

# Cooperative Decision Support Systems

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## INTRODUCTION

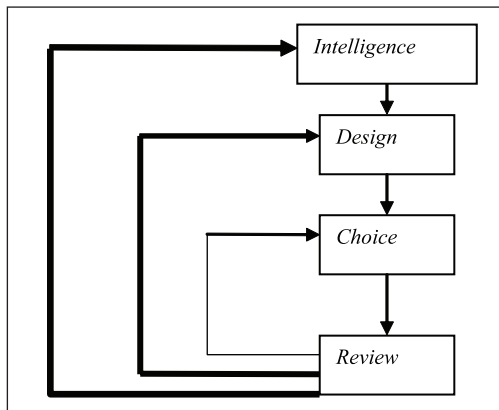
The subject of our research aims to support in the most suitable way the collaborative decision-making process. Several scientific approaches deal with collaborative decision-making: decision analysis (Carlsson & Turban, 2002; Doyle & Thomason, 1999; Keeney & Raiffa, 1976) developing different analytical tools for optimal decision-making; in management sciences the observation of decision-making styles activity (Nuut, 2005; Fong, Wyer, & Robert 2003); decision-making as a group work (Esser, 1998; Matta & Corby, 1997); studies concerning different types of decisions focalised on number of actors: individual (Keeney & Raiffa, 1976), group (Shim, Warkentin, Courtney, Power, Sharda, & Carlsson, 2002), cooperative (Zaraté, 2005), and collaborative (Karacapilidis & Papadias, 2001). For the collaborative decision-making field, the situation is clear. In most of research studies, the concept of collaborative decision-making is used as a synonym for cooperative decision-making. Hence, the collaborative decision-making process is considered to be distributed and asynchronous (Chim, Anumba, & Carillo, 2004; Cil, Alpturk, & Yazgan, 2005). However, we can stand out several works, having different research approaches, considering collaborative decision-making process as multi-actor decision-making process, where actors have different goals. Considering (Panzarasa, Jennings, & Norman, 2002) the collaborative decision-making process is seen as “a group of logically decentralised agents that cooperate to achieve objectives that are typically beyond the capacities of an individual agent. In short, the collaborative decision-making has generally been viewed and modelled as a kind of distributed reasoning and search, whereby a collection of agents collaboratively go throughout the search space of the problem in order to find a solution.” The main interrogation of this article is to study the best way to support collaborative decision-making process.

## BACKGROUND

Many studies are based upon the work of Simon (Simon, 1977). Le Moigne (1990) develops the canonical model of decision-resolution process based upon the Simon’s definition of the process. The working hypothesis adopted in this study is that “the decision can be represented as a work of symbolic computation,” as Simon’s model. The decision-making process, considered as a cognitive process of problem solving, is constituted of four main phases: intelligence, conception, selection, and review.

We notice that there have been changes influencing decision-making process (Teulier-Bourgine & Zaraté, 2001). Decision-making in organisation is becoming more and more multi-actor and complex. We could cite the work of Gorry and Scott Morton (1971) stating that the more one organisation is complex, the less are the chances that the decision will be taken by one single actor. Therefore, participants of one decision-making process have to integrate multiples points of view that are not necessarily in harmony. Due to the rapidly changing environment, every actor involved in a decision-making process has to augment his or her own vigilance and information research. Therefore, based upon the work of Simon, we propose a revisited decision-making process. The intelligence phase is becoming more complex and more active because of the environment to be taken into account. These changes have also influenced the decision-making progress. The actors have a prominent role of research of pertinence. Before these changes, the decision-makers have to search for efficient information in order to not forget important information; they must very rapidly sort out information that is very numerous. The conception step is also more frequent because every time the context is changing, every time the decision-maker must redesign a new solution.

Figure 1. The revisited decision-making process of Simon (1977)



The step of choice seems to stay the same because the very rapid sorting out process does not imply an alternatives generation and a systematic comparison among them and finally the choice of one of them.

The review process is then modified. As shown in Figure 1, the two first steps are visited more often than the third one. Several iterations are necessary for decision-makers before the choice by itself.

Summarising, the revisited cognitive decision making process is composed by four steps: intelligence, design, choice, and review and the two first steps are visited very often, the decision makers must sort out the information in a very efficient way.

This process being modified, the need of new kind of decision support systems is obvious.

We present a study developing different situations of collaborative decision-making process and give an overview of different support adequate in each case. We develop a matrix of collective decision-making process taking into account two criteria: time and space.

Our purpose is to define what a collective decision making process is.

Authors consider collaborative decision-making process as a multi-agent socio-cognitive process. Thus, they incorporate beliefs, goals, desires, intentions, and preferences in what they call mental modeling. Panzarasa, Jennings et al. (2002) formalise a model giving the insight in: a) the agent's mental states and processes and b) a range of social behaviours that lead them to solicit and take part in decision-making process.

The authors also adopt a prescriptive approach in order to give a set of possible actions in every step of collaborative decision-making. The model is developed using social mental shaping, the process by which the mere social nature of agents may impact upon their mental states and motivate their behaviour. Their collaborative decision-making model consists of four phases:

1. The practical starting-point
2. Group ideas generation
3. Social practical reasoning
4. Negotiation.

This developed model, as the authors state, "aims at developing the theoretical foundation of collaborative decision-making by using a formal language." The authors do not propose a concrete help for decision makers in this process. Moreover, they consider the collaborative decision-making process in an idealised world and not to be iterative. The process is socially oriented and "captures underpinning motivations and social processes of each stage."

In order to clarify this collective decision making process, we intend to propose a typology of it according to the different situations. Decision makers could work:

- In one hand at different places or not, and
- In another hand at different times or not.

We then can find different types of collective decision making process (see Figure 2).

Collective decision making situations and the corresponding supports are defined as follows:

1. Face to face decision making: different decision makers are implied in the decisional process and meet them around a table. This is a very classical situation and it could be supported by every kind of group decision support systems (GDSSs) as well as GDSSs rooms.
2. Distributed synchronous decision making: different decision makers are implied in the decisional process and are not located in the same room but work together at the same time. This kind of situation is enough known and common in organizations and it could be supported by every

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