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Part B Stage 1 OUTLINE STREP

Proposal full title: **Managerial Intelligence Reinforcement Operations:** Socio-cognitive Modelling of Human, Organisation and Computer Intelligent Decision-Making

The proposal acronym: **MIRO**

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Type of instrument: STREP (Specific Targeted Research project)

Activity code addressed: NEST-2004-ADV

Submission stage: OUTLINE proposal

Duration of the project: 30 Months

Proposal abstract:

The objective of MIRO is to improve human management intelligence by theoretical knowledge and technological means. These are to be obtained by the novel top-down object-based goal-oriented methodological approach (TOGA). Today, management decision support is merely a shared label for a multitude of systems covering the broad range of differing tools used in different domains. Only partial theories of management intelligence exist, with limited domain-dependent foci on specific aspects of managerial decision-making. MIRO aims at a domain-independent unified "light theory" of practical knowledge about mental decisional processes, apt to improve general management capacities of humans. This model will be developed into a computational socio-cognitive intelligence framework AMI (Abstract Managerial Intelligence) theory for manager-computer cooperation, to be demonstrated using test-cases based computer games. Such aid could improve the way in which individuals identify and solve decisional problems, promote socio-organizational changes, build and apply their priorities, values and emotions. The TOGA methodology aims to ensure domain-independence and coherence of the theoretical and derived practical results by strict adherence to a process of iterative top-down refinement. It is based on research results of emergent intelligent socio-cognitive engineering and on an incremental meta-theoretical bases that unify systemic, scientific and engineering paradigms together. The proposal is a pioneering attempt of constructing, applying and validating an integrated conceptual frame of formally standardized ontologies, models and techniques. The problem addressed is of growing relevance at the individual, socio-political, and European-levels. MIRO's intelligence reinforcement will enable faster, more aware and more effective human thinking and acting in all forms of the modern society. According to the NEST criteria the proposal is rather "visionary" than "anticipatory".

Objectives

This inter- and over-disciplinary project intended to facilitate different societal and citizens problems related to individual and organizational decision-making. This research proposal reinstates old dreams of computer scientists: to support or even make complex management decisions. In the 1950s, von Newman worked already at the Simplex theory and game theory. Closer to our times, expert systems and data mining revive this tradition; even chess with the success of Deep Blue is not foreign to this endeavour. However these undeniable successes pale in comparison to the original ambitions: to understand and make complex management decisions computational. The over publicised information overload due to the Internet makes the need to meet this goal even more pressing. Our world becomes ever more complex: More non-linear phenomena test the human capability to cope. The ”law” of unintended consequences gets applied more often; there is abundance of information everywhere. The efficiency of human thinking depends on the precision of the language used, therefore the success of MIRO will be dependent on applied and developed ontologies, meta-methodology and finally, models. We believe that new integrated theoretical insights coupled with new advances in human machine interfaces (games and AI technologies) provide us with a chance to set a significant step forward.

The project is planned to be strongly “goal-oriented”. It is based on available models of cognitive and computational intelligence and will demonstrate its results through advances in the understanding of management decision-making and the development of computerised tools. In this sense, the main objective of MIRO is to demonstrate that a general Abstract Managerial/ Intelligence (AMI) can be modelled, computer implemented, and naturally and computationally reinforced.

Socio-cognitive research objective

The research top-objective of the project is a theoretical and experimental demonstration that generic managerial/management intelligence can be modelled and reinforced in two manners.

- The first is the development and application of a *light theory* of Abstract Managerial/ Intelligence (LAMI), for the improvement of general managerial capacity of individuals by providing practical knowledge about useful schemata of the mental decisional processes.
- The second is the development of a general Abstract Managerial/ Intelligence (AMI), i.e. .a socio-cognitive computational intelligence framework for cognitive manager-computer cooperation, which can be formally allocated to human decision-makers and to their computer advisors.

AMI should be extended to a managerial computational high-intelligence model. This goal requires the development and validation of new integrated socio-cognitive model of a system which include managerial decisions of individuals and intelligent organisations **These models will provide a generic framework of computational high-intelligence**, i.e.: - *applicable for the analysis of natural and artificial intelligence-based systems, and unified, domain-independent, carrier-independent and role-independent, - with the capacities of: allowing for goals and domains changing, learning of new preferences and knowledge, and meta-reasoning which has to enable reasoning about the own reasoning at the symbolic conceptualisation levels.*

Technological objectives

According to the NEST- Adventure requirements, the project will face three technological challenges:

- Theoretical and experimental support in the verification and validation of the theoretical models in a concrete management decision.
- Integration and implementation of self-growing strategies, in particular for ontologies and methodology employed.
- Integration of human machine interaction to handle the cognitive interfaces with the management and especially the advice that the system will give to humans.

For the above reasons we intend to use two evaluation approaches:

- The development of a demonstrative managerial decisional game shell (MAG – MAnagerial Game system) composed of the domain independent simulator of the decision domains and an intelligent managerial advisor, which will support human decision makers.
  Two or three test-case scenarios will integrate the theory and the technology. They will demonstrate the flexibility of the models and their utility in extremely different types/classes of decisional problems. The following situations will be considered: emergency management, management of human executors, citizen interaction with society and a business decision. The development of these cases will be done with a strong emphasis on the relation between people in management and on the ethical and social problems involved.
- The organization of courses/training for the managers and evaluation of their results.

The results from these two approaches will be compared. **Finally, the project will provide a unified modelling framework and a computational systemic theory of managerial high-intelligence decision-making.**

These results will be in two forms: a *light theory* – designed for humans and which should be disseminated in the form of seminars, courses and in training sessions, and a *computational theory* - implementable as a software kernel for domain dependent specialised intelligent managerial advisors (a personal High-Intelligent Management advisor, HIM).

Seen from another perspective, this proposal concerns also *capacity building* of the managers of economic, socio-political and scientific institutions acting at different organisational levels and directly managing human and business resources. Capacity building means improving the way in which the actors function within society, how they identify and solve decisional problems, how they promote socio-organizational changes, how they build their priorities, and how they apply their own values and emotions in decision processes.

The long-term objective of the project is to help the interdisciplinary, over-disciplinary and IST-related new Socio-Cognitive Engineering to emerge and to become a strategic as well as a routine conceptual tool for economic, social and individual development in the future. Socio-Cognitive Engineering should contribute qualitatively to the mainstream IST activities and accelerate the sustainable development of the future knowledge society as an alternative efficient conceptualization framework.

Importance of the Idea

The objectives of MIRO are based on new emerging interdisciplinary possibilities of taking a systemic approach to real-world problems. It is the intelligent decision making that is seen here as their key aspect, more precisely, managerial decision-making is considered as an essential cognitive capacity of every intelligent being. In contrast to the commonly adopted perspective of an external absolute observer and incremental bottom-up knowledge development, the meta-engineering perspective of MIRO intends to apply an internal and introspective stance, and not to develop but rather to manage the use of the concrete applicative properties of existing advanced theoretical frameworks and technologies. In this light, further innovations brought about by MIRO are:

Validation of a new top-down goal-oriented object-based socio-cognitive engineering methodology; Discovery of fundamentals and laws of managerial intelligence and decision making; New systemic goal-driven data acquisition and analysis; Integration of multi-domain rational thinking with emotional, ethical and cultural motivations; Elaboration of an incremental building of standards; Guidelines for the framework to reinforce and strengthen managerial intelligence.

In a not so long-term perspective, the reinforcement of management intelligence will be considered as a necessity for the improvement of knowledge management capabilities required by increasing real-world problems of humanity (for instance, in global changes of ecosystems management or for the citizens' participation and the governance in the future knowledge society). We may claim that the current situation requires urgent scientific and technological intervention. **Nowadays' preferred intuitive and implicit consensus building in distributed decisional situations is not economical, is time consuming and involves ever increasing risks.** Computerised intelligent decision support can allow people and societies to realise better their social and human objectives.

Furthermore, knowledge of the decision making process will help the society at large from another angle. MIRO intends to contribute to the development of the necessary concepts, theories, models and tools for both perspectives. The practical cases will provide a strong empirical validation of the theories. Therefore, the results of the project will have an impact in the medium as well as in the longer terms. In the medium term, in the domains of academic education, innovative intelligent technologies development, and modeling of aggregates such as the organization-human-technology-environment. In the long term, on the global and individuals-oriented sustainable development of cultural knowledge society. The reinforcement of management intelligence is required due to the increasing complexity of problems facing humanity.

The Approach and its Plausibility

A) The Approach

The weakness of the modern explosively developing technologies is caused by the lack of theories, which could indicate how they can be applied to the development and management of real world complex human-technology systems. In contrast to existing decision making practices, MIRO will deliver a new methodology of management decision making that increases users' awareness of their activities. It will be based on explicit, documented, and commonly accepted criteria, such as new integrated paradigms, shared ontology and reasoning frameworks. The research methodology used in this project is original itself: it does not subscribe to the incremental bottom-up nature of mainstream social and cognitive studies. Its rigorous pragmatic/engineering meta-paradigms are: to be always goal-oriented and to apply top-down knowledge ordering. Research actions will follow top-down rules applied to bottom-up knowledge acquisition. The adopted set of paradigms and methodological rules, together with the initial ontological framework for an intelligent cognitive agent architecture, will constitute a unique formal approach to the identification, specification and validation of managerial generic intelligence which is not yet represented in the subject matter literature.

The project intends to develop a new explicit methodology of management thinking which is based on explicit commonly accepted criteria, such as: new integrated paradigms, common ontology and model specialization rules. Users will thereby be more aware of the grounds and implications of their knowledge and decisions than with currently used alternatives. Formally, the MIRO approach follows a systemic top-down goal-oriented methodological framework. The kernel of the proposal is Theoretical Work focused on model building in the project's goal-domain. A strong consensus is to be sought subsequently within the consortium regarding ontology, methodology and models. The adopted project is the result of the systemic evaluation of numerous but rather specific theoretical frameworks distributed in the subject matter literature and visible on the Web, as well as from lessons from the ample practical experience of the consortium partners. It is a formally assessed consequence of the leading project hypotheses.

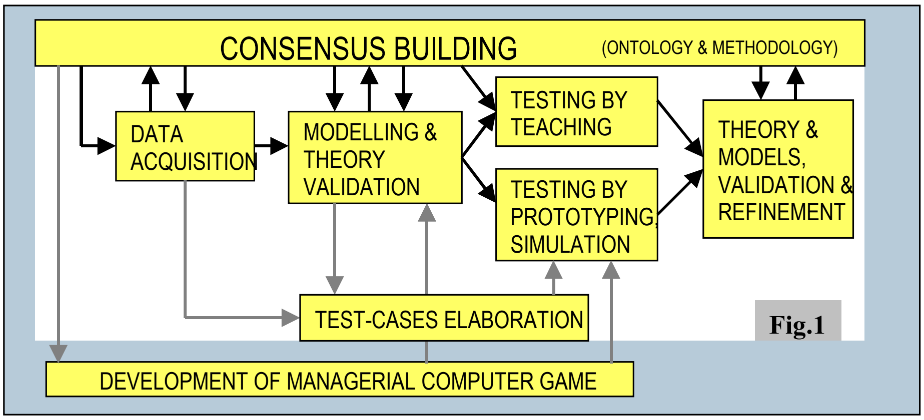

Fig.1

The theoretical framework: The project methodology is based on current research results in the field of emergent socio-cognitive systems engineering. The TOGA (Top-down Object-based Goal-oriented Approach) meta-theoretical framework is considered as an initial and also self-developing conceptualisation tool. TOGA is a systemic approach to goal-oriented knowledge selection and ordering. It is formalized top-down on many abstract and meta levels and is especially designed for very complex real world problems. The project methodology thus is part of an incremental unified meta-theory that rigorously satisfies systemic, scientific and engineering paradigms emergent in the field of socio-cognitive engineering.

The practical experience: The suggested approach has been heuristically analyzed and employed in EU and ESPRIT projects by 3 consortium partners (References). The project's lead hypothesis is that management intelligence is domain and problem independent and that the managerial decision-maker role can be provided in the form of a formally distinct and user configurable system of information, preferences and knowledge bases (these concepts are redefined). The central challenge is to *establish solid foundational principles* for improvement of managerial intelligence by the modelling and design of systems of interacting humans and intelligent computational entities. Improvement of management intelligence can be achieved in three concurrent ways: by **theory and models development** and their dissemination/deployment; by development of **technologies supporting humans**; and by sharing/allocation of intelligence models **across** humans and "machines".

This global vision of management intelligence involved in all human-society activities requires: conceptualization meta-tools; a framework for tools development; a meta-methodological framework; and a strong consensus on the initial hypothesis and top-down development paradigms and ontologies. These requirements lead to the project main activities scenario illustrated in Fig.1.

A more detailed specification of the MIRO project strategy resulting from Fig.1 will be described and presented in the full proposal in the form of task-oriented and competence-based workpackages (they are illustrated in Table 2). A brief description of the key WPs follows:

WP1. Meta-Theory: *TOGA Application, Development and Validation*; The primary objective of WP1 is to provide an ontological and methodological support for the development of the theoretical computational framework of Abstract Managerial Intelligence. The Meta-theory WP starts from the top TOGA framework but going down it can adapt other meta – theoretical solutions just available in the literature. In such a case, if utility of specific theoretical frameworks will be evident then their goal-oriented applications, in frame of a general TOGA ontology, will be performed. Final validation of the TOGA meta-theory will be performed by the confrontation of the results of the validations of AMI and the Light AMI with the TOGA initial and new meta-theoretical frameworks developed in the course of the project.

WP2. Computational Theory: *Development of **AMI** foundations by Socio-cognitive Management Intelligence Modelling: identification, generalization, re-conceptualisation, and validation*. The AMI Computational Theory will adhere to the use of clear formalizations and top-down conceptualizations (expressed in set theory, algebra, logics, graph theory, etc.), aiming to stay clear of specific software engineering terminology, ill-specified terms, and gratuitous reifications ("boxology"), and independent from specific implementation tools and platforms. The work of WP2 will focus on re-usable axioms and laws, directed by the criterion of observability and thus verifiability, and, in general, consensus building.

WP3. Light Theory: *Data acquisition, development of **LAMI** and experimental validation*. The work of WP3 has two objectives. The first objective is to provide input to WP2 in form of a phenomenological ontology and of generic DM scenarios. The second is to develop a Light Theory based on the output of WP2 and validate it through a series of workshops/experiments providing feedback to all the other key packages WP1, 2, and 4 and contribute to the overall assessment of the models and tools developed throughout the project. *The **first objective** will be achieved through a focussed, strongly goal-oriented acquisition of information, knowledge and preferences (guided by the TOGA basic ontology and methodological rules from WP1) related to descriptive and analytical models, and theory frameworks existing in the enormous decision making and decision support literature.*

WP4. Empirical Testbeds: *MAG Software development, application, experimental testing and demonstration*; The main Goal/objective of WP4 is to develop TestBeds (a managerial decision-making game set), it means software tools/systems which functionally support the realization of the WP2 and WP1 objectives. Taking under consideration that main Goal/objective of WP2 is the development of a new computational theory of AMI, and this development requires a sequence of V&V activity of sub-products, we assumed that such activities can be performed also experimentally. For this purpose the final main objective of WP4 is to develop the MAG Set (demo) therefore it has to include the demos of: **HIM** (High-intelligent Management Advisor) with a cognitive human friendly interface, and **GES** (Game Environment Simulator) shell.

B) Plausibility

The Top-down Object-based Goal-oriented Approach requires the development of a project ontology and of decision models on every **generalization layer**, and their specialization on the successive inferior layer. Therefore, every layer can be independently implemented and validated. In the current situation, it is impossible to define how many specialization layers it will be possible to develop, but the theory and models layer developed last will always be applied for the light theory, and implemented in the form of a computational High-Intelligent Management advisor (HIM). This strategy facilitates the achievement of the project objectives and will provide an indication of how the next level specialization has to be done, even though the level of detail required for full practical computational usability in concrete specific domains of managerial decisions may not be reached entirely**. In any case, the management intelligence model will be developed to such a level that its usefulness can be demonstrated**. Another issue which remains outside the scope of the present proposal, is the teaching of HIM, i.e. to provide the advisor "in real time" with the knowledge, preferences and information required. A possible approach could be the development of *learning from the Web* capabilities. Possible requirements for and solutions of these issues should be clearer at the end of the MIRO project. First prototype of MAG managerial game-set will be a test-bed for the validation of the HIM solution and a base for the development in future numerous kernels for specific intelligent Decision Support Systems and autonomous robots.

Why MIRO is "visionary"

The socio-economic impact of the project results is bound to increase with the continuous growth of complexity of modern society. At present, it is characterised by continuously changing decisional rules, specialization of competences of executors, overload with marginal information and the necessity to function under time and economical constraints. These conditions dramatically increase individual stress and the probability of human decision errors in presence of poor knowledge of decision-makers about their mental processes and resulting biases and uncertainty of decisional criteria, especially in organizational distributed decision-making. Under such conditions, from the socio-political perspective, on the one hand the possibility of democratic participation of the citizens increases but on the other hand the reciprocal comprehension between the policymakers and the society becomes always more difficult. Social consensus building requires not only attractive promises and operation at the level of human values and emotions but, in the knowledge society, it **requires a widespread knowledge about the generic decision-making processes** with their commonly recognisable invariable components and data types applied. A structured reference decision-making model will enable faster, more aware and more effective human participation in all forms of the modern society.

Overall, MIRO will benefit the EU information society in terms of economics and improved services reaching its customers, users, suppliers and citizens, in general improving the competitiveness of European organizations and companies. MIRO's citizen oriented results will also support two of the main goals of the e-European initiative.

- Bringing every citizen, every business and administration, into the digital knowledge age, by online and real-time improving the management intelligence.
- Creating a digitally literate Europe, by developing methodological tools that should enable a successive (post-MIRO) large specific improvements of the intelligence model.

Summarizing, the MIRO project is a visionary research across a very wide spectrum of science and technology and with an orientation towards their long-term development. It involves specialists from mathematics to cognitive and social sciences, engineers and managers.
As required by NEST ADVANTURE, it satisfies two conditions: firstly, it is outside of interests of the Thematic Priorities of FP6 and secondly, the research is of a high novelty, highly ambitious and has a high risk. MIRO's project assumes a never rigorously validated but very promising, not conventional top-down approach driven by the TOGA formal meta-methodology constrains and therefore it gives researchers an opportunity to develop their own ideas and their local methodologies. In parallel, it requires strong creative and not routine thinking. MIRO is going beyond the "normal" frames of bottom-up incremental knowledge and technology building.

Estimation of Resources Needed

The project ontology and model structure development requires partners with interdisciplinary experience in the following domains: advanced AI technology research, cognitive experimental modelling, modern business management and socio-organizational research. All of them have to demonstrate the capacity of **consensus building**, i.e. to be able to take systemic perspectives on their basic activities and their contexts, and to be capable of cooperating in a common conceptualisation platform constructed jointly with the specialists from other fields. Strongly differentiated points of view are preferred initially, in order to cover numerous aspects of managerial decision-making processes in various domains and circumstances. Therefore, we decided to obtain project critical mass by allowing for a relatively large number of highly motivated consortium partners, so as to cover all of the following required competences: practitioners, socio-cognitive modellers, teachers, software systems developers (they are only roughly illustrated in Table 1 and Table 2). **We need to add that for the reason of the specificity of the project, all partners are both domain-experts and end-users.** In developing its theory, the consortium will benefit from interaction with experts from other research communities such as organisation theorists, social scientists, economists, psychologists and anthropologists.

Project Management

Due to the strongly innovative and management-oriented character of the Project, the task of coordinating the consortium is divided between a financial/administrative coordinator (FC) and a scientific/technical coordinator (SC). The Project Coordinator will be the FC. The SC will chair the Project Coordination Committee (PCC), which will decide about high-level management issues. According to the scheme in Fig.1, we distinguish three basic Competence Groups composed of the partners and subcontractors: the Consensus Building Group (CBG) is focused on ontology & methodology of the project; the Modellers Group – including socio-cognitive modelling, testing and training courses; and the Developers Group covering software systems & game technology.

Dissemination and Exploitation Activities

An extensive strategy for dissemination of results and will be pursued jointly with exploitation plans throughout the project. MIRO will create a strong awareness, not only at European level, through activities of all involved parties. Exploitation will evolve throughout the whole project duration, in parallel to the other activities. The aim is to analyse the realities within which the MIRO results and services are going to operate, to identify their objective market through the definition of potentials and problems, and finally to define a market plan able to bring this innovative service to success.

Table 1. Distribution of main competencies and experiences of the **8** MIRO proposal partners.

	Partner Nr., Country & **Competences domain:** Type:	1 Gr B	2 It R	3 Pl R	4 FR R	5 UK R	6 Il B	7 It R	8 Ru R
1	Management knowledge	+		+	+				
2	Systemic Methodology & Ontology		+	+	+		+	+	+
3	Cognitive Modelling		+	+	+			+	+
4	Social Modelling		+	+	+		+		+
5	Managerial Cases	+	+	+	+	+	+	+	+
6	Teaching	+	+		+	+	+	+	+

7	Game Systems Development					+	+		
8	Advanced Software & AI technologies		+	+	+	+	+		

The three routine dissemination strategy lines will be: Sc. publications and presentations at international meetings; Organisation of targeted workshops, courses and; Publications in popular media to notify and educate citizens and managers and production of dissemination materials, using all form of multimedia technology.

Table 2. Illustrative distribution (adequate to Table 1) of main partners effort among the **project Workpackages**

WP Nr.	Partners: / WP Title:	Gr 1	It 2	Pl 3	Fr 4	UK 5	Il 6	It 7	Ru 8	Total Effort %
1	Meta-Theory: TOGA Application, Development and Validation;		X	x	x	x		x	x	15
2	**Computational Theory:** Development of **AMI** foundations by Socio-cognitive Management Intelligence Modeling (identification & generalization &validation)	x	x	X	x			x	x	27
3	**Light Theory**: Data acquisition, development of **LAMI** and experimental validation			x	X	X	x			22
4	**Empirical Testbeds**: MAG Software development, application, experimental testing and demonstration	x				X	x		x	20
5	Dissemination of Results	X		x				x		11
6	Project Management	X								5
Total	Partner contrib. 100% =	13	15	16	17	14	8	10	7	100

Comments:
The total effort and partners' contributions are adequate to the detailed MIRO systemic tasks graph, not evidenced yet in this short document.
R indicates research organizations,
B are business organizations.

X - workpackage responsible partner, **x** – indicates main contribution only ,

Some Relevant Publications

According to the explicit assumptions of TOGA, for a Decision-Maker, the real-world is a source of quasi-infinite number of information. In consequence, every perceived problem may be presented in quasi-infinite number of manners dependent on the external circumstances and properties of intelligent agent (D-M'er). Therefore *"There are many ways to solve an informally defined problem but the right solution is able to make all the difference"*.

The project subject and partners have been chosen after deep and careful analysis of the state of the art, candidates' publications, and especially, on the base of their strong motivation and consensus on the leading hypotheses of the proposal. All human-partners have numerous publications and long experience in interdisciplinary fields with a mature systemic reflection on their specific activity areas. The MIRO subject domain is so new and over-disciplinary that the relevant publications are either very numerous or very rare, it depends on the criteria applied. We intend to use goal-oriented adaptive strategy for they definition. Anyway, for the illustration purposes only the selected references are presented below. Of course, they do not evidence really wide and "goal-oriented" spectrum of the partner competences.

A) Methodology Oriented:

Some older publications, since 1994, relating to the suggested TOGA theory and its applicability to the MIRO objectives, are available on the Web [for example: Google search: "TOGA Theory" or "IPK Architecture"]. As well as, the recent contributions of Partners **2, 3,7** to this field, are the following:

[partner 2, 3] . "*Socio-Cognitive Engineering Paradigms for Business Intelligence Modelling: the TOGA Conceptualization* ".<name> international Conference Proceedings", 2002.

[partner 2] " *Socio-Cognitive Engineering Scenarios for the Reinforcement of Global Business Intelligence: TOGA Approach* "<name>.International Conference Proceedings", 2002.

[partner 2] "*System Approach to the<system name> Global Specification* " Technical Report of the … ESPRIT Project, 2002.

[partner 2] Three university < name> theses: 2000, 2002, 2003. and other 3 in preparation.

[partner 2] "*Agenti Cognitivi Semi-Intelligenti per Imprese Virtuali di e-Learning: Applicazioni di Metodologia TOGA e Tecnologie Web Multimediali*", Proceedings of <name> Italian Workshop, 2003.
[partner 2, at al] <paper title>, International Journal of Risk Assessment and Management, IJRAM, 2001.
With all partners contribution: an international workshop <title> 2003 on the subject matter.

B) Domain/subject Oriented

"Miro" oriented Intelligent Agents in Social DM Contexts:

Partner 4 contributions to the specification of multi-purpose, unified, domain-independent, carrier-independent and role-independent models, ontologies and techniques needed to the design of effective intelligent agents interacting dynamically in group and community contexts to facilitate through direct intervention different situations related to individuals and organizational decision-making.
"Computers that criticize you: Stimulus-based Decision Support Systems," *Interfaces*, …, 1993.
"Case-Based Decision Support," *Communications of the ACM*, …, 1998
"Using conversational agents to support the adoption of knowledge sharing practices", *Interacting with Computers, 2003.*
"Understanding Organizational Dynamics of IT-Enabled Change: A Multimedia Simulation Approach," *Journal of Management Information Systems,* …Winter 1997-1998.
Partner 8**:** < *Paper title> in* Proceedings of the International Workshop on Modelling and analysis of safety and risk in complex systems", 2002.

Other references which illustrate the general state of the art:

J. J. Horan, *Counseling for Effective Decision Making.* 1977, http://horan.asu.edu/cfedm/chapter12.php
J. Quesada, W.Kintsch, Complex problem solving: a field in search of a definition?, Institute of Cog Science, Univ of Colorado, Boulder, http://lsa.colorado.edu/~quesadaj/pdf/TIEScomplexProblemSolving.pdf
Irv Boichuk, The Concepts of Making, Implementing and Evaluating Decision, 2001. http://www.technicalinfo.bc.ca/decisions.pdf
J. Joyce, Foundations of Causal Decision Theory, 1999.
G. E. Monahan, Management Decision Making, 2000.
Z. Shapira, Organizational Decision Making, 2002.

Only for the illustrative purposes, from the Google **Web search** (12 Apr.2005) the results for **"managerial decision-making model(l)ing"** returned only **1** document (related to specific problems in Molecular Computational Biology for Clinical Data) and for: **"managerial decision-making process"** we obtained **769 documents**. As well as, we found for **decision-making, intelligence**, about 3.500.000 docs, for **decision-making, and** about 35 000 docs for **"computational intelligence"**. For the **"modelling of computational intelligence "and "modelling of managerial/management intelligence" returned** zero docs, but for**" managerial intelligence "** or **"management intelligence"** we have found 23.800 docs.
The above rough comparison indicates that the **task of modelling** is not yet represented on the Web in the context of a management intelligence and decision-making, but not **computational** analyses of different **domain-dependent** " managerial decision-making processes" are objects of numerous "soft" studies.

C) Technology Oriented

Advanced software and AI technologies are well established in the proposed Consortium, they have not been considered as a critical factor for its objectives, and therefore this last type of references is not considered as indispensable in this anonymous document. We mention only:
M Lewis and J. Jacobson, Game Engines in Scientific Research. Comm. ACM, 45, 1, Jan 2002.

More detailed thematically structured references will be included in the Full Proposal.