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CHOICLAWEB: SUPPORTING INDIVIDUAL CHOICE THROUGH GROUP DECISION TECHNOLOGIES

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Abstract: *Support groups of users during decision making show increasing commercial interest in various contexts such as scheduling, prioritization tasks, recommendation of products and services, software engineering and configuration. The aim of group decision technologies in such contexts is to support groups of users in identifying decisions acceptable for the whole group while taking into account aspects such as decision optimality, consensus, and fairness. In this paper we give an overview of decision scenarios where group decision technologies can help to improve decision quality with regard to the mentioned aspects (and beyond). In addition, we provide an overview of the* ***ChoiclaWeb*** *environment that aims to support the above mentioned scenarios and thus provides a major basis for the implementation of group-based decision support tools in commercial contexts.*

Key Words: ***Recommender Systems, Group Decisions, Recommendations to groups, Individual Choice Support, Group Decision Technologies***

1. INTRODUCTION

Various business decisions have to be taken by groups of users and not by single persons. In modern business environments very often the responsible decision makers have no chance to meet face-2-face. Due to this fact the support of the decision making processes by means of AI technologies such as, recommender systems becomes a key aspect. There exists a lot of different scenarios which can be distinguished by the way decision alternatives are collected and presented as well as the recommendatons for the group are calculated. Mass customization is driven by a lot of individual customer decisions in the value co-creation process (see [1]). Especially in the context of configuration scenarios the number of decisions to be taken is increasing rapidly and thus the customers are relying on different techniques that help in their decision processes. Opinions, experiences and recommendations coming from other users or from the own peer group can play an important role in facilitating and confirming the choice of customization decisions of a user.

The remainder of the paper is organized as follows. In the following section we categorize relevant scenarios with a special focus on business decisions and discuss knowledge representations and recommendation aspects on the basis of examples. In section 3 we present ChoiclaWeb which is a web-based group decision support tool with the goal of increasing the quality of group decision processes. We then conclude the paper and present some topics for future work.

2. DECISION SCENARIOS

This section presents different decision scenarios which are highly relevant in business environments. We stick to three wide-spread scenarios namely *Polls*, *Challenges* and *Configuration*. Foregoing user studies conducted at Graz, University of Technology showed that these scenarios are of highly relevance in the context of business environments. In the following subsections we describe the mentioned scenarios in more detail with a special focus on relevant parameters as well as advantages for the decision makers.

2.1. Polls

In numerous scenarios (especially in business environments) the opinion of more than one person is needed before taking a decision. A Poll can be considered as a basic decision support method that helps to better understand the opinions of the different members of a group of users. In such contexts, people who are invited to give feedback are in most cases not the same people who are involved in the decision making process itself. Classic examples where Polls can be applied in the context of software engineering are scenarios with following questions:

- Which feature should be implemented for the next release?
- Which logo do you prefer for the next release?
- What is the best location for the next Hackathon?
- Which software version (responsive web, Android, iOS) do you prefer?

The main support value of a Poll scenario for the decision making process is the fact that it helps to to

easily get feedback from a large group of users. A basic definition of a Poll includes a question / problem description and possible answer options related to that. A variety of additional parameters which can be set gives this scenario much power as well as a versatile application field. Besides numerous other parameters, one important parameter in such scenarios is a so-called *maximum vote* parameter. This parameter allows the creating person of a poll to restrict the number of answers which can be seleted by the participating people of the poll. Another important parameter of Polls is *closed group / open group*. If closed group is choosen, the administrator of a poll selects the participants explicitly and thus has full control over the participants (the administrator knows exactly about the feedback group). All selected participants receive a personal invitation and have the chance to give feedback only once. In open group settings, everybody who has access to the link of the poll can provide feedback (like in most question tools used by websites). Poll scenarios do not offer any kind of group recommendation technology which affects the decision making process itself. Polls typically summarize the feedback of the users and indicate the »winning« answers (answers with the highest vote count). Additional typical example application scenarios of Polls in business environments are the following:

- Feedback of customers on a new marketing campain
- Location for business meeting or dinner
- Best-paper awards at conferences
- Feedback from employees or customers on planned new product features
- Feedback of customers on new software features
- Feedback of customers on quality of service
- Employee of the year
- Christmas celebration party (location and/or time)

The advantage of the Poll scenario is that the set-up is easy to handle and not very time consuming and thus provide a basis for decision makers to get feedback very quickly from a large group of users. On the basis of this argumentation, Polls can be seen as a very efficient way of supporting most everyday business decisions without explicit recommendation technologies in the back-end.

2.2. Ranking

Ranking scenarios are decision scenarios which also occur very frequently in company environments. The main goal of such a scenario is is to identify the best option out of a number of possible alternatives where, compared to polls, the alternatives (answer options) are not given in advance by the creator of the decision task but by a group of people. A ranking scenario is in most cases a two-step process. The first step is to collect (crowd source, see [2]) the alternatives from the user group and step two is to vote for the collected alternatives. In the first step a question is shown to the participants (representing the crowd from which the ideas should come from). The creator of such a scenario mostly sets a deadline until when the participants have the chance to enter their contributions (e.g., alternatives). The following step of the ranking process is basically similar to the voting process of a Poll. In the *Ranking* scenario, the group which represents the source of contributions for alternatives / options can either be the same group that votes for the alternatives or a different group. Typical ranking scenarios in the context of business envorinments are, for instance, the identification of the best location for Christmas celebration, the best marketing strategie for a new product or service or simply the best logo for a new launched product.

One major advantage of the Ranking scenario is the nearly infinite potential for identifying new alternatives / options from the crowd and thus also ideally supporting an open innovation process. When using such a scenario decision makers are able to choose from a larger pool of ideas instead of creating options on their own or in a very small group.

2.3. Configuration

If the complexity in group decisions scenarios riases, there is often a need for additional parameters to define the properties of a decision. In such scenarios it is very likely that there exists some restrictions regarding the combination of individual values of the parameters. When taking into account these restrictions, these decisions can be represented as group-based configuration scenarios [3]. A concrete example of such a typical configuration scenario is release planning [4]. The goal in the release planning scenario is to assign a set of requirements to a predefined set of releases. Ideally a system also builds upon a consistency check with the goal of identifing conflicts of the assignments of the requirements to the releases. The group decision task in such a case is represented by the votings of the stakeholders for the assignments of the requirements to the releases. Additional constraints are needed to restrict certain assignments of requirements to releases. Such constraints ensure that the sequence of requirements is taken into account or that the cumulative time effort of requirements assigned to a certain release does not exceed a defined time limit/span.

The process of identifying the optimal group decision in a requirements engineering scenario can be divided into the following three steps:

1. The first step of the decision process allows every stakeholder to assign his / her preferences for each parameter of the decision task.
2. In the second step the system takes the restrictions between the constraints into account. The problem is encoded in a way such that a constraint solver [5] can be used for solution search.
3. Based on the valid configurations restricted by the constraints in the previous step a heuristic such as *Group Distance* can be applied to identify the most satisfying configuration for the group of stakeholders. *Group Distance* returns a recommendation which causes the lowest overall change of the individual preferences [6]. Other typical heuristics are, for instance *Least Misery*

and *Majority Voting*. Least Misery tries to avoid misery inside a group by presenting the best of all lowest evaluations as group recommendation. Due to this, items may be selected that no group member hates but also nobody really likes [6]. *Majority Voting* returns the configuration with the parameters which received the most user votes as group recommendation [6].

The following table (Table 1) shows an example of a group-based release planning scenario. This scenario deals with a group of three stakeholders (SH1, SH2 and SH3) which want to assign four requirements (reqA, reqB, reqC and reqD) to either release 1 or release 2. The following two constraints restrict the assignment of the requirments.

1. C1: reqB must be in the same or one release before reqC.

2. C2: Every release needs at least one requirement but not more than two.

Table 1. *Group-based release planning example with two constraints. c1: reqB ≤ reqC; c2:* $\forall_i : 0 < numreq_i \leq 2$

parameter	preferences		
	SH1	SH2	SH3
reqA	2	1	1
reqB	2	2	2
reqC	1	2	2
reqD	1	2	1

Release plan					Distance			GD
Id	req A	req B	req C	req D	SH1	SH2	SH3	
1	2	1	1	2	2	2	4	8
2	1	1	2	2	4	2	2	8
3	2	1	2	1	2	4	2	8
4	1	2	2	1	2	2	0	**→4←**

As presented in Table 1, the members of a group of three stakeholders (indicated with SHi) specify their preferences by assigning each requirement (reqA ... reqD) to one of the releases (1 or 2). After this procedure is done the constraints Ci have to be taken into account during the calculation of the release plan. Finally, a recommendation heuristic (in this case *Group Distance* (GD)) is applied to propose a release plan. The group recommendation is highlighted bold in the last column of Table 1.

There are several other typical application scenarios for group-based configuration in context of business environments such as, for instance, *Product Line Scoping* [7] which is related to the task of determining boundaries in a product line. Also *Investment Decisions* (e.g., decisions about project funding) [8] are often taken by a group of users. Constraints which have to be considered by the group of users in such scenarios are, for instance, (a) overall amount of money that can be invested and (b) main topics which should be adressed in those projects. Applying a configuration-based group decision tool show a high potential to help decision makers by serving an overview of the achieved consensus as well as enable well documented and comprehensible decisions.

3. CHOICLAWEB ENVIRONMENT

The *ChoiclaWeb*[1] environment – developed by SelectionArts[2] –tackels the above mentioned challenges and thus brings the support of groups of users in the mentioned contexts to the next level. The community version of ChoiclaWeb (with limited functionalities) is available for free on the basis of a responsive web application (see www.choiclaweb.com). The business version supports all three mentioned decision scenarios. The following figure (Figure 1) depicts an example Poll scenario (available also in the community version).

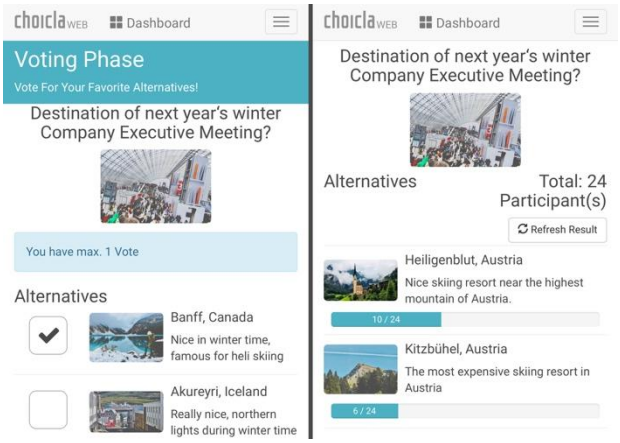

Fig. 1. *Poll about the destination of the next year's winter company executive meeting. The left part of the screen indicates the user interface for giving feedback and the right part of the screen shows the result page of the poll*

Figure 1 presents on the left hand side the user interface where participants are invited to provide feedback on the given question / problem description - in this case, a question about a meeting location for the next year's winter company executive meeting. The invited participants can vote for one alternatives at most. The right hand side of figure 1 shows the result screen of the poll where the »winning answer(s)« (answer(s) with most votes) shows up on top of the answers list.

4. CONCLUSION AND FUTURE WORK

This paper illustrates different common decision scenarios which typically arise in groups of users in the context of business environments. In such contexts a large number of decisions have to be taken. Recommendation technologies show the potential to increase several important aspects of group decision processes such as decision quality (optimality), consensus in the group of decision makers as well as fairness among the group members. Factors, such as documentation aspects, mechanisms that trigger information exchange among the group members as well as discussions can have positive influence on the decision quality [9]. Consensus in the context of group decision processes can be achieved by applying techniques which force additional voting iterations in

[1] www.choiclaweb.com
[2] www.selectionarts.com

case of contradicting preferences (e.g., planning poker - see [10]). Selected decision heuristics which take into account information of past decision processes can help to achieve fairness among group members in recurring decision tasks [11].

In addition, we presented an overview of the ChoiclaWeb environment that aims to support the above mentioned scenarios in an everyday-use fashion.

In future work we focus on the extension of the *ChoiclaWeb* technologies with regard to support more decision scenarios such as, for instance, Sequencing and Questionnaires. Our vision is to make the set-up of different frequently occuring group decision tasks as simple as possible. The resulting decision task should be easy to handle for users on different devices (mobile and desktop) and make group decisions in general more efficient.

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