

## Designing Enterprise Decisional System with Agent Based System

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### Abstract

*Facing problems related to the information systems (IS) evolution and consequently decisional systems (DS), conceptual models must facilitate the organisational environment representing in which the (IS) may evolve and strategic objectives on which they must align so as to understand the imposed requirements for their development. Thus, changes have to attend an alignment of (IS) and (DS) within optimising and strategic stakes of the enterprise. Enterprises are increasingly information centric, and recent trends reveal that most competitive businesses require more agility in their enterprise information system and decisional system to strategically position themselves in their environment. As a solution, we suggest a multi-agent approach for the DS modelling. This approach is based on a referential framework to analyse the requirements of strategic alignment and agent technology. The decisional multiagent system proposed is composed of three sub-systems: extracting and uploading sub-system, data mining sub-system and analysis and decision support sub-system. The objective of this work is to give an overview of the DS concepts. In order to describe this central concept in the research on decisional systems, we will refer to all theoretical supports of these systems integrating the approach of situational decision and the question of the necessary architecture to implement these systems.*

### 1. Introduction

The engineering area of Information Systems (IS) refers to the extensive use of engineering techniques to design, implement, maintain and evolve the IS. The two main levels recognised in this area are: the conceptual product and the realised product. Indeed, it is traditionally assumed that all engineering activities leading to product (IS) are organised into two groups:

the activities of conceptualization and processing activities.

All optimisations currently adopt two main pillars, business intelligence and decision already widely used in optimisations. These can in a comprehensive manner, understand, predict, pilot, simulate or seize new opportunities by following pertinent structured or unstructured information that is given by these new tools. The main challenge remains the rapid correlation of this information. Thus new approaches are needed to streamline costs, processes and resources within an optimisation [1].

Generally, at the level of DS the predefined data warehouses models [2] raises the DS package issue. In other words, can we industrialise the analysis of an enterprise in terms of its activity area? There is a simplistic first approach of business intelligence close to the operational reporting. As example, this approach is summed up to describe facts in multidimensional way. More strategically, the second approach makes the difference with the competition. In both cases, the predefined systems in the DS area are, at best, a work base to personalise and, at worst, an obstacle to strategic management of the enterprise.

The fundamental question that arises is as follows: Is it entirely possible to use methods of designing computer systems that are known and widely used to meet the requirements of the system development actors? Most methods do not take into account some dimensions: functional, optimising, human, technical, and external. In addition, these methods do not have any evaluation criteria. Therefore, in the logic of performance research and responsiveness to the needs and requirements, changes must be accompanied by an alignment of IS and DS on the organisational issues and enterprise strategy.

With the Internet development, data tend to be more complex. The diversity of these complex data and their volumes (historical data bases or data warehouses)

poses a significant problem in their modelling, which must be oriented for analysis objectives. The main objective of this work is to enhance the added value of DS particularly data warehouses based DS and to use it as quality and performance asset for the enterprise. The second objective is to contribute to improving DS engineering. To do this, we propose an approach for modelling DS which is based on user requirements, enterprise strategy, and the use of a multi-agent framework, IS/DS and enterprise strategy. For this, we define decision processes associated with the elaborated strategy. This would allow developing solutions to exploit complex data, including rapprochement of the storage process and data mining to design autonomous systems that ensure optimal performance of complex data access.

The remainder of this paper is organised as follows: in the second section we present a related work on the decisional approaches. The third section defines a reference framework for the DS development. Section 4 describes the concepts of enterprise strategy, the alignment modelling of strategy / DS and presents the contribution of DS to the enterprise strategy. The fifth section presents an overview of multi-agent systems. The sixth section describes the decisional multiagent system (DMAS). The seventh section presents the DS development process that we recommend. Finally, we finish this work by a conclusion where we display our contributions, limitations, and perspectives of this endeavour.

## 2. Decision making approaches

The theoretical decision making approaches define the way in which DS will be developed. Also, it may be interesting to analyse the decision-making theories to better understand the advantages and limitations of different DS. A historical interpretation of decision theory can identify three main stages in terms of DS implementation.

### 2.1. Heuristic Based Approach

The first decisional theories were based on the use of a standard model leading to determining an optimal solution to address a given problem. This vision is based on finding the best solution according to one criterion among a predefined set of possibilities. The exact methods, such as mathematical programming [5] [6] and

more particularly the methods of integer programming [7] [8], dynamic programming [6], programming by constraint propagation [9] [10] [11] [12] and procedures for separation and evaluation [13] [14] [6], guaranteeing an optimal solution in polynomial computation time.

Metaheuristics are eminent by the number of solutions that underlies their research. There is a distinction between those that handle a lot of solutions and those that handle only one solution. Methods that attempt to improve iteratively a solution are called local search or trajectory methods, such as taboo research and simulated annealing. However, methods known for global search as the optimisation by ant colonies or genetic algorithm, act on a set of solutions providing implicit parallelism in the search for better ones.

Metaheuristics are often combined to reap all benefits. For this, they also combine with exact methods. To cope with the complex decision-making, two developments have been implemented. The first one is to take into account the uncertainty related to nature states and the probabilistic analyses developed.

The second is to integrate the preferences of decision makers, the subjective probability theory which has been adopted by using a decision criterion and the subjective utility. This theoretical approach has led to the current operational research based on the optimisation modelling activities by mathematical and computational approaches with the aim of finding the best methods to accomplish these activities. The methods developed in this area are usually the foundation of multicriteria decision making and are especially used in financial domain.

### 2.2. Artificial intelligence based Approaches

The previous approach has been widely challenged by the introduction of psychology and cognitive science [15]. This second stage is marked by recognition of an effective reasoning kind based on heuristics.

These heuristic modes of reasoning relative to a given context can solve problems for which exhaustive list of states are impossible to define. They can be used as a way to solve complex problems for which an algorithmic approach is inappropriate. In this context, many researchers [16] have developed a method called "General Problem Solver" which can be described as the first comprehensive model of information human processing. As such, it falls clearly within the power of artificial intelligence. Comprising a central mechanism based on means-ends analysis and a central model of memory, this method has been the starting point of a

very large number of decisional making systems. The figure below illustrates the model that forms the basis of the majority of decision making systems implemented until now:

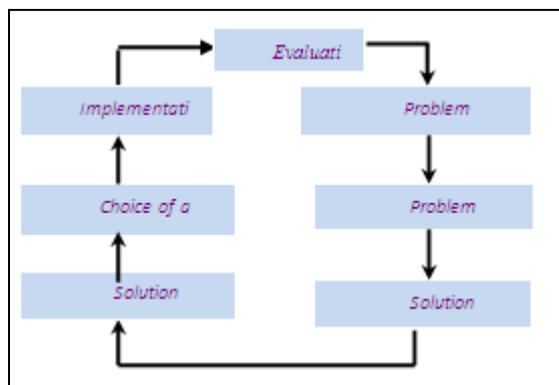


Figure 1. The basic decision-making process

The main contribution for DS is the use of Artificial Intelligence techniques (AI) and distributed artificial intelligence (DAI). The first contribution lies in the integration of advances in AI into DS. Thus, several current researches in AI have led to the creation of different types of DS:

- Approaches issued from the founding work in AI (which included Simon HA) led to the development of expert systems;
- Connectionist approaches represent the foundation of neural networks;
- Approaches using biological metaphor resulted in genetic algorithms.

The second contribution is how to use the cognitive approach for the designing of the DS. Thus, the cognitive approach is one of the foundations of past and current work on the DS design.

### 2.3. Situational Approaches

Taking into account the situational context in decision making will be the basis for establishing the paradigm of the "situation decision" [17] [18]. In this current analysis, a decision must include the context in which it is made. The decision model will be based on the recognition of decision situation by the decision maker. The novelty of this approach compared to the previous ones is that there is no longer the study of cognitive processes in isolation from the contexts in

which they are exercised in. Thus the decisions are not planned and carried out of the situational context [19]. The current of the situation decision does not take into account all decision making processes, but focuses its analysis on a particular item.

In this approach, the decision becomes of secondary as the decisive aspect is the management of the understanding by the decision maker. Thus, in this context, the DS approach does not propose a set of potential solutions, but it offers the decision maker a representation of the context. Therefore, it permits to encourage the consideration of the situation by the decision maker. The main contribution of this research approach for DS lies at the interface, which may appear consistent as the interface exerts a great influence of ergonomic point of view on the decision maker. Thus, new approaches to interface design begin to emerge: "Ecological Interface Design" [20].

### 2.4. Emerging Approach

To continue fulfilling their role as decision support, normally the DS must be framed with the enterprise strategy to continue. However, DS must be projected into the future by extrapolating within current trends. This focusing on two elements that seem very relevant to know: the heterogeneity of data (structured and unstructured) and extension in terms of organisation.

On the one hand, decision makers are confronted all the time by adapting to situations and taking into account various types of data, hence the need for adaptive DS. The decision is made by controlling all kinds of information in a designed or free environment. On the other hand, organisational boundaries are always difficult to establish in a decision environment. Given these different decision making approaches and these constraints, a new generation of DS begins to emerge. In fact, all decision-making approaches have limitations and, in a given situation, an approach is more appropriate than another. For example, the classical approach can give good results in some cases. Thus, it appears depending on the case, a DS approach will be more adequate than another. Thus new classifications based on the decision context [21] can be proposed. Moreover, it is essential to capitalise on the past experience, which is an inescapable concept. In this aim, we believe that a hybrid approach based on heuristics and capitalised experience would bring much

to the situational decision making. Figure 2 illustrates this point of view.

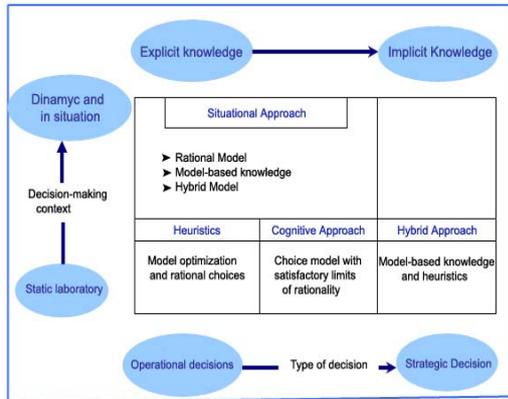


Figure 2. Characteristics of decisional process

### 3. Reference framework

Faced with continual changes of enterprises environment, the hierarchical and pyramidal models evolve toward open system based on a complex network of interacting business processes (BP). To improve understanding these processes, enterprises are induced to build abstract representations of their organisation, the environment in which they operate (other functions, customers, suppliers), and their flow among different actors. In this context, the strategy concept plays a major role in controlling the evolution of these systems. Indeed, the effectiveness of DS depends on the coherence between strategy, organisation, and information system [22].

An appropriate strategy modelling allows simulating any change and understanding its impact on the effectiveness of all processes. Thus it provides valuable decision making information to adapt the structure and flow to the changes [23]. Figure 3 illustrates these concepts with their different interactions.

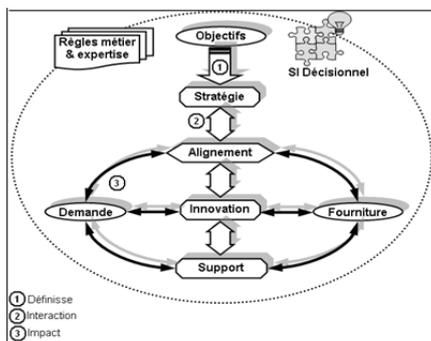


Figure 3. IS/DS development Framework

**Objectives:** Represent the overall vision of the enterprise. The objectives clarity allows enterprise long-term planning as well as actors, customers and suppliers. This vision must be simple and unifying the whole enterprise activities.

- **Strategy:** It helps to understand how the objectives will be achieved by joining the strengths, weaknesses, opportunities, and risks in the enterprise environment.

- **Alignment:** This is a process of integrated control which coordinates all activities and corporate functions. It allows updating of all strategic and operational plans while enabling to control a constantly changing environment.

- **Demand:** Represents the consolidation of all management activities of customer demand. This includes business forecasting, order management, the enterprise positioning as well as managing the customer relationship.

- **Supply:** Represents the consolidation of all business activities necessary to manage internal and external production resources.

- **Innovation:** Represents the consolidation and coordination of all management activities focused on the introduction of all new enterprise tasks.

- **Support:** It is the integration of all activities necessary for the enterprise business: Finance and Human Resources.

**Decision making system:** Represents all measures focusing on the causes and origins of performance, which enable an enterprise to check whether its activities are conducted efficiently. The focus on these measures, rather than on usual accounting and financial indicators, achieves the desired results.

- **Business rules and expertise:** Represents resources and expertise that allow the delegation, decision making, and involving enterprise actors in the steering process.

### 4. Strategic alignment

#### 4.1. Definition

The definition of enterprise strategy can lead to identify strategic business processes around which the enterprises structure their activities and as well as their

operational business that they practise conformably to each strategic business process, which we schematised in the figure below (Figure 4).

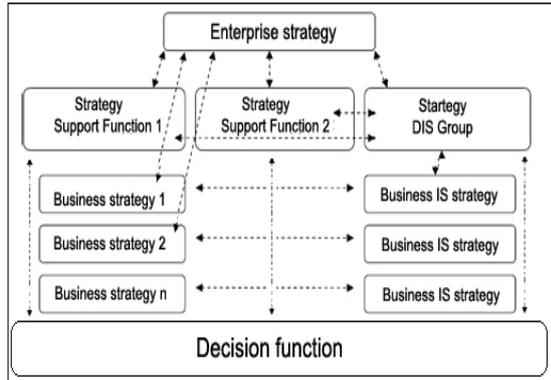


Figure 4. Enterprise functions

Basically the business strategy is broken down into several functional strategies, each of which is aligned with the strategy of the information system. Furthermore, the different business strategies (hence business processes) are correlated with both the business strategy and various IS that are corresponding to business enterprise. And so, to keep a consistency among the different strategies they are under a decisional function control whose role is played by the decision-making system. Thus, the vision of the business IS, representing its overall structure that articulates its various activities based on strategic decisions without giving detailed descriptions of the progress of these activities or their interactions in the context of transversal activities.

#### 4.2. Strategic Alignment Mechanism

Currently the ability to understand what happened and simply being reactive in an enterprise environment does not permit the leadership role. It should be much more active and must be proactive, anticipate, and make decisions about a situation before it becomes a cause of predictive crisis.

For this, we must have an active IS decision coupled with operational systems to freely analyse fresh data to conceive intelligent operations implementation so to as innovate. This leads to the fact that the concept of separation between the IS and the DS is not quite correct: we must move towards a comprehensive model integrating the two systems. The design of IS and DS

should be integrated in an approach taking into account the constraints of both systems (see Figure 5).

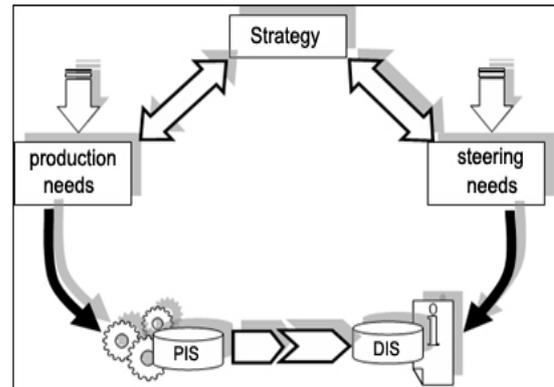


Figure 5. Alignment on strategic requirements

This mechanism aims to control the evolution of IS/DS and to put them at the service of enterprise strategy. It allows the new directions of the industry to optimise investments and to promote dialogue between different actors and stakeholders.

#### 4.3 BI and decisional system

The aim objective of business intelligence (BI) is to further consolidate the activities of decision making. Thus, an infrastructure for BI can be considered as a decision support system. Although BI was considered in particular as a tool for competitive intelligence, in the background, it is a support system for decision-making. The BI paradigm is based on new information technologies and telecommunications applications internal analysis of structured data and business processes while relying on intelligence, analysis and dissemination of information with new added value on the company's competitors. Finally, competitive intelligence is not more than a decisional component [21].

Often, BI applications use data extracted from a data warehouse or data marts. However, all data warehouses are not operated by BI and all applications of BI did not need a data warehouse. To distinguish between the DS concepts and BI concepts, Forrester [22] defines BI as a set of methodologies, processes, architectures and technologies that transform raw data into relevant and useful information used purpose of developing effective strategies, tactics, operational and relevant information

for decision-making. When using this definition, the IE also includes technologies such as data integration, data quality and data warehousing.

#### **4.4. DS Contributions to the enterprise strategy**

The DS have a competitive advantage in defining a business strategy. They occur mainly at two levels: firstly by helping decision makers to anticipate the consequences of change, to make quicker decisions, and to be as a tool for steering the enterprise towards greater performance.

Enterprises can rely on IS and DS to improve their forecasts to reinforce the relevance of their decisions. For this, they take advantage of historical data to analyse trends and develop models taking into consideration external parameters: forecasts based on chronological series.

Another contribution is that they can draw a true strategic map that connects different objectives and means. They can monitor and quantify the achievement of these objectives through qualitative and quantitative indicators.

More academic research advances and simultaneously more technological architectures impose requirements for the decision making system integration. The future of DS evolves toward an open system. There are two major ways that seem important to the theoretical and managerial interest.

Improving complex decision making lies in the generation of new solutions (creative solutions). In this context, the concept of a creative decision making has been mentioned [09]. The research has then been divided into two streams. The first is to support individual creative decisions. The second focuses on creativity in group decision making. Although DS design promotes creativity of particular interest to managers, academic research seems barely to lay the foundations of such systems. Indeed, there is a lack in theoretical basis of the creativity concept that can be integrated into the DS design.

### **5. Multi Agents systems and DS**

#### **5.1 Agent and multiagent systems**

The agent paradigm has emerged in the beginning of 1990. This concept is used in many studies including the design of DS. Defining an agent has become difficult as

its meaning is more developed. Thus, several kinds of agents can be described: autonomous systems with capabilities are reactive and proactive.

An enterprise performance, both in terms of cost, in terms of quality and delay, depends more heavily on its ability to leverage its relationships with its partners (contractors, suppliers or subcontractors), to interface and integrate its information systems and decision processes. The Multi-Agent technology offers the possibility to reach these objectives. It constitutes a new dimension for cooperation and coordination in an enterprise. It provides a very appropriate architecture for agile information systems development. With agent-based technology a support for complex information systems development is introduced by natural decomposition, abstraction and flexibility of management for organizational structure changes [24].

The research on intelligent agents and multiagent systems has recently been on the rise. The stream of research on information systems, decision making process and enterprise integration [25][26] makes the MAS framework a very appropriate tool for integrative decision support within information systems. Similarities between the agent in the MAS technology and the human actor in business organizations in terms of their characteristics and coordination lead us to a conceptualization where intelligent agents are used to represent actors in human organizations.

Whereas the emergence and applications of the agent technology in the business domain have grown over the recently, the field currently deals with innovative approaches and architectures for solving enterprise agility and information systems integration problem. This framework would also have to provide a base for conceptual analysis and of integrative information systems modeling based on the MAS paradigm. Consequently, the agent-based approach provides the pro-activity and adaptability necessary for decision making processes. These Systems can integrate cognitive behaviour.

#### **5.2 MAS characteristics**

The duality between agent as an autonomous entity and adaptive multi-agent system as decentralized cooperative offers a framework indeed very privileged to address issues of information systems increasingly dynamic and requires a perfect agility for the future

The agent technology is growing to be a new framework for developing complex and intelligent systems. Agents are sophisticated computer programs that act autonomously on behalf of their users, across

open and distributed environments, to solve a growing number of complex problems. Increasingly, however, applications require different agents that can work together. A Multi-Agent System (MAS) is a loosely coupled network of software agents that interact to solve problems that are beyond the individual capacities or knowledge of each problem solver [27].

The reasons to adopt this technology are as follows:

- Agents reduce the network overload; allow packaging a conversation and dispatching it among the different system components, where the interaction can take place locally.
- Agents overcome network latency
- Agents encapsulate protocols. Communication protocols often become a legacy problem.
- Agents work asynchronously and autonomously.
- Agents adopt dynamically, by the ability to sense their environment and react autonomously to changes.
- Agents are naturally heterogeneous.
- Agents are robust and fault-tolerant, because of their ability to react dynamically to inauspicious situations

### 5.3 Decisional multiagent system

The idea is to use agents as a tool of implementing distributed multilactor's decisions. The concept of distributed decisions has emerged in Artificial Intelligence research and involves the tasks segmentation in which different activities will be managed by agents interacting among them. Thus, multi-agent technology may be a way to integrate a new decision model and therefore to design a new kind of DS: Multi-Agents DS.

The DS designed and constructed on the basis of a multi-agent framework are equipped with a self organisational nature (ability to update itself by observation, learning, and functional adequacy to perform its task correctly). Indeed, a multi-agent system is able to adapt and learn from the expressed needs and beliefs of different development partners.

The agent-based model [26] does not describe a closed universe. It is an open system with the hyper-textual organisation of staff and the permanent link between the individual and collective level. The collective information is updated through transactions of

different partners involved. It is not necessary to have a perfect representation of the environment to act.

### 5.4 Multi-agent Modelling of Decision Process

In the area of information technology, issues of reuse, autonomy and collaboration among components have been important research that led to such technological developments clustered around the agent concept. The aim of our work is to use this paradigm with overall logic and to design principles of these technologies to enrich the business processes modelling.

The proposed approach can be qualified as an emergent approach. Each decision activity is accompanied by indicators within a test or situation that may trigger it, interrupt it or change its course. And we do not advance the paths between activities. Each activity is represented by an agent. In our vision, we do not consider activities as steps in the transformation that represents the decisional process, and the linkage between activities are not limited to information or services exchange. Our vision constitutes a process whose conduct is neither determined nor predetermined. It is only described by its component activities and their respective actors. It is a vision in which the actors are free to accomplish an activity when the final result is consistent: the overall behaviour of decisional process emerges from interactions between different activities.

This vision has led us to consider the decision making activity as an intelligent entity able to act, react and especially to make decision. We model the activity and the actor by the agent concept.

Therefore, we propose the following model of DP: a DP is MAS where each agent has been characterized by behaviour, use of resources and communication with other agents through interactions (see Figure 6).

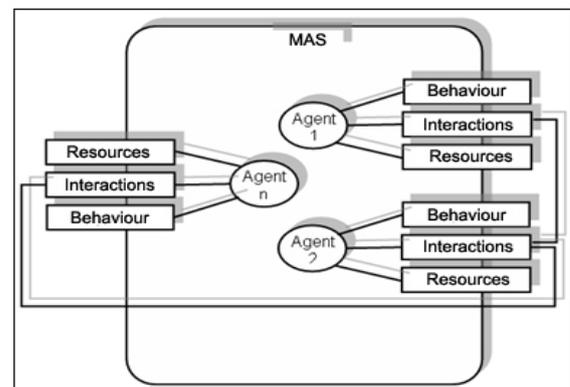


Figure 6. Agent composition

The DP processing will particularly depend on interactions and decisions of each agent (an agent solicits another or responds to a solicitation). It also depends on the resources availability and the effective participation of each agent.

## 6. DMAS Architecture

To enrich the design of IS and particularly DS, in our approach, we propose a multi-agent based modelling. To enrich the design of IS and particularly DS, in our approach, we propose a multi-agent based modelling. It is structured as follows:

The data warehouse, which is part of DS, is uploaded by MAS where each agent is responsible for extracting basic data from a production database. The data are processed by other agents to make summaries of synthesis that will be stored in historical data warehouse layer. Figure 7 illustrates this.

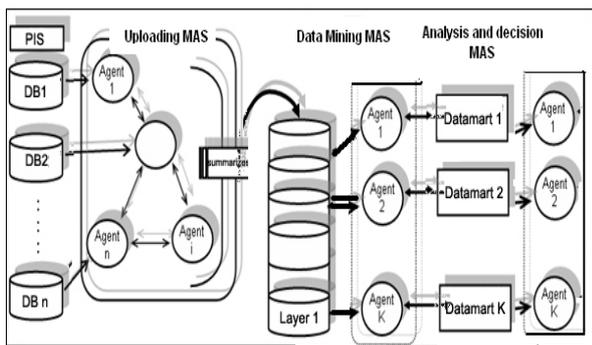


Figure 7. DMAS architecture

In this work, we propose a decisional multiagent system where each decision activity is accompanied by pertinent indicators or situational criteria that can trigger it, interrupt it or change its course. The course of decision making process is not determined a priori, it emerges from interactions among different activities performed by actors. This vision has led us to consider the decision making activity as an intelligent entity able to act, react and particularly elaborate decisions. Thus we model the activity and the associate actor by the agent concept. Therefore, we propose a decisional multiagent system (DMAS) architecture based on a classification into three multiagent subsystems: extracting uploading Sub- system, data Mining Sub-system, - Analysis and decision Subsystem

### 6.1 Extracting and uploading Data Management Sub-system

This sub-system is composed of an interface agent and a set of a set of data management agents, each one of these agent having in charge the data extracting from the corresponding source database.

The interface agent has in charge all the necessary interactions between this sub-system and the other sub-systems. Data Management Agent performs several tasks of managing data. It has a link to the database that contains the product demand data and regularly is updated.

The Data Management Agent handles the preprocessing of the data: data normalization, data aggregation of obvious outliers and data transformation to defined format before sending it via the interface agent to the Data Mining sub-system. Such preprocessing allows reducing the impact of unruliness and data pertinence.

As the database is frequently updated, the Data Management Agent take into account the new data and forwards to Data Mining Agent for updating the data warehouse.

### 6.2 Data mining sub-system

This sub-system is composed of an interface agent and a set of a set of data mining agents, each one of these agent having in charge the data extracting from the data warehouse and upload it into its corresponding data mart corresponding source database. The interface agent has in charge all the necessary interactions between this sub-system and the other sub-systems.

### 6.3 Decision Analysis sub-system

This sub-system allows the end user data mining based on the generation of standard reports or by the specification of the defined user queries. This sub-system is composed of an interface agent and a set of analysis decision agent agents:

-Interface agent having in charge all the necessary interactions between this sub-system and the other sub-systems.

- Analyzer Agent: provides all data marts information. It receives requests from users and needles to the data mart containing the data requested..

## 7. DS Construction

The process design must take into account the user's requirements by capitalising as much as possible on

experiences and knowledge. Once built, the DS have to evolve depending on demand and new objectives which should be scalable, flexible and adaptive. The design of a DS is a process that can be structured into four phases strongly interdependent and iterative:

- The initiation phase of DS project whose objective is to determine the reasons for the choice of these systems, which permits not only the analysis of features of the information and application but also the expected benefits for decision making actors.
- The second phase will define the DS technical and organisational framework concerning the technological choices and determine the organisational framework of the system.
- The third phase will implement the applications one by one (specification, design, implementation, and deployment).
- The fourth phase involves the use and measure effectiveness through feedback from the two previous phases. In this work, we limit proposal to the construction of a DS based on a data warehouse. To do this we propose three interrelated steps.

### 7.1. The preliminary study

This phase of the study is similar to any preliminary step to implement a new system. The principles of used methods in information system development remain valid for the DS. In this step we proceed to the requirements capture and we should determine the contents of the data warehouse and its organisation according to the expected results: We must also identify the necessary appropriate data warehouse functioning particularly by identifying available data in the IS: All production data are not useful in the DS. At this level the requirements and their structuring can lead to a data warehouse structuring into several databases called Data marts.

### 7.2. Data Modelling

The data modelling constitutes the conceptual and logical models. Conceptually, the multidimensional model is used and represented as a cube because the data will always be considered as facts to be analysed on several aspects.

The requests are often interpreted as extracting a plan, a cube segment, or aggregation of data along a plan or a segment.

The data warehouse is uploaded by extracting selected information in the IS. This information is, if necessary, usually checked. Otherwise, it is processed before being injected into the data warehouse. This data warehouse uploading process, which is performed periodically, provides "historical layers" that are information system projections of the enterprise.

This phase aims at data warehouse tables' uploading from transformation of primary raw data.

Guaranteeing the quality of the present information in the data warehouse, the extraction step is critical: an analysis performed on erroneous or incomplete data can distort the enterprise strategy. We distinguish four steps:

- Data Search and retrieval;
- Data filtering;
- Data Processing;
- Data Uploading;

The searching and retrieving phase is to pick only the relevant data according to their sources. The phase of data filtering is to purify them: anomaly detection, removing duplicates, grouping similar data, and detection of inconsistencies.

The transformation phase consists of placing the necessary format, computation of secondary data and melting or disintegration of composite information. We put the data in the desired format to facilitate analysis at the reporting stage.

Finally, the uploading phase role is to store information correctly in the corresponding fact tables of the data warehouse.

Unlike IS, the data warehouse organisation is oriented towards the reports production, indicators and dashboards.

### 7.3. Exploitation

A data mining agent operates in the data warehouse to discover 'information'. Data mining is the searching process in the warehouse to find pertinent information used for decision making.

The classification is one of the most widely used exploring modes. It consists of finding the design of the information and categorising it into different classes. Data mining agents can discover a significant trend

change or a key indicator. They can detect the presence of any new pertinent information.

## 8. Potential Contributions of agent technology

Among all possible tools, we defend here the thesis that multi-agent approaches in their various versions and applications may be a useful tool as far as they do not reduce systems and allow a description integrating quantitative, qualitative and symbolic descriptors. They operate as much as possible for the growth of computer processing capabilities to represent DS which can be of different Kinds:

- Their distributed and parallel property allows us to describe well the complexity of the problems in decision-making situations

- They allow the integration of quantitative, qualitative and symbolic descriptions.

- They exploit parallel computing resources made available through the network generalisation and their operating tools.

- They can easily permit actors represented by MAS to switch to solving problems by specifying constraints on agents and progress towards a stable collective state which represents the solution.

- The multi-agent problem solving includes multi-actors (each actor brought a subgroup agent) and multi-criteria (the environment can be as complex as necessary).

- Systems Integration is based on the concept of services, not on data concept. We directly transit to collaborative systems by integrating information services dedicated or shared. The structure is dynamic and adaptive by using the symbolic capabilities of agents to represent the decision making process (structural adjustment and negotiation model).

The main contribution of the MAS is the double deduction mechanism available to agents at the level of tasks resolution and the meta-level that allows them to observe themselves, interact during problem solving and change the course of their execution.

## 8. Conclusion

This work constitutes a framework of significant advances in decision making engineering and also includes opportunities of integrating the situational concept in the DS modelling. To do this, we firstly

propose a development framework for decisional systems. Secondly, we recommend different concepts modelling related to the alignment of Information system with decisional system and enterprise strategic mechanism.

The use of multi-agent paradigm is very innovative because it is not based on a closed and hierarchical model. It does not rely on limited representations. There is no predefined planning, and it subsequently emerges from interacting. The mechanism of cooperative networking can temporarily resolve the issue of control exchange. In this environment everything is permanently negotiated at the same time from a clear planning. In this contribution, we have tried to illustrate what the potential contributions may be induced by the use of multi-agents for analysis, facilitation and resolution of decision-making situations. We suggest a methodological approach, a developed DS argumentation modelling and problem-solving for multi-criteria/ multi-actors decision making. This modelling is based on the decision making within a situational context. To enrich this work and to consolidate decision making process, our perspective is the external data integration to the enterprise internal data. To illustrate and validate our proposal, we plan to apply this approach on various examples.

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