Improving group decision-making in IT service management by the use of a consensus-based MCDM method

Igor P. da Silva, Alberto S. Lima, Neuman de Souza
Federal University of Ceará
Fortaleza, Brazil
igorpimentel@gmail.com, {albertosampaio, neuman}@ufc.br

Flávio R. C. Sousa, Lincoln S. Rocha, Thomaz E. V. da Silva
Federal University of Ceará
Fortaleza, Brazil
{flaviosousa, lincolnrocha}@ufc.br, thomazveloso@virtual.ufc.br

Abstract—**Group decision-making in companies that practice IT service management (ITSM) is a difficult and challenging activity. There are particular issues that hinder the performance of IT management committees, such as the lack of productivity, duration of the meetings, physical distance between members, and low quality of some complex decisions, among other restrictive factors. In this paper we present a method based on wisdom of crowds' theory and Analytic Hierarchy Process (AHP), designed to automate the process of group decision-making for IT management committees. We conducted a case study in a Brazilian IT company, and the results indicate that managers considered our method and tool useful, preferable to the current decision-making method, complete and easy to use.**

Keywords- IT service management; group decision-making; IT management committees; winsdow of the crowds; AHP.

I. INTRODUCTION

Companies that practice IT service management (ITSM) using management recommendations of Information Technology Infrastructure Library (ITIL) [1], are getting greater transparency in IT management and delivering high quality IT services, in an IT governance [2] approach.

Business-driven IT management (BDIM) [3] is a recent research area that involves a set of models, practices, techniques and tools, in order to map and quantitatively assess interdependencies between business performance and delivered IT services. The decision-making involved in theory and practice in BDIM was discussed in [4].

IT management committees (ITMC) are very important tools to align both, business and IT goals. These committees need to meet periodically to discuss issues of various natures, issuing opinions or deciding on them. We can cite as examples of committees activities: Consultations, decisions and approval of IT budget, strategic plans, rules and regulations related to IT, among others [5]. Among the main difficulties faced by IT committees' actors, we can mention: Remote member participation in meetings; Guidelines of long time-consuming meetings; Difficulties on the choice in-group decision-making; Low quality decisions.

In this paper, we proposed a new method to support group decision-making in IT service management.

II. LITERATURE REVIEW AND RELATED WORK

IT Management Committee (ITMC) objectives are: align IT actions to the organization strategic guidelines; promote and support the IT projects prioritization to support planning strategies needs; identify and implement opportunities for improvement. ITMC formulate and implement IT strategies and plans, aligned with organizational high-level goals. It directs, monitor and evaluate IT management, observing the IT operations performance, strategies and plans implementation and compliance with IT policies [5]. The ITMC operating cycle comprises three stages (see Figure 1): 1. IT Committee constitution; 2. Communications planning; 3. Meeting schedule execution.

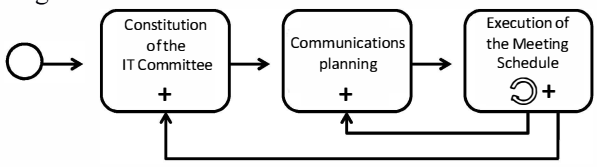

Figure 1. ITMC operating cycle [5].

The ITMC constitution deals with the establishment of a new committee or the reform of existing committee [5]. In communications planning phase, we identify the stakeholders and plan the communication events to meet information needs. Each meeting follows a cycle that goes from agenda preparation to information distribution. Members can revise the committee constitution or its communication planning (See feedback arrows in Figure 1).

Decision-making is a cognitive process by which one chooses an action plan among many others (based on varying scenarios, environments and factors) to a problem situation [6]. People make decisions often based on subjective aspects. When deciding to use group decision-making, one must question whether the efficiency gains will be sufficient to overcome the losses in efficiency. Techniques for group decision-making can help in classification and prioritization of best-presented alternatives in a timely manner. Decisions can be taken by: *Unanimous vote*: Everyone agrees with the decision taken; *Majority:* over 50% of those present agree;*Plurality:* Greater group decides even if there is no

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majority; *Dictatorship:* Someone decided by the group. In our proposal, we adopted the majority decision type.

The consensus decision-making is a dynamic way to reach an agreement among all group members. When one votes directly each item of the agenda, usually the majority of voters do prevail their opinion. When a group considers consensus, seeks solutions that are actively supported by all. This approach ensures that all opinions, ideas and concerns are considered in decision-making. Our consensus decision-making strategy was inspired by the Delphi technique [9] and "wisdom of crowds" theory [8].

Multi criteria decision-making (MCDM) methods can be divided in those based on *Multi-Attribute Utility Theory* (MAUT) and those based on outranking. The most common MAUT methods are the *Weighted Sum Model* (WSM), the *Weighted Product Model* (WPM) and the *Analytic Hierarchy Process* (AHP); the most common outranking methods are the ELECTRE method and the TOPSIS method [14]. In [17], authors reviewed literature of the multi-criteria decision making approaches. AHP is quite a basic and popular decision-making method in IT contexts [18]. It is designed to cope with both the rational and the intuitive to select the best from a number of alternatives evaluated with respect to several criteria. AHP was used to support IT decision-making process, based on best practices guides [10], structure outsourcing problems [19], construct the objectives of ERP selection [20], aid information retrieval and improve web search results from a controlled vocabulary [21], to obtain better outsourcing provider selection for small and medium enterprises [22], to analyze a IT service management framework and associated processes [25] and to proceed a web site selection for online advertising [26]. In [11], authors cited some inefficiencies of group decision-making in committees, as the excess of caution, the vote and the delay. Fuzzy logic was proposed in literature to improve some MCDM models. We can cite the Fuzzy AHP (FAHP) [23] and Fuzzy ELECTRE III [16].

III. PROPOSED METHOD

The proposed method was based on the phenomenon called "wisdom of crowds"[8], whereby the judgment and collectively constructed perceptions by a group of people, is properly inserted in a context, outweigh the individual perceptions in terms of foresight and quality of the choices made on a set of offered options. The method capture estimates directly from perceptions of the committee members group (crowd) and, then the result converges towards a common, which represents the "average" of captured perceptions. In addition to capturing the perceptions of the "crowd" (several members of the management committee), the method seeks to allow comparison between the evaluated items, so that committee members are able to decide, based on what was told by the other members. Figure 2 shows a view of our group decision-making method. We have examined the MCDM methods and have chosen to base our method on Analytic Hierarchy Process (AHP) [24] support for the following reasons: it is by far the most popular method, it has been used in IT contexts and is easily amenable to extensions (can be improved in a future work). The AHP both allows for inconsistency in the judgments and provides a means to improve consistency [20]. When IT committee needs to assess complex decisions involving multiple factors, our method includes AHP [24, 25, 26] as an option to support group multi-criteria decision-making. In this case, the committee members can set criteria, weights and discuss about the values of AHP parameters. When members are voting using our method, the AHP module results are shown to members to guide group decision-making.

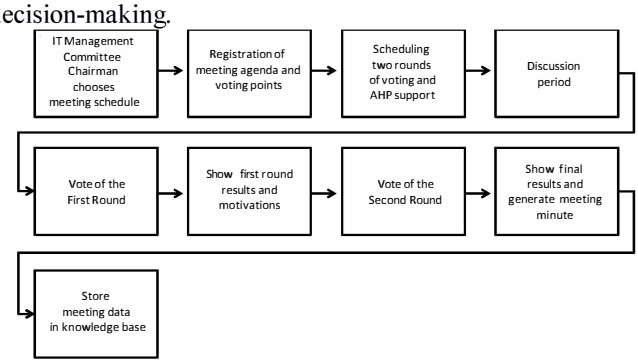

Figure 2. Proposed method.

Our method was automated in a system that supports the ITMC operating cycle, specifically the third stage, meeting schedule execution. As shown in Figure 2, the decision-making process must be performed in two rounds. In the first round, the committee chairman presents the entire agenda of the meeting to the members, who will have access to all information pertaining to committee activity (decision, AHP module or consultation on a subject). In multi-criteria decisions, members choose the AHP parameters values to input our model and get the results. After usual discussions, which are also supported by the system via forum, the committee chairman places each agenda item to a vote in its first round. Members vote and justify their motivation for performed choosing. At first round end, all members can view the results with the selection process justification for each group member, in an anonymous form, to not suffer influence. The second round is the time when the final choice is actually taken. The member can change his/her choice, due to some argument in the first round justifications list that has convinced, or can keep his/her previous vote.

We observed all the steps needed for design, development, testing and validation to develop our *Support Group Decision-Making System* (SGDMS) [7]. Due to time restrictions, the first version of our tool was developed using the Portuguese language.

IV. CASE STUDY AND RESULT ANALYSIS

We planned and carried out a case study in a Brazilian telecommunications company. The company name will not be revealed due to business confidentiality.

The sample used in the study included the members of the IT Committee, with five business managers, the IT manager and five IT project managers, and five technicians (IT experts).

After the presentation of the proposed method, an interview was conducted with 11 IT managers of industry, financial and IT areas, in a face validity exercise [16, 17].

So, our sample involved 27 evaluators. Our proposal was used in 10 IT management committee meetings. The context involved ITMC meetings analysis. We evaluated the hypothesis related to usefulness, completeness, preference and ease of use. We attempted to observe [12] and [13] recommendations, during the research planning phase. We used a controlled experiment to validate our tool.

The case study involved the following steps: Literature review; Method development; Design and implementation of software tool; Meeting with managers; Using the tool in ten meetings; Results presentation and discussion with managers; General results tabulation; Method validation with managers; Publish final results.

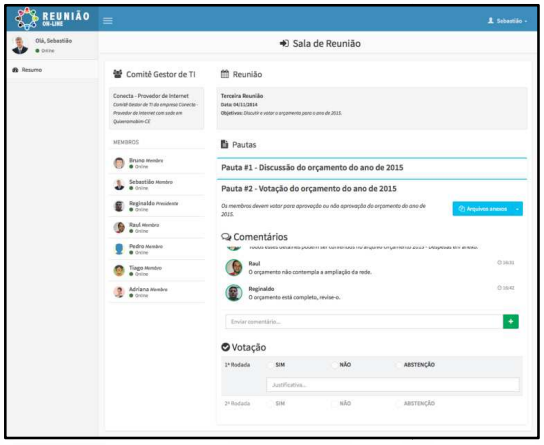

Figure 3. Virtual meeting room.

In our software tool, the profile *Admin* can edit and delete existing entries; register new users; and manage the list of registered committees. Chairman profile includes options to manage committee meetings and agenda, see the meetings list, start/stop meetings, start/stop the vote of the first round, start/stop the vote of the second round and generate meeting minutes. As a member, chairman can access the virtual meeting room. Member profile can view a summary of upcoming meetings on the system's home screen. A member can access the meeting room (Figure 3), and view all the committee's information, such as description, which the other members, meeting aspects such as date and objectives and the agenda list, with its annexes. A member stillcan comment on the guidelines and vote (first and second round). As a member, Chairman can perform all these actions too.

During our case study, the committee decided about migrating applications to software as a service (SaaS) in the cloud, using our tool AHP support module. The SaaS services are those representing the adoption of the cloud model in its most comprehensive form. The user of software on the SaaS model is also user of platform as a service (PaaS), and infrastructure as a server (IaaS), indirectly. The SaaS provider offers the use of software over the Internet and charge for use without the need for investment in hardware, software and specialized IT staff for environmental management. For various types of business, this transformation of capital expenditures in operating expenses is extremely attractive. Furthermore, the total cloud service cost is generally lower than the cost of the service available in the customer environment (on-premises).

In AHP, we decomposed the problem into a hierarchy decision criteria and alternative using paired comparisons to express the relative importance of a criterion with respect to each other. Thus, it becomes possible to construct an array of pairwise comparisons and calculate the eigenvector, to finally calculate a score for each alternative, and the alternative with the highest score by the selected method.

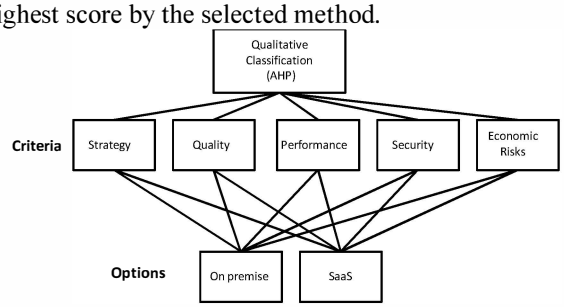

Figure 4. Migration decision modeled in AHP.

To support the Committee multi-criteria decision, members combined cost and key qualitative factors aiming to generate notes to be calculated for the software as a service (SaaS) and also for the on-premises version. That option that obtains the highest score (best cost-benefit) should be the preferred option. To calculate the scores value, the following steps were performed: Estimate the cost of software hosted internally (on-premises): C_h; Estimate the cost of software as a service (SaaS): C_s; To evaluate the benefits and risks of software as a service (SaaS): B_s and also from internally hosted software (on-premises) B_h using AHP (the end result is a value between 0 and 1 for each solution); Normalize the costs obtained in steps 1 and 2 that represent values between 0 and 1; Calculate the cost-benefit of each solution.

Figure 4 shows the AHP model view, which was proposed to evaluate this decision. Committee members used the methodology presented in [15] to develop the AHP model for the decision, using our tool. Due to space restrictions we will show some AHP used data (See Tables 1 and 2).

TABLE I. PAIR COMPARISON BETWEEN CRITERIA

	On premise	***SaaS***
Strategy	5	9
Quality	5	7
Performance	9	5
Security	9	3
Economic risks	9	1

TABLE II. AHP FINAL RESULTS

	On premise	**SaaS**
Year 1	0,8312	1,4952
After 5 years	1,1188	0,8522

When IT management committee members considered the 1st year, the SaaS option would be much more interesting, because it received a higher note. However, over 5 years, the on premise option becomes more interesting, because the initial costs are amortized. It is noted that despite the cost comparison always be in favor of SaaS option, the favorable qualitative assessment to on premise option slightly reduces this cost advantage. The AHP results are very important to a decision-making process, and should be discussed by the committee. We observed that in second round, after seeing

AHP support and decision motivations in first round, committee members followed the AHP results for year 1 and chose the SaaS option.

TABLE III. FACE VALIDITY RESULTS

Hypothesis	% who believes	Is there enough statistical evidence to support the hypothesis?
Preference: evaluators preferred the method presented in relation to the current form of group decision-making group.	100	yes
Utility: Evaluators considered the method useful.	100	yes
Ease of use: Evaluators considered the proposed method easy to use and apply.	93	yes
Completeness: Evaluators considered the presented method complete in relation to objectives.	100	yes

Our face validity exercise [12, 13] obtained 100% of positive evaluations in almost all evaluated hypothesis, except for the relative ease of use of the method/tool (93%). We used a binomial test at 5% significance level, to produce the results shown in Table 3.

V. FINAL CONSIDERATIONS AND FUTURE WORK

In this work, we proposed a consensus-based MCDM method that can improve the productivity in IT management committees. Our proposed software tool can be used in computers, tablets and smart phones, automating meetings, decision-making process and supporting the use of AHP.

We observed that the AHP use to support complex decisions improved the speed on group decision-making. The voting process was conducted in two rounds, which can allow reaching a consensus among decision makers. In addition to this possibility, our proposed tool also allows the adoption of conventional decision-making process, the use of AHP in a multi-criteria decision-making, as well as consultations and meetings with merely informative agendas. Our main contribution was the proposed method and software tool. The initial results indicated that our proposal is useful, preferable, complete and easy to use. As threats to validity, we can cite that the case study was executed in a single company, in 10 meetings of 1 IT management committee, and it is difficult to generalize the results. Although these limitations, our initial results were promising. In a future work, we plan to repeat the study in IT committees of different business areas companies.

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