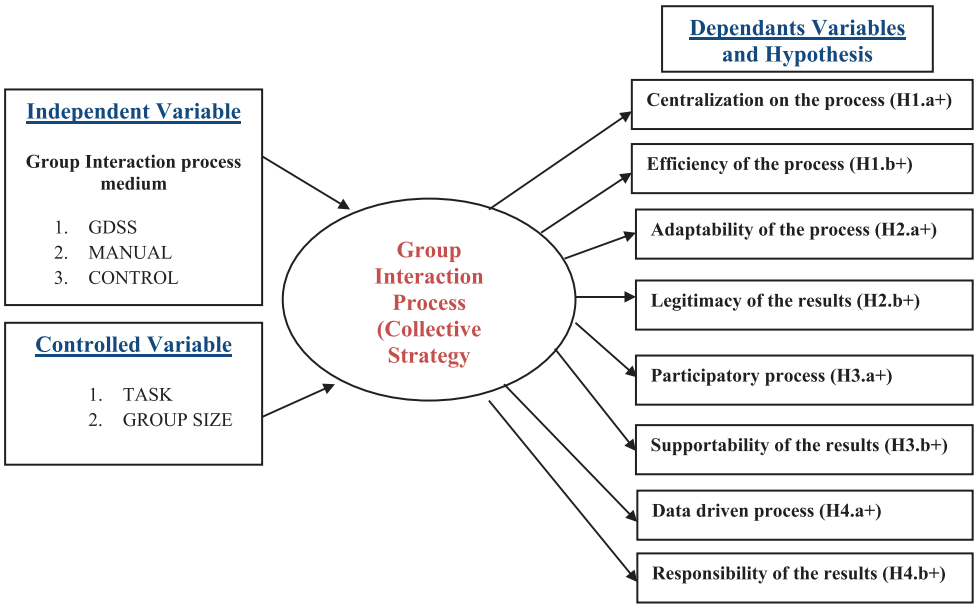


Table 3: Means and H values related to dependant variables

Dependant variable	Group decision support system (mean value)	MANUAL (mean value)	CONTROL (mean value)	H (value)
Centralization on the process	4,46	2,95	2,76	8,16
Efficiency of the process	4,57	2,9	2,35	12,5
Adaptability of the process	4,35	3,78	2,5	5,4
Legitimacy of the results	4,75	2,84	1,5	8,22
Supportability of the results	2,67	3,58	4,27	3,79
Participatory process	4,78	3,85	3,1	13,1
Data driven process	4,57	3,51	3,51	6,85
Responsibility of the results	3,13	4,26	3,78	4,33

as procedures that structure the decision making process of the group (Danial and Anne, 1996; DeSanctis and Poole, 1994; Gopal et al., 1993; Murli and Bostrom, 1995; Howard and Paul, 1995). GDSS allow for a democratic and equitable decision making process (Locke and Lathman, 1990; DeSanctis and Gallupe, 1987). Following the argumentations, the hypothesis of this research assume that groups supported by structure (technology or manual) perceive effective interaction process comparing to groups not supported by any structure. The hypotheses of the research are indicated on Figure 3.

4. RESEARCH METHODOLOGY

To test the research model, laboratory experiments were used. The experimental design of the research allowed us to manipulate the decision support provided to the group members to control the task and size of each group participating in the experiment. This design resulted in three different experimental treatments. The first where group members were supported by a GDSS. The second where the members of the group were supported by paper and pens and a manual structure in the form of steps. The last one where the members of the group are not supported by any structure or steps. In fact, the two types of group (GDSS and Manual) have the same structure of the interaction process. Sixty managers enrolled in the MBA program inside the national school of business and management (Casablanca – Morocco) took part in this research. The average age of participants was 35 years old. All participants were professionals. Their different preoccupations and professional experiences brought us even closer to a business context and behavior. The average number of work experience was 9 years. In total, 57% of the participants were women. 12 groups participated in the research and were randomly assigned to the laboratory experiments.

The GDSS used to conduct the experiments is Group System V designed and developed at the University of Arizona. Currently, group system technology is marketed by a US company. An evaluation copy of the Group System V was used to perform all experiments. Only the modules of brainstorming and voting of the software were used. Six microcomputers were used. One of these was used by the experimenter (facilitator) to administer the operation of the Group System V software, and the other five by the participants. All the microcomputers were arranged in a U shaped configuration, and connected together to form a communication network. In the experiments where the group members are supported by a GDSS, a public screen was placed at the back of the room so as to be clearly visible to all participants.

This type of configuration corresponds to that of a "decision room." In order to ensure homogeneity of laboratory experience, for each type of research group, a procedure for conducting the experiment was designed and used. In addition, two questionnaires were developed to collect data from the research. The first questionnaire provided information about participants, their work experiences and their computer skills. The second questionnaire served as a data collection instrument to assess the collective strategy formulation process. All the items presented in this second questionnaire allowed measuring the dependent variables of the research model. The three types of group are subject to the same task. The Table 2 shows the content of the task.

4.1. Statistical Results and Test of the Hypothesis

The Kruskall-Wallis test was performed to test the hypothesis. In order to calculate the H value associated with each dependent variable, the following steps were performed.

Step 1: Ranking the different values of the three types of groups according to ranks for each variable that depends on the search pattern. This is an increasing ranking, the lowest value assigned to the dependent variable in question is ranked 1, the highest value is ranked N = 60. At the end of this step, for each type of GDSS, MANUAL and CONTROL, all the respective values of each dependent variable are replaced by ranking value. Thus the sum of the ranks for each type of group is calculated.

Step 2: This step calculates the Kruskall-Wallis test value. The formula 1 was used.

Formula 1: $H = (12/N * [N + 1]) * (R2/n) - 3 * (N + 1)$.

- N = 60: Refers to the total number of participating in the experiment
- Rj: Refers to the respective sum of the ranks of each type of group for the dependent variable under research
- nj = 20: Refers to the number of participants in each type of group. In the case where the ranks of classification are repeated, formula 2 is used.

Formula 2: $H = ([12/N * (N + 1)] * [R2/n] - 3 * [N + 1])/C$

$C= (t3 - t)/(N3 - N)$ (t is the number of repetitions of each rank)

The Table 4 shows the average of each type of group on the different variables dependent on the research model as well as the H value associated to Kruskall-Wallis test.

Table 3 presents the possible relationships between the independent variable (group decision support medium) and the eight dependent variables to evaluate the information determination process. Each hypothesis is tested and maintained if the probability associated with the value of H (Kruskall-Wallis test) is below the threshold of significance a = 5% (0.05). Table 4, summarizes the results obtained for the test of the eight hypotheses of the research.

5. DISCUSSION

During the test, some hypothesis (6) were tested and preserved, while others (2) were tested and then rejected. Figure 4 shows the profile of collective strategy formulation process. This figure is divided into four quadrants considered as perspectives for evaluating the collective process of strategy formulation. Each perspective is represented by two axes. The set of axes is the eight dependent variables of the research model. The profile of each type of group is shown in the figure according to the different averages attributed to the dependent variables. A profile directed to the outer end of an axis generally denotes a positive perception. However, when the profile is directed towards the center of the axis, the members of the group had a negative perception of the variable being tested.

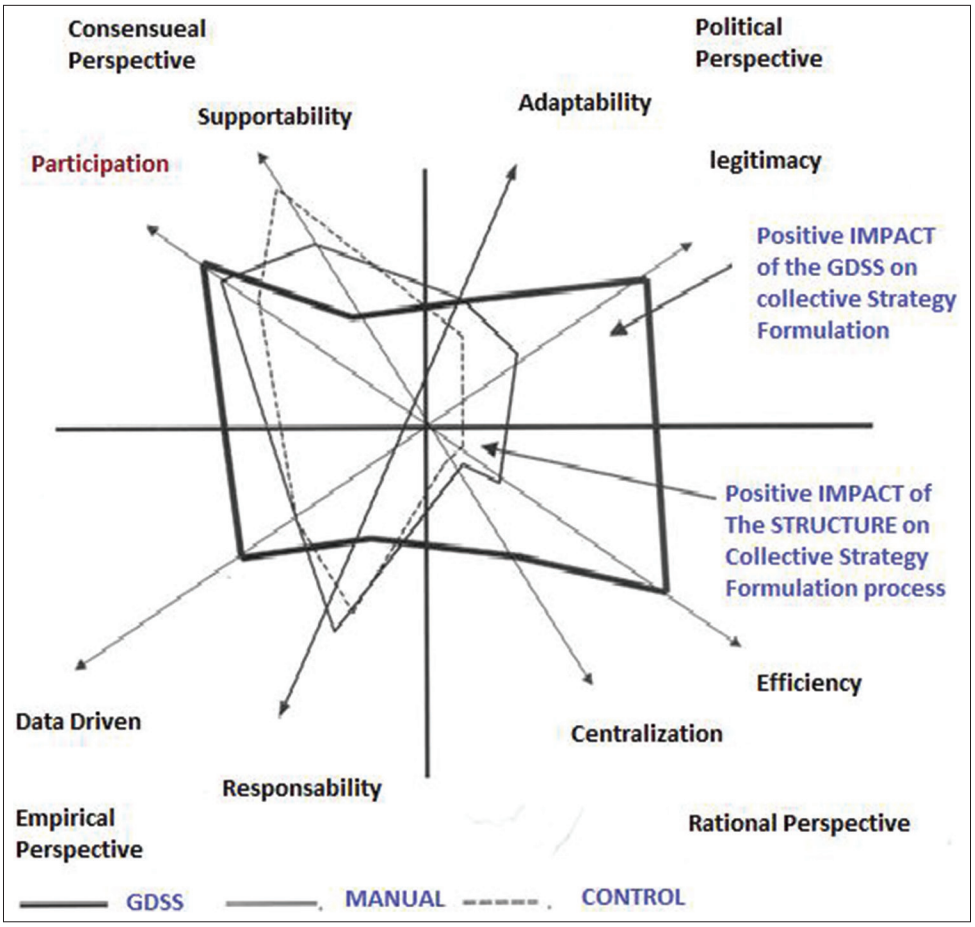
5.1. Analysis of the Interaction Process of the CONTROL Group

Before the beginning of each experiment in the four groups, the members would voluntarily gather around one person. This member was physically located most of the time in the middle of the group and had the implicit mission of ordering the group's interaction process. The discussion began with a redefinition of the concept of strategy formulation. Each member of the group

Table 4: Synthesis of hypothesis test (*P<0,05)

Dependant variable	H (value)	Probability (value)	Confirmed hypothesis	Rejected hypothesis
Centralization on the process	8,16	P<0,02*	Yes	-
Efficiency of the process	12,5	P<0,01*	Yes	-
Adaptability of the process	5,4	P<0,05*	Yes	-
Legitimacy of the results	8,22	P<0,02*	Yes	-
Supportability of the results	3,79	P>0,1	-	Yes
Participatory process	13,1	P<0,001*	Yes	-
Data driven process	6,85	P<0,05*	Yes	-
Responsibility of the results	4,33	P>0,1	-	Yes

Figure 4: Collective strategy formulation process profile



proposed his own definition and tried to impose it on the other members of the group to influence them. Some members showed an authoritative style when proposing issues to strategy formulation. This authoritarian style of expression was manifested by forms of discussion dominance, which were intended to influence the decision making process inside the group. Other members of the group, approved the ideas conveyed without asking why. They participated with words like "*yes, we can consider it...*" or "*It's a good idea...*". This shy form of participation can be explained by the lack of anonymity and the emergence of different forms of behavior in a conventional group meeting (Burdett, 2000; Garden and James, 1995). In the four experiments observed, when one member of the group advanced an idea that may be perceived differs by the other members, the latter immediately withdrew it, without giving any explanations. The interaction process in this type of group lasted on average 18-25 min. In general, in this type of group, the perception of the process of strategy formulation was the weakest compared to that of the MANUEL and GDSS groups. These results can be explained, on the one hand, by the non-structuring process of collective strategy formulation (McCartt and Rohrbaugh, 1995), and on the other hand, the emergence of different forms of group's behavior observed during the interaction (Limayem, 1996; Poole and DeSanctis, 1989; Hobman et al., 2002; Ho and McLeod 2008).

5.2. Analysis of the Interaction Process of the MANUAL Group

Members of this type of group perceived average effectiveness of the collective strategy formulation process in comparison with members of the GDSS groups. Before starting the meeting in this type of group, a manual structure for strategy formulation was defined and explained to different members of the group. This manual structure was seen as a three step agenda: The individual generation of strategy options, a collective discussion of strategic options, and voting on these strategic options. Indeed, The meeting began with an individual generation of strategic options. Each member of the group then wrote their own strategic options on a document. In this first step, which lasted on average 7-13 min a total silence characterized the decision room as all participants focused on developing their own ideas. No negative form of interaction or behavior that could influence the members of the group was noticed. During the discussion of the strategic options generated in the first stage, each participant spoke to read, explain his strategic options to the different members of the group. These explanations are sometimes argued by real life examples that influenced the other members of the group as to the relevance of the strategic options mentioned. Already, in this second step, the group members should reach a consensus on a set of strategic options that will be used in the voting stage. This consensus was not easy to establish due to the divergence of ideas conveyed in the group. It was at this moment, when there were conflicts that raised inside group's discussion. Each participant or group of participants defended their own strategic options and, felt that they are the most interesting to be on the list of voting. Almost in each experiment, a member of the group came up with a solution that alleviated the pressure conflict inside the group. In the discussion stage, which averaged 24 min, the group members seemed to be interested in this form of categorization and classification, which made it possible to reach a consensus. The third stage of the interaction process in this type of group was voting. In general, before beginning this third stage of the manual structure, the group members were wondering about the voting procedure. The experimenter then gave a brief explanation and announced the beginning of the last part which lasted on average 10-15 min.

In all interaction processes of the MANUAL group type, the group members used the calendar steps (manual structure) in a sequential manner. This sequence of steps seemed to the members of each group to be a logical order that allowed for the best possible results. In no interaction process, members of the group felt that the steps of the agenda were set to help decision-making. On the contrary, these steps were considered an obligation, in their view, no derivation on the order of the steps of the total agenda was allowed.

5.3. Analysis of the Interaction Process of the GDSS Group

The perception of the collective strategy formulation process was the best compared to that of the MANUAL and CONTROL groups. Indeed, the integration of the decision support system into the interaction process in this type of group has, on the one hand, positively influenced the perception of the interaction process and on the other hand supports all the actions taken by the group members to determine these strategic options. Members of this type of group did not have prior knowledge of the decision support system used in the experiments. The practice sessions provided at the beginning of each experiment revealed that, in general, members of the GDSS group were familiar with the use of a computer. A brief presentation of the module used in the experiment was made to all groups.

In all groups, the meeting determined by an individual generation the strategic options. To reach this end, each participant of the group had at their disposal a screen and a keyboard to work and generate the strategic options. A public screen at the back of the room presented the strategic options generated by the group. This screen was considered, on the one hand, as a source of inspiration for the members of the group. For the first step of a greater number of strategic options were generated. This first step usually lasted between 14 and 19 min.

In the discussion stage, the display of strategic options on the public screen simulated a sharp discussion among the members of the group. Verbal and face-to-face conversations were held among the group members to assess the relevance of each strategic option. These conversations, which ended in disagreement in most groups, raised conflicts in the group. In this discussion, participants' attention was focused on the public screen, but in the manual groups the participants faced each other face to face. In all experiences with GDSS groups, a list of 15 to 20 strategic options was kept for the voting stage. At first, members of GDSS groups approached the prepared steps of the experiment in a sequential manner. In a second step, the GDSS was integrated to help in the accomplishment of the task. The difference between the GDSS and MANUEL groups is that the MANUEL groups perceived that their use of the stages of the agenda was a constraint to be

respected. In contrast, GDSS groups used these steps to facilitate the collective process of identifying strategic options.

6. CONCLUSION

The research showed that the structuring of the group's interaction process positively influenced the perception of group members in a task of collective strategic formulation process. The highly significant results achieved by the GDSS groups compared to the MANUAL and CONTROL groups are due to the integration of a GDSS into the collective strategy formulation process. Indeed, based on the quantitative and qualitative analyzes of the three types of research interaction process; we believe that a GDSS positively impacts the collective strategy formulation process. The use of a GDSS largely facilitates the establishment of a list of strategic options, and by the same way, eliminates the drawbacks associated with the phenomena that emerge during the course of time in conventional group work session. On the other hand, a GDSS incorporates tools that apply to the context of group work. These tools, such as (Electronic brainstorming, Voting), add an additional level of structure to the stages of strategy formulation, and subsequently, increase each group member's perception as to their satisfaction.

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