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Knowledge-Based Strategy Development: An Integrated Approach

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Abstract: Strategy development is a rational decision making process, carried out by a group of managers aiming to match the organization's resources to the opportunities arising from its competitive environment. We argue that, in order to develop successful strategic plans, contemporary business organizations should exploit features from diverse disciplines to attain a synthesis of the strategists' highly specialized state-of-the-art knowledge. In this paper, we present a collaborative framework where Decision Support Systems and Knowledge Management Systems features are integrated for the appropriate handling of strategic management issues. Based on a well-defined ontology model that interweaves concepts from the Knowledge Management, Argumentation Theory, Decision Making and Multicriteria Decision Aid disciplines, our framework enables strategists to collaborate and accomplish a common understanding of different user perspectives. Furthermore, it assists them in reaching a decision by exploiting the organization's knowledge resources.

Keywords: Collaboration, Knowledge Sharing, Knowledge-Based IT Infrastructures, Semantic Web Technologies, Strategy Development
Categories: H.4.2, H.4.3, H.5.3, I.2.4

1 Introduction

Strategy development is widely perceived as a core organizational process [McLaughlin, 95; Harrison and Pelletier, 00]. By referring to it, we imply the rational decision making process carried out by a group of managers (strategists) in order to match the organization's resources to the opportunities arising from the competitive environment [Andrews, 71]. This involves the identification of the basic goals of an enterprise, the consideration of alternative courses of action, and the allocation of resources necessary for carrying out these goals [Chandler, 62]. Experiences reported by an increasing number of companies show that their long-term survival and competitive success is determined not so much by their financial muscles and size, but by the manner in which they consciously attempt to learn, create, codify, and utilise knowledge [Argyris, 96].

In line with the above, the quality of a formulated strategy depends on the quality of the knowledge used [Andrews, 71; Feurer and Chaharbaghi, 95a]. For this reason, strategists have been challenged to evolve from planners and strategy creators, to strategy finders, knowledge generators and catalysts of change [Mintzberg, 94].

Strategists, either perceived as decision makers or knowledge workers, especially when working in a distributed environment (both in time and space terms), need support as far as their collaboration and communication requirements are concerned. During a strategy formulation process, they often propose a set of alternative courses of action and consider their expected impacts in order to reach a decision. Empirical evidence shows that team strategy development is an interplay between social processes and knowledge processes [Schwarz, 03]. Groups-within-groups of managers with similar views can emerge at any instance of the decision making process. In such settings, knowledge is clustered around specific ideas, solutions or views, resulting in knowledge exchange and reconstruction. However, the overall process is often obstructed due to issues such as the vague knowledge about the preference degree of one alternative over another, or the difficulty of expressing preferences with exact numerical values. Furthermore, decision making is often impeded by the use of different terminology and means of expression of the individuals' positions, mostly due to the decision makers' diverse professional backgrounds.

In order to provide contemporary business organizations with the necessary means to develop successful, knowledge-based strategic plans, we argue that a combination of diverse disciplines is required to attain an appropriate synthesis (and convergence) of the strategists' highly specialized state-of-the-art knowledge. Towards this aim, this paper presents a collaborative framework, where Decision Support Systems and Knowledge Management Systems features are integrated for the handling of strategy development. Decision Support Systems are traditionally dealing with technologies for representing and processing knowledge in order to facilitate decision making [Boznek et al., 81]. Knowledge Management, on the other hand, is considered as a managerial, computer-based approach aiming at collecting, processing, and organizing organization-specific knowledge assets for organizational activities such as decision making [Prusak, 2001].

Exploiting features and functionalities from the above two categories of systems, we have developed a web-based platform that can be employed as a forum of reciprocal knowledge exchange, conveyed through argumentative discourses, the ultimate aim being to support the related decision making process. Based on a well-defined ontology model that interweaves concepts from the Knowledge Management, Argumentation Theory, Decision Making and Multicriteria Decision Aid disciplines, the proposed framework provide strategists with the means to accomplish a common understanding of different user perspectives. Moreover, it can address the requirements of efficient and effective knowledge exchange between strategists during argumentative discourses.

The remainder of the paper is structured as follows. Section 2 presents the proposed framework's motivation, as well as its architecture and main modules. The following sections focus on the proposed framework's modules, their functionalities and communications. More precisely, Section 3 presents the framework's Argumentation Graph and its knowledge elicitation features. Section 4 discusses decision making issues concerning the problem formulation and the evaluation of its alternative solutions. Section 5 describes the user modelling functionalities embedded in the proposed framework. Section 6 concludes with final remarks on the overall contribution of the proposed approach.

2 The Overall Approach

Spender [Spender, 96] views an organization as a dynamic, knowledge-based activity system, emphasizing that it is an organization's knowledge and ability to generate knowledge that form the core of such theory. According to Drucker [Drucker, 93], the source of long-term competitive advantage for any organization is derived from access to some form of knowledge that it can exploit. The need to focus on knowledge as a source of competitive advantage has necessitated organizations to embark on a change of their structures in order to facilitate knowledge sharing and dissemination. Organizational forms created for this purpose are, among others, cross-functional teams and workgroups, recently known as Communities of Practise (CoPs). The proposed framework's primary goal is to provide CoPs engaged in strategic-level decision making with the appropriate means to collaborate, so as to reach a decision by exploiting all the possible knowledge resources. This means bringing together people who hold complementary knowledge that can be unified, revised and improved while it is being used for decision support. To meet the above requirements, we have developed a web-based, argumentation enabling platform that, being based on a properly structured ontology model, aids in the capturing of the organizational knowledge and augments teamwork in terms of knowledge elicitation, sharing and construction, thus enhancing decision quality.

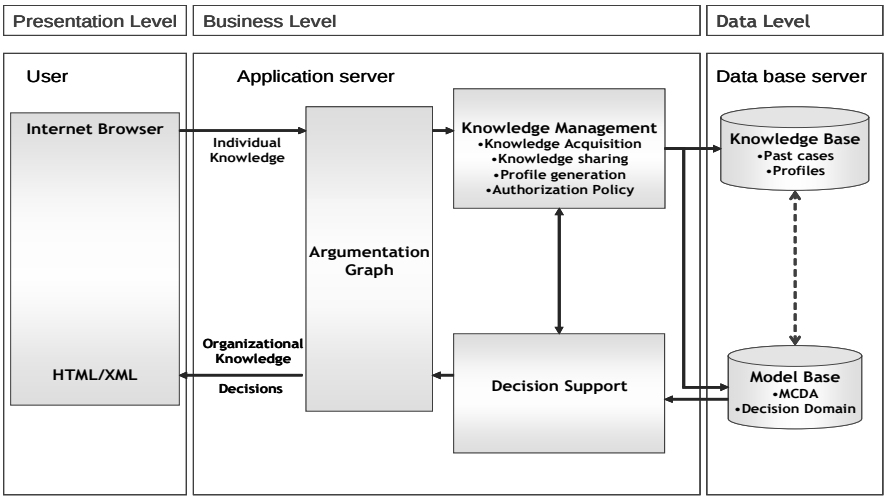

Figure 1: The proposed framework's architecture

Existing web applications providing knowledge management services are essentially static, while the interaction among all parties involved is performed by humans. However, recent developments in the areas of Web Services, Grid Computing and P2P networks make the management of a complex system's interactions more and more efficient (see http://www.agentlink.org/fp6/docs/agent-cities-inet_eoi-response_07.06.02b.pdf). Web-based technologies have a major impact on the design and implementation processes of all types of Decision Support Systems [Ba et al., 95]. To ensure a high standard of communication and

collaboration among all parties involved (humans and software agents) in the context under consideration, our approach has thoroughly exploited the .NET and XML technologies. Figure 1 presents a functional diagram of the three-tier architecture of our framework. Its main components are the Argumentation Graph, the Knowledge Management, and the Decision Support modules, as well as the Knowledge Base and the Model Base. In the following sections, we discuss in detail the main features and functionalities of the proposed framework.

3 Argumentation Graph

The core component of the proposed framework is an Argumentation Graph that provides a visualization of the discourse (discourse graph) through which strategists may contribute their positions in order to solve a strategy development issue. All individual positions inserted in the graph (i.e., *goals*, *alternative solutions*, *arguments in favour or against*, *criteria*, *constraints*) are called discourse items. These are considered and treated as items of knowledge associated with a specific semantic value according to their placement in the discourse graph and their creator. A *Scoring Mechanism* (see subsection 4.2) is employed in order to evaluate their contribution to the overall discourse according to the place of the graph where they are inserted, as well as their initial values, relationships and creator.

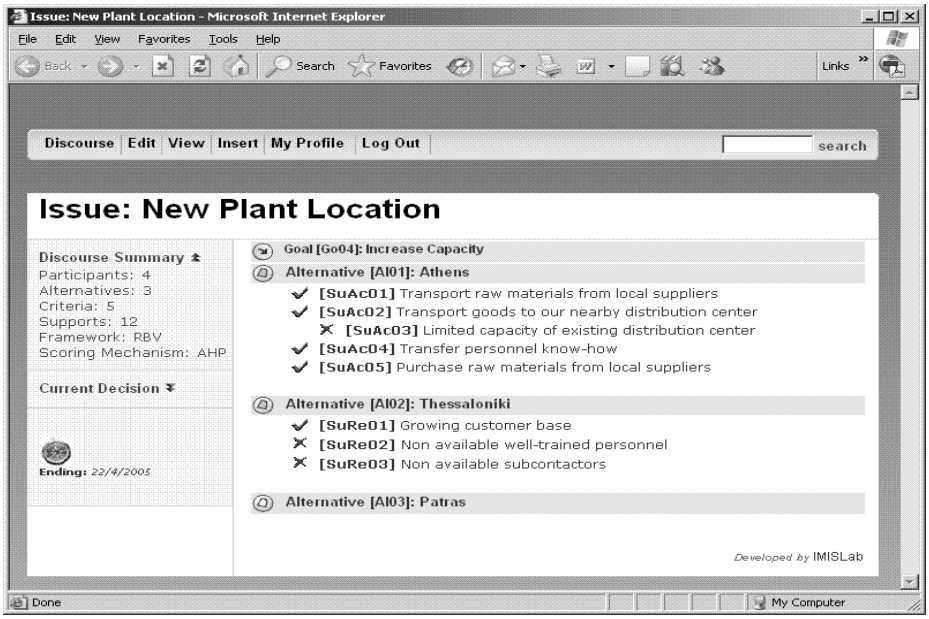

Figure 2: An instance of the Argumentation Graph

Figure 2 illustrates an instance of a discourse example case related to the issue of building additional capacity. As shown, each discourse item is preceded by an icon that serves for folding/unfolding purposes and an identification code which is

associated to its type. Upon the entry selected each time (by clicking on it), the discussants may consider the permitted actions and act accordingly. For instance, one can argue in favour or against a certain discourse item and relate his/her argument to a certain criterion. Furthermore, discourse items inserted in past discourses can also be accessed and reused in an ongoing discourse, as they may contain related bodies of knowledge.

The Argumentation Graph is an ASP.NET application. Users can access it through a common interface browser. The discourse's structure is delineated by an XML Schema that complies with semantics explicitly defined in a properly developed ontology model [Evangelou et al., 05]. This model has been defined with the Web Ontology Language, which provides the necessary means for the specification of diverse knowledge domains. Thus, it facilitates the common understanding between humans and establishes interpretability of Web content. The structuring of the proposed platform's Knowledge Base also conforms to the above model.

3.1 Knowledge Elicitation

In our approach, the Argumentation Graph comprises a set of knowledge elicitation features, since all discourse items inserted in the graph are considered and treated as interrelated pieces of knowledge and have a specific semantic value according to their definition and placement. Furthermore, the platform is able to exploit the strategists' actions to maintain a set of properly developed metadata reflecting their attitude in the specific knowledge domain (e.g. how often the "cost" criterion becomes the decisive factor for the resolution of a discourse and which decision makers are always contributing to this issue?). A third functionality enhancing knowledge elicitation builds around the construction of a chronicle (in the form of log files) that provides a summary of the decision makers' actions during a discourse. This information can be further analysed with cluster analysis or causal maps in order to enrich the users' profiles and amend their mental models. Furthermore, it can be used for the analysis and validation of the related decision making process. Finally, pieces of these chronicles can be retrieved from the platform's Knowledge Base through a search engine to be reused in future discourses.

4 Knowledge-based Decision Support

Characteristics of information needs and models differ with respect to the specific decision support environment [Gorry and Scott Morton, 71]. In order to evaluate the proposed alternatives and establish an acceptable solution, trade-offs among the different points of view must be carefully weighed. Our approach comprises a set of *Decision Making Frameworks* for the structuring of the related discourses and a set of associated *Scoring Mechanism*s to evaluate the overall argumentation. Both kinds of models, which are stored in the Model Base, can be updated according to the new knowledge stored in the Knowledge Base. The Decision Making Frameworks are defined by a set of XML Schemata that comply with the ontology's semantics. The mathematical models of the Scoring Mechanisms are implemented in C# (these are also stored in the Model Base). Communication of the models used each time and the Knowledge Base is achieved through well-structured Web Services.

4.1 Decision Making Frameworks

Despite the long way that both research and practise have come since the pioneer works of the 1960s, the early concepts of strategy development are still more valid than ever [Feurer and Chaharbaghi, 95a]. The variety of conceptual frameworks and tools in the area of strategy development cannot be regarded as mutually exclusive, but as mutually supportive [Feurer and Chaharbaghi, 95b]. Complying with the above, we have adopted some of the most commonly used notions and theories stemming from the Strategic Management research field to provide CoPs developed in a business context with the means to develop strategic plans. More specifically, we have adopted the *SWOT* (Strengths, Weaknesses, Opportunities, and Threats) framework [Porter, 80], the *Resource Based View* of the firm [Wernerfelt, 84], and the *Profit Impact of Marketing Strategy* (PIMS) approach [Buzzell and Gale, 87]. These domain-specific decision making frameworks are actually used for the modelling of the problem under consideration. The model selected for the solution of a specific problem also delineates the structure of the argumentation to be performed.

4.2 Scoring Mechanisms

Techniques coming from the Multiple Criteria Decision Aid (MCDA) discipline have been extensively used in cases where collaboration between a group of people has a prominent role. The selection of the proper MCDA technique requires knowledge and experience, as derives from a plethora of classification and sorting techniques that have been evolved during the last thirty years. As epitomised in a series of related articles, each of these techniques has its advantages and disadvantages and serves best a specific problem domain. In our approach, for the calculation of a discourse's outcome, we have employed a set of alternative scoring mechanisms, which are based on the *Analytic Hierarchy Process* [Saaty, 80], the *Multi-Attribute Utility Theory* [Edwards, 94], and the *Outranking Relations Techniques* [Roy, 91]. These mechanisms provide the means for integrating multiple views of a problem and support both quantitative and qualitative criteria. Having exploited their strengths and weaknesses, the system may indicate the most suitable one for the problem under consideration, by exploiting a set of predefined rules and metadata [Evangelou and Karacapilidis, 03].

5 User Modelling

One of the major challenges in developing software is that all users are different [Lessler et al., 04], in that they vary in terms of intelligence, knowledge, training, experience, personality, and cognitive styles [Miner, 78]. The efficient and effective user modelling is one of our framework's main objectives, as managing an organization's knowledge is fully dependent on assisting one manage his/her personal knowledge. Towards this aim, users are categorized in our approach according to five different roles (i.e., discussion coordinator, decision maker, domain expert, knowledge manager, and external entity). With respect to his/her assigned role, each user has a specific access level, while he/she is associated to a set of permitted actions. In the proposed framework, each participant is associated to a profile that

reflects his/her behaviour during his/her participation in the argumentative discourses and knowledge sharing activities. This is accomplished by extracting a *behaviour pattern* (mental model), according to parameters related to a user's involvement in the overall process (e.g. discourse items inserted, frequency of appearance, intervention on items inserted by his/her peers, etc.).

6 Discussion

We have argued that a proper integration of knowledge management, decision making and argumentation features appears as a promising solution for contemporary organizations to resolve strategic issues. This is achieved by surpassing communication impediments amongst people who hold complementary knowledge that has to be unified, revised and improved. Within our approach, knowledge management functionalities have been employed in order to acquire the users' knowledge and exploit it for supporting the underlying decision making. Our approach exploits well-established decision making models and techniques with respect to the problem domain. At the same time, it puts emphasis on the importance of communicating knowledge to develop a shared understanding of the contemporary organizations' activities. We envisage it not just as another groupware solution, but as a highly active tool that will provide a structured way for modelling and solving a strategy development problem. Our primary future work direction concerns the thorough evaluation of our approach in diverse organizational settings.

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