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Project-Team SITE

*Modeling and Development of Economic
Intelligence Systems*

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Theme :

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Table of contents

1. Team	1
2. Overall Objectives	1
2.1. Introduction	1
2.2. Brief presentation of our problematics as related to the Environment for the Realization of an EI project (EREIP)	2
2.3. Highlights	4
3. Scientific Foundations	4
3.1. Economic Intelligence	4
3.1.1. Information System user-actor modelling	4
3.1.2. Modelling of the interaction between the user and a mediator	6
3.1.3. Decision-maker profiling, decision-problem understanding	6
3.2. Design and exploitation of data warehouse	7
3.2.1. From the design of IS to the design of S-IS	7
3.2.2. Data warehouses and strategic information systems	8
4. Application Domains	8
4.1. Overview	8
4.2. Economic Intelligence (EI)	8
4.3. Document and knowledge management	9
4.3.1. Multimedia document modelling	9
4.3.2. Document annotation	9
4.3.3. Knowledge capitalization	9
4.3.4. Knowledge and strategy elicitation	10
4.3.4.1. Problem and knowledge elicitation	10
4.3.4.2. Study of documentation and book firm strategies	11
4.4. Design and exploitation of data warehouse and watch system	11
4.4.1. Data warehouse and strategic information systems design	11
4.4.2. Database administration: management, extraction and structure	12
4.4.2.1. Dynamic model integrating a user-model	12
4.4.2.2. EI process for data warehouse design	12
4.4.2.3. Information risk management	12
4.4.2.4. Integration of heterogenous data	13
5. Software	13
5.1. METIORE	13
5.1.1. Functional characteristics	13
5.1.2. Data model	14
5.2. METIORE-WISP	14
5.3. DIMS collaborative platform	14
5.4. RUBICUBE platform	14
5.5. MECOCIR	15
6. New Results	15
7. Contracts and Grants with Industry	15
7.1. Institutional partnerships	15
7.2. Contracts, research agreements and industrial actions	16
7.3. Visit, Invitation	16
8. Dissemination	16
8.1. Animation of scientific community	16
8.2. Teaching	17
8.3. Administrative loads	17
9. Bibliography	18

1. Team

Faculty Member

Amos David [(Team Leader) Professor, Information and Communication Sciences, Université Nancy 2, HdR]
Odile Thiéry [Professor, computer science, Université Nancy 2, HdR]
Lylotte Lacote-Gabrysiak [Associate professor, IUT, Université Nancy 2]
Gérald Duffing [Associate professor, ICN]
Stéphane Gorla [Associate professor, IUT, Université Nancy 2]

PhD Student

Hanène Maghrebi [Université Nancy 2, ATER(thesis to be defended in 2010)]
Pierre Humbert [Université Nancy 2, ATER(thesis to be defended in 2010)]
Victor Odumuyiwa [Université Nancy 2, (thesis to be defended in 2010)]
Olusoji Okunoye [French government scholarship since 2007 (thesis to be defended in 2010)]
Olufade Onifade [French government scholarship since 2007(thesis to be defended in 2010)]
Fausat Oladejo [French government scholarship since 2007(thesis to be defended in 2010)]
Idowu Gbolahan [French government scholarship since 2007(thesis to be defended in 2010)]

Administrative Assistant

Antoinette Courier

Other

Babajide Afolabi [Associate Professor, Computer Science, Obafemi Awolowo University, Ile-Ife, Nigeria]
Chedia Dhaoui [Post Doctorat, Faculty of Economics and Business, University of Sydney, Australia]
Charles Robert [Associate Professor, Computer Science, University of Ibadan, Nigeria]
David Bueno [Associate Professor, Computer Science, University of Malaga, Spain]
Audrey Knauf [Associate Professor, Lille Catholic University, France]
Philippe Kislin [Associate Professor, Paris X University, France]
Najoua Bouaka [Université Nancy 2, (Thesis defended in December 2004)]
Frédérique Peguiron [Chief librarian, Université Nancy 2]
Marie-France Ango-Obiang [Université Nancy 2, (Thesis defended in December 2007)]
Patrick Nourrissier [NetLorConcept]

2. Overall Objectives

2.1. Introduction

The focus of this team is on the design and development of an environment for **Economic Intelligence (EI)** projects in which **strategic information system** plays an important role.

Definitions of EI

1. It is a set of coordinated actions of search, processing and distribution for exploitation, of useful information for economic actors. These actions are carried out legally with all the necessary protection for the safeguard of the company's patrimony, and with the best quality, delay and cost¹.
2. It is the process of collection, processing and distribution of information with the goal of reducing uncertainty in taking strategic decisions².

For us, these two definitions characterize our research objective. In fact, the increasing predominant role of information in socio-economic sectors or in organization in general is evident.

¹Martre, H., "Intelligence Économique et stratégie des entreprises", Rapport du Commissariat Général au Plan, Paris, La Documentation Française, 1994, pp. 17,18

²Revelli, C., "Intelligence stratégique sur Internet", Paris, Dunod, 1998, pp. 18,19

Communication and information technologies, particularly data processing and Internet, make it possible to manage information of different nature: primary information, secondary information, tertiary information, information with added value. Whereas primary information is the direct product of authors, secondary and tertiary information are transformations into reduced models of the primary information to feed databases. Information with added value is the product of analysis and synthesis of these various types of information. Information is used more and more as object of reference and aid tool for strategic decision making. The concept of EI becomes indispensable for the production of interpretable indicators for decision making based on the use of the company's internal and external information.

The process of EI is based on the **process of watch**. We distinguish here two types of watch: **tactical and strategic watch**. The tactical watch feeds the company's actors with information, and the studied temporal horizon relates to the present and the very short term (information on the economic situation). The strategic watch is characterized by the distribution of information to the entities of management of the company (Directorate-General, Direction of Plan, Direction of Strategy...). The studied temporal horizon is the present, the very short term, medium term and long term.

In order to consider EI as a research object, we believe that it should be considered as a process. This process can be defined as follows:

- a) Identification of the decision problems to solve in terms of threat, risk or danger.
- b) Transformation of decision-problem into information search problem.
- c) Identification of relevant information sources.
- d) Validation of the information sources.
- e) Collection and validation of collected information.
- f) Processing of the collected information for the calculation of indicators.
- g) Interpretation of the indicators.
- h) Decision making for the resolution of the decision problem.

The stages (a), (g) and (h) are of particular importance because they determine the success of an EI project. Indeed the EI process is a global process where the orientation chosen in each stage will determine the type of the final result. For example, if a company decides to make decisions in offensive manner towards a competitor, the information to use, the sources of this information, their processing and the interpretation of the final result will determine the effect of the company's decision. It should be noted that information used is not only factual as in corporate databases but heterogeneous by nature as well by their source and by their validity or their range. It is also informal because it might not have been published.

2.2. Brief presentation of our problematics as related to the Environment for the Realization of an EI project (EREIP)

Based on the EI process adopted by the research team as presented above and as illustrated in figure 1, an environment for the realization of an economic intelligence project should allow the implementation of all the phases in the process or assist in their implementation. Therefore, the environment is based on a "strategic information" system that will integrate all the functional characteristics necessary in all the phases.

We have identified four invariants in all economic intelligence projects, which are, a **decision problem**, a **decision maker**, **required information** for solving the decision problem, and the **protection mechanisms** for the organization's patrimony. Our work is based on the hypothesis that the efficiency of the environment is highly dependent on the adequacy of the collected information as a result of the EI process in solving the decision problem.

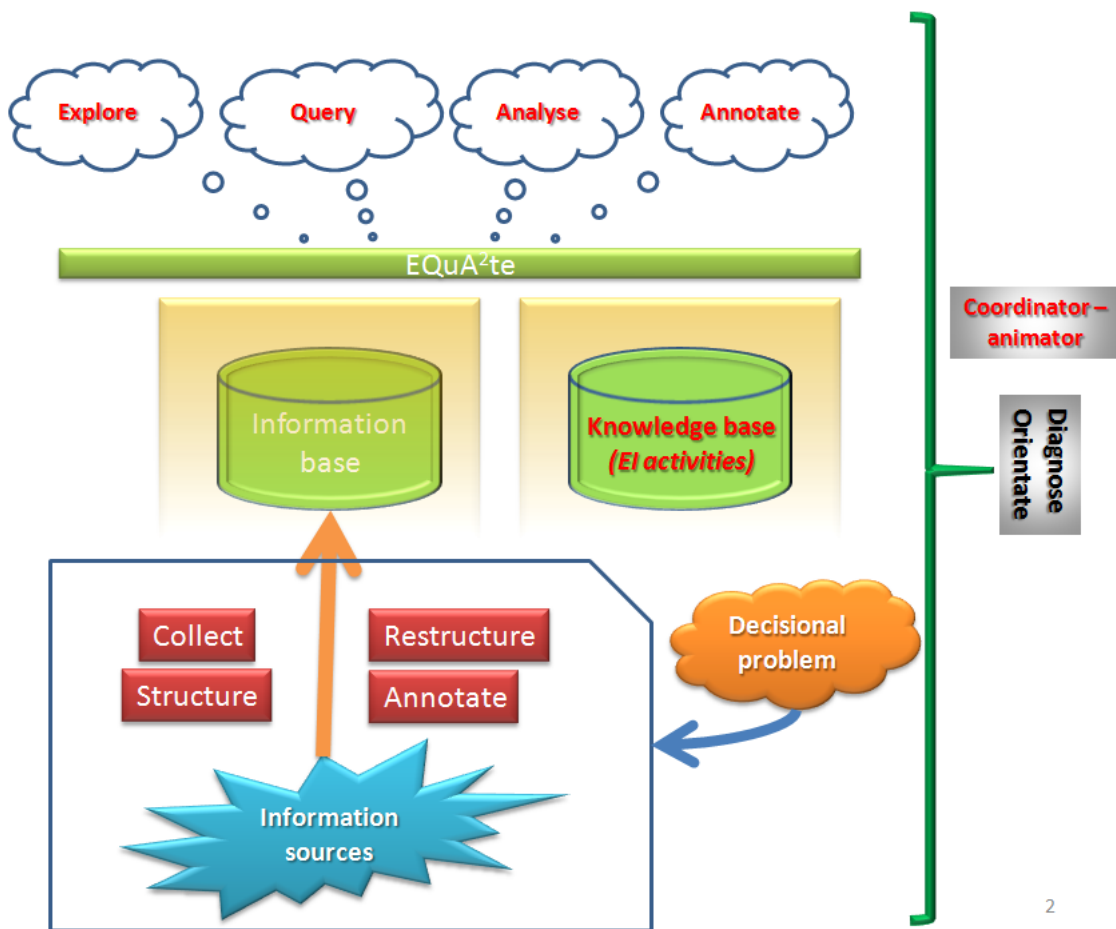


Figure 1. Architecture of an Environment for the Realization of an EI Project

Therefore, as illustrated in figure 1, there should be a module for the specification of the decision problem and this step should be the starting point in the realization of an EI project. The main problematic here concerns the problem of specifying the decision problem by the decision-maker and making it comprehensible for the other actors, particularly the person that will be charged with collecting relevant information. Apart from the study on information representation, the study here embodies studies in psychology, cognition, sociology and other fields concerned with the study of "needs".

The second module concerns the collection of the relevant information for solving the decision-problem. One of the problematics related to this stage concerns the transformation of the decision-problem into information retrieval problems. The success of this stage depends on how well the decision-problem has been understood by the person charged with the information collection. This explains why the first stage which concerns the decision-problem specification is primordial for the success of all the succeeding stages in the environment. Another problematic in this stage concerns the structures and the forms of the collected information. Often, the information collected is of various forms (text, images, sound or combination) and of diverse structures. Some information are not structured or semi-structured. So the problematic of structuring information, integration of heterogeneous information and representation of multimedia information in preparation for their use in decision-problem solving constitute some study areas in the research team.

Another module in the environment is that which will allow for the exploitation of the collected and preprocessed information. The research team has come up with a functional model for this module which is called *EQuA²te*. This model resulted from the study on personalization of information retrieval systems as presented in section 3.1. *EQuA²te* stands for Explore, Query, Analyze and Annotate. In fact we believe that the end-users of the information base in the EREIP should be able to perform any of the function in *EQuA²te*.

The information base in the information system for managing the collected information is just a part of the information needed for solving the decision-problem. There is also need to acquire and store all the generated knowledge by the various actors during the process of solving the decision-problem, from the specification of the decision problem to the interpretation of the indicators generated from the collected information. The materialization of the knowledge will constitute the knowledge base.

Finally, two transversal problems concern the management of risks in the process and how to coordinate the whole process.

The scientific foundations presented in section 3 are related to the problematics briefly presented in this section.

2.3. Highlights

1. In terms of capacity building, the theme of the research team has enjoyed tremendous recognitions year. Professor Odile THIERY was promoted to the category of "Exceptional class", Professor Amos DAVID was promoted "First class", two PhD students employed as associate lecturers.
2. In terms of academic recognition and dissemination of knowledge, the research group GDR-IE to which our research team belongs, has been involved in the production of a book and two special numbers on economic intelligence.
3. In terms of recruitment of ours students, Audrey KNAUF has joined Lille Catholic University as associate professor.

3. Scientific Foundations

3.1. Economic Intelligence

3.1.1. Information System user-actor modelling

The objective of this research orientation is to allow the taking into account of the characteristics of the actors in the process of EI by user modeling. Our goal is to propose models and methods making it possible to

produce results as relevant as possible by the system, in response to the users information need. This should be applicable to traditional information retrieval and also in a context of strategic information systems where the concept of data mart corresponds to the modeling of the end-user of the system, for example the director for whom such a system is essential for a good decision making. The foundation of personalization techniques of the system's response is based on the concept of relevance. The relevance of a solution is often measured compared to the user's query. As the query does not necessarily represent the user's information need, the user judges the relevance of the response compared to his need, which does not correspond to the measure of relevance by the system. The technique which consists of the evaluation of the proposals of the system to indicate their degree of relevance is integrated into certain IRS. Thus, the system has knowledge of the adequacy of the system's response to the user's need. Nevertheless, the system obtains this need only by an estimate based on the queries. Instead of calculating this need, we propose to integrate its representation in the user model. This constitutes the originality of our proposal. This amounts to storing in the Strategic Information System (SIS), among the meta data of the system, an explicit representation of the structure of various data marts. These orientations of taking into account the actor during the development and then during the exploitation of the data warehouses is a major field of our research. Indeed nothing really exists currently in the field, neither in the companies' systems (including the tools of Customer Relation Management (CRM) or personalization of the E-business), nor in research in SIS.

The objective of modeling the user is to be able to personalize the system's response. User modeling is the way of representing a user and his behaviors. That also relates to the way of exploiting knowledge available on the user. Three categories of model are proposed:

- (a) User profile: where to a user is associated his query that represents his need. In this context, the user's need is relatively stable. The profile is applied to new information in order to propose the most relevant information to him.
- (b) The implicit model: where the user's behavior and his preferences are represented implicitly. For example the visualization of a document by the user can be interpreted as adequacy of the document compared to his request.
- (c) The explicit model: where user's behavior and his preferences are also represented but according to user's specifications. For example, even if the user visualizes a document, it is necessary that he indicates his opinion on the degree of relevance of the document compared to his request.

The exploitation of a user profile (a) is generally individualized. The implicit or explicit model, (b) and (c), can be individualized or processed using the method of stereotype. By the technique of stereotype, the users are grouped into classes and an interpretation applies to all the users of a class.

The representation of the cognitive parameters on the users, for example the parameters necessary to know their levels of knowledge for a better interpretation of their request, requires the safeguard of the user model through sessions and individualized.

Our work on the personalization of response in IRS began within the framework of our work on Computer-Assisted Learning (CAL), by student modeling, in a context of training using images. We proposed an explicit model represented by cognitive parameters for each learner. The cognitive representation is based on the cognitive phases identified in a process of human learning. Four phases, which correspond to levels of evocative habits, were integrated into the model:

- **The phase of observation:** the learner takes note of his environment by the process of observation;
- **The phase of elementary abstraction:** the learner designates the objects observed by names, which also corresponds to a phase of acquisition of vocabulary;
- **The phase of symbolization and reasoning:** the learner employs specialized vocabularies which concern a level of abstraction of high concepts. For example, somebody on a low level of abstraction can say " I see a fish ", but cannot say " I see a piscivorous bird" (i.e. a bird that feeds on fish, implying a form of abstract classification and specialized vocabulary);

- **The phase of creativity:** the learner discovers and adapts knowledge which is not presented in an explicit way in the system. For example, during the experimentation using our prototype BIRDS, a pupil identified the fact that all the carnivorous birds have short legs, which was not explicitly presented in the system.

As a result of these studies, we developed a functional model that we believe should be implemented in an IRS in the context of economic intelligence. This model is called *EQuA²te*, meaning Explore, Query, Analyze and Annotate. The four functional characteristics represent the four levels of evocative habits.

3.1.2. *Modelling of the interaction between the user and a mediator*

The objective of this research topic is to propose models of interaction between a user and a mediator, or between two users. In relation to user modeling, the problems of this orientation relate to the determination of the status and the knowledge on the collaborating actors. In a context of EI, the taking into account of the status of a collaborator is essential because it is necessary to check his competence and the degree of confidence that one can have in him. This last point shows the relation of the studies in user modeling and collaborative work. We hope to refer on the one hand to the results of the studies on protection of patrimony, in particular the concept of misinformation, and on the other hand to the results of studies on interactions between users of information resource centers. The specificity of this axis relates to the introduction of the concept of interpersonal communication which implies two users in an information retrieval system. The results of this axis will allow the sharing of domain knowledge as well as human competences. The community of information and communication sciences is very interested by the studies of this axis because the results will make it possible to try out interpersonal communication models in a precise context of information retrieval. There are currently tools for forums of discussion and chats but these tools do not allow the coordination of the dialogue and the process of information problem solving.

Collaborative work is already initiated in the field of **groupware**, where the objective is on designing models for collective management of tasks. Systems' architectures available make it possible to share data and to work in virtual spaces. This approach is becoming increasingly important for maximizing the capitalization of knowledge in organizations in order not to lose it with time. This is currently called **knowledge management**.

In the field of information retrieval, collaborative work does not relate to only automated knowledge management but also to the interaction between the human actors in the process of information retrieval. The most frequent situation is that of interaction between a user and an expert in the methodology of information retrieval, for example a researcher and a person in charge of a library. Knowledge to be exploited in this context relates to knowledge on the researcher, his current needs and the history of the current need. Studies in information retrieval show that the knowledge of the experts in methodology of information retrieval on the users accelerates obtaining the solutions to the user's needs.

Amos David proposed for prototypes STREEMS and METIORE three modes of use:

- Autonomous mode where only the user uses the system.
- Observation mode where one user observes another user while carrying out a process of information retrieval without being able to intervene.
- Collaborative mode where two users intervene together to carry out the process of information retrieval.

3.1.3. *Decision-maker profiling, decision-problem understanding*

EI is mainly an activity of decision-problem solving. This activity is carried out by the decision-maker who must formulate exact description of the decision-problem in collaboration with the watcher (the person charged with information collection) who must locate, supervise, validate and emphasize the strategic information needed for solving the problem. In order to optimize the sharing of knowledge between the decision-maker and the watcher, we tried to establish a bridge between two models: the model of the decision-maker and the model of the watchers information search problem. These linked models can help to increase the precision

of the representation of the various parameters of the problem and to allow a greater performance and an optimization of the resolution to the decision-problem.

The first part of this section is specially oriented towards Information Retrieval Problem expression activity which is realised between the person requesting for information and an expert charged to resolve the problem. For this, we defined a set good expression principles (notably inspired from Tauli and Grices pragmatic conversation principles). These are three principles: Adhesion principle; Reformulation principle; and Memorization principle. The second part of this axis concerns a model called WISP (Watchers Information Search Problem). It is an extension and an application of a EI metamodel to describe and help the user to formulate his information needs during a consultation of bibliographic references. It is tridimensional and multifaceted integrating: 1) analytical dimension view; 2) methodological dimension view; and 3) operational dimension view.

3.2. Design and exploitation of data warehouse

3.2.1. From the design of IS to the design of S-IS

Current evolution of information systems (IS) in companies towards client-server architectures requires adapting the traditional methods of IS design. Indeed, in these new architectures, the client-server applications appear as components of various types: storage components, processing components, dynamic components of execution. The basic idea of our proposals is that it is possible to use the same model throughout the successive stages of this design, to obtain the whole software components constituting the automated information system. This is the model OOE, standing for Object Operation Event. We introduced it starting from our research on REMORA method and of the study of commercial MERISE method in France.

Presently, the standard in company's data processing remains the MERISE method even if the tendency is towards object method design such as OMT or UML or at least based on more advanced models such as that of MERISE/2. Without occulting the merits and achievements that MERISE method allowed in company's data processing, it should be recognized that multiplicity of levels of design and realization of IS, the multiplicity of models at various stages and maybe especially the lack of rules for passing from one level to another, or from a model to another seriously handicap the use of the method. This is why we are trying to define not only one single model but also the set of rules for passing from conceptual modeling to logical-physical modeling which will lead to the list of software components to be programmed. We present here briefly this model and its bases:

- The OBJECT category represents the concrete or abstract system elements and its environment i.e. the organization. For example an order.
- The OPERATION category represents the actions within the system or its subsystems. For example, analysis of the order following its entry which will modify the quantity in stock of the ordered product.
- The EVENT category represents the events occurring in the system in the course of time. For example, the arrival of an order which starts the analysis of an order, out-of-stock condition characterized by the fact that the quantity in stock became lower than a certain stock, etc.

In this approach, the state of the system is defined at a given time by the state of the objects which belong to it at that moment. The system evolves in the course of time following the execution of operations which are triggered by the system's internal or external events. The operations act on the objects and cause changes of state which in turn can be events.

This proposal is called causal dynamics because the same cause always produces the same effects. The origin comes from the method REMORA which was popular world wide in the domain of IS design methods. This is because, well before becoming obvious since 1975, we proposed a modeling method based on simple concepts which then not only make it possible to build data bases almost automatically but also to build transactions on the data base by transformation rules using the conceptual solution (starting from the events and operations).

The idea that we retain is that the strategic information systems are particular information systems and that the modeling technique that we proposed previously can adapt to these new IS.

3.2.2. *Data warehouses and strategic information systems*

Data warehouses have become not a phenomenon of mode but an essential instrument for a good management of an organization. They are at the base of any strategy and decision making of a company. The followings are some definitions of the basic concepts.

A *data warehouse* is a data base organized to meet the specific needs for decision making. This base contains historical information on the company, its operation and its environment. It is fed from production data bases and from external information of the company. It is thematic, related to a field that interests the decision-maker, having a temporal reference, sure i.e. whose quality was checked, easy to access, non volatile and regularly updated. In fact, a data warehouse is an integrated view of the organization. It is the core of Strategic Information Systems (SIS).

Information systems (IS) can be strategic from two angles. On the one hand all the current IS of organizations comprise strategic information and allow the automation of the organization as well as making it possible to satisfy the strategic objectives of the direction (example: an IS for improving the inventory control, development using accounting incomes of summary tables in a Spreadsheet). This is called S-IS (Strategic "information system"). In addition, more and more of IS are dedicated only to decision making (example: IS as aid for market choice). This type of IS is called SI-S ("Strategic information" system). In this case, it is the IS in its entirety that is devoted to strategic decisions and comprises only information of strategic nature (example: the results of sales turnovers by country over several years). We are interested here in SI-S i.e. IS of the second type, those which are directly of concern of researchers in EI field. A data warehouse serves as a link between the two types of IS. The company's IS are the first built. They are various and divers, and comprise strategic information. It is necessary to extract from it information necessary for decision making and also their structure (called meta data). This constitutes the relational warehouse (so called because it is currently managed by a relational DBMS). From this data warehouse are extracted multidimensional data bases, so called because they make it possible to view the organization from various angles or dimensions (example: from axis of time, sold quantity of products or sales turnover). These multidimensional data bases constitute what is called strategic information system. Indeed they are made up only of data suitable for decision.

This data warehouse gives rise to, by filtering in terms of user profiles (or finally a user model), to data marts. These are the smaller dimensions of the data warehouse designated to a department or a function of the organisation: Marketing, Finance ... They are updated periodically, based on a multidimensional view of data, and are non modifiable by the users.

We are well aware that the design of SIS requires a particular design steps and a complex modeling methodology. However the related idea of modeling based on the minimum of reusable concepts at each stage appears completely realistic to us. This research orientation has already been started within the framework of a previous DRT project with SNVB Bank.

4. Application Domains

4.1. Overview

Our models and software can be applied in any socio-economic sector concerned with the use of information for decision-making.

4.2. Economic Intelligence (EI)

4.2.1. *Study of Economic Intelligence organizations and systems*

4.2.1.1. *The coordinator: the manager of EI process*

Participant: Knauf Audrey.

The Economic Intelligence Devices (EID) recently appeared in France, concerned with seven identified actions of EI (watch, KM, animation, training, counselling, security, influence). We took part in the establishment of one of the devices, in which infomediaries are responsible for promoting and coordinating the actions of EI to the profit of decision-makers. Within the framework of a thesis, we sought to identify competences necessary for a better piloting of the EID. Our study led to the proposal of a guide (CEID: Specifications of competences of the Coordinator in a EID) allowing to take into account the necessary roles and competences of the coordinator according to the actions of EI implemented in the EID. This tool makes it possible to generate a form of questionnaire which can be used to prepare role specification in order to recruit a coordinator. CEID allows the definition of a new profession and thus its integration within a reference frame of training, such as that proposed by Alain Juillet, Senior Director in charge of Competitive Intelligence in France. Earlier results from this work has been tested at the regional level such as in the project DECILOR.

4.3. Document and knowledge management

4.3.1. Multimedia document modelling

Participant: Maghrebi Hanene.

User studies focusing upon multimedia information needs, its uses and representation are still very limited in the information retrieval world. Our goal is to provide an empirical basis to acquire information that can help user in his retrieval, to better satisfy his information needs, and therefore focus on the problem of how to reduce the distance between multimedia information representation (using the case of cinematographic documents) and the users needs. The complexity is that multimedia information is compound information composed of a variety of information elements (sound, text and image), which are difficult to represent, index and access. In fact, in multimedia information, the text or the sound elements accompanying the image guides the user in his interpretation of the image and bring out a meaning in which the user never thought of. The semantic concepts depicted in, or otherwise emerging from, an image is specific to a user. We can summarize our approach, on which we base the development of our system, on three stages. Firstly, we believe that the starting point of our research is a group of problems that can be summarized as the distance between users information needs and the multimedia information that he needs. Secondly, in order to reduce the gaps, we propose to model user at the same level as multimedia document for better satisfaction of information needs in terms of time and response relevance. The modeling that we propose is done by contextualizing the use for which the retrieved information will be put. Thus the user's information need is translated into information use context. We noticed that it is easier for a user to express information use context than to specify his information need. We think that there is a high dependency between user needs and information use context. In our research, the context of use is integrated into information representation that can help refine users information needs. Thirdly, we propose an approach that allows a user to carry out information retrieval and at the same time participate in indexing multimedia documents in the database through annotation process since the semantic aspect of multimedia information varies from one user to another.

4.3.2. Document annotation

Participant: Okunoye Olusoji.

We are developing tools for generating annotations that would be based on the objectives of information search by users. Based on a good caching techniques, the proposed system would be able to monitor the activities of the user vis-à-vis the annotations made on the documents consulted. The consulted documents on information search problem in a given context and annotations made on them would be documented and stored. The exploitation of the generated annotations, documents consulted and characteristics of the annotators in the proposed system would be based on *EQuA²te* architecture. The system would be able to give suggestive solutions to similar information search problem based on past annotations.

4.3.3. Knowledge capitalization

Participant: Oladejo Fausat.

The goal of this study is to enable the preservation of knowledge in the various phases of the EI process by acquiring, organizing and integrating such knowledge in order to exploit it in terms of re-use and distribution of knowledge. Our approach is to harmonize EI models (knowledge resources) for capitalization and optimization of decision-making process. The result of this study will contribute to the development of the knowledge base as presented in figure 1. Finally, we have developed an application package for EI Knowledge Capitalization (EIKC) System. This prototype system allows actors to log in based on their roles. In the course of solving a decision problem, the system tracks and stores the activities of each EI actor as well as the interaction among them including the initiation of a decision problem (DP), concessions among actors, definition of the decisional problem, information research specification, its reformulation, etc. Other activities for which knowledge is generated include the resolution of information search problem such as identification of relevant information sources, collection of relevant information from databases and open sources, analysis of collected information for producing indicators for the resolution of the DP. EIKC can produce the following types of knowledge among others:

- Details of each past DP
 - The initiator
 - Who participated in its specification
 - The contributions of each participant
 - Temporal evolution of the specification of a DP
- Yearly distribution of DP
- The actors involved in past DP
 - Cross analysis of DP and actors
 - Cross analysis of actors and roles
- Information (solution) retained for the past DP
 - Details of retained solution with relevance justification
 - Cross analysis of solutions and the DP
- Sources used for resolving past DP
 - Why the choice?
 - Who identified the source?
 - Cross analysis of sources and DP

About application areas, the system can be used in any socio-economic organization such as educational, economic, politics, banking, production industries, etc.

4.3.4. Knowledge and strategy elicitation

4.3.4.1. Problem and knowledge elicitation

Participant: Gorla Stéphane.

To resolve the problems of interpretation of the sense to accord to a term of Information Retrieval query, we created a elicitation knowledge tool: Hyperspective, which helps to show the interpretation variations that exist between two persons about the expression of a concept. The MIRABEL model (Model for Information Retrieval query Annotations Based on Expression Levels) presents, like its name indicates, an Information Retrieval Problem from its expression point of view. It is centred on Information Retrieval Problem formulation. This model is represented as a set of parameters for descriptions linked with the understanding and archiving of an Information Retrieval Problem. These parameters are hierarchically ordered and propose a double description of problem expression as a sum of templates: firstly as a function of a number of contextual data and secondly as a function of a group of components of an Information Retrieval Problem expression. All of these templates help to question the problem and to generate complementary information in form of write-ups that helps in understanding the problem, that we name annotations. This model and a tool called Hyperspective (used in the clarification of ambiguous concepts and ideas) were defended in a thesis in January 2006. The second part of this work is in representing the activities of the person charged with collecting the information to use in resolving a decision-problem. Another complementary approach is based on social and technical analysis of user needs and context in an organisation. The main purpose is to represent the different actors based on the artefacts in the project. In continuation of problem and knowledge elicitation work, this problematic is turned to a particular informational problem : organisation strategy identification and explanation. Then, we complete our works with a particular interest for : territorial intelligence concept, creativity methods (particulary TRIZ and Synectics), war-rooms and wargame practices, information visualization and the strategy board game metaphor. Its principal objective is to develop a visualization tool to map a situation or a strategy. At this moment the Materalia lorraine competitiveness cluster is interested in the development of this project.

4.3.4.2. *Study of documentation and book firm strategies*

Participant: Lacote-Gabrysiak Lyllette.

This work study first what we're doing is it's about gathering works on the evolution of jobs and policies on books and on documentation in France nowadays, as regards what libraires offer as well as how editorial policies evolve. Secondly, it has for goal to understand and identify publishing firm strategy in regard to and society and information and communication technologies evolution.

4.4. Design and exploitation of data warehouse and watch system

4.4.1. *Data warehouse and strategic information systems design*

The objective of this axis is to propose an architecture, a model, a methodology making it possible to design a SIS of high quality and meeting the needs of the various actors of an organization. This axis is close to the problem of user (or customer in the broad sense) modeling. In addition, the current market tools (the most known being Cognos and Business Object but now open source tools as Pentaho or SpagoBI) propose not only to build the multidimensional cube i.e. the multi layer views and in the space of the data warehouse (and by so extracting the data necessary for its update) but also to exploit it intelligently i.e. allowing an extraction of knowledge (primarily by reporting tools). By experience this software although based on a relatively elementary intelligent module already make it possible to discover rules and concepts of which we would not have thought of. In this sense they are better than the simple spreadsheets and statistical tools which primarily make it possible to answer questions which one does not know the exact answer but of which one has an idea. We want to add here a module which really does data extraction, in order to improve the functionalities of these tools at two levels: at the level of data extraction to build the warehouse and at the level of exploitation of the multidimensional data base. One other objectives is to install tools making it possible to check, even a posteriori, the quality of the data of a warehouse. For the moment we focus our work on the construction of the warehouse and the data marts obtained from heterogeneous data sources. The idea is to find the warehouses meta base automatically and to integrate into it the meta data on the user. In the field of data warehouses, risk management is considered as a project management issue. We believe however that it is worth taking it into account at each stage of the overall IE process. To list potential risky situations in IE stages, we propose to analyse these stages using the triplet « user - information - process » as a scheme to

identify risks, and we adopt a two-fold approach: structural and dynamic. At the structural level, we add to the warehouse metadata the need to support risk management. At the dynamic level, we refine interactions between the end-user and the system by adding risk detection and management rules. Our purpose is to design a « risk-aware » data warehouse over its entire lifecycle, namely: design, exploitation (and supervision), and utilization by end-users.

4.4.2. Database administration: management, extraction and structure

4.4.2.1. Dynamic model integrating a user-model

Participant: Babajide Afolabi.

The aim of this research is to develop a dynamic information system model that is based on the use of an efficient user model. In most of the existing systems, the data structures are such that they cannot be changed. Our interests lie in dynamically looking up a system and verifying the availability of data that could respond to a user need, if not available then look for the data that can respond to this need from the sources either within the organisation or outside of it (pulling information from sources). We are also interested in redundancy, i.e. picking up data available in the system and verifying the kind of needs they can respond to, using a user need profile that is based on the user model. This can be used in pushing information to the users. This work resulted in model *MORPRI²E* (Model for the representation of Information Search Problem in Economic Intelligence) based on user's activities and is actually being tested using LORIA's publications base.

4.4.2.2. EI process for data warehouse design

Participant: Frédérique Peguiron.

Our study shows that the consideration of the end-user when designing a data warehouse of document resources applied into a teaching framework, that integrates the user modeling, has consequences on the design of the information system. Our model *RUBI³* (Representation of the User's needs at the time of Interrogation of an Information system after Identification) highlights a typology of the users, whose activities and functions vary according to their needs. The system built using the model *RUBI³* reveals a model of data warehouse design revolving around 3 levels: applications, modeling, metamodeling. The process of Economic Intelligence does not only support the passage from an Information system into a decisional Information system, but it also constitutes the link of its integration into an Economic Intelligence System. The resulting thesis³ was defended in November 2006.

4.4.2.3. Information risk management

Participant: Onifade Olufade.

To Information Risk Management in EI context, we are presently hybridizing principle of Ontology and Fuzzy in what we call FuzzOntolgy. The rationale is from the Ontological framework [19] to facilitate appropriate use of linguistic variables in declaring the membership functions. The development is in progress and is oriented with a Cognitive-based Risk Factor Model for identification of possible occurrence of risks to monitoring. We focus on the risk in decision process when the data in data warehouse are not consistent. Then, Knowledge is seen as legitimate and meaningful resources that strengthens the overall management performance. As a result, knowledge management is viewed as a sine qua non towards creation, storage, sharing, and reusing of the organizations knowledge, employing advances in today's technology. Economic Intelligence (EI) is saddled with usage of timely availability of information towards strategic decision making. However, while decision making is based on available information, it has been observed with concern that reconciling the need for decision and subsequent search for relevant information poses a serious threat to the overall decision because of some intangible factor that are difficult to be expressed culminating into non-quality of retrieved data, and sometime time taken to adequately mapped the decision makers mind-set into an appropriate object for information retrieval. Ontology potentially enable automated knowledge sharing and reuse among both human and computer agents; this is facilitated based on their ability to interweave human and machine understanding through formal and real-world semantics. Our framework attempts to capture operational complexities and

³F. Peguiron. "Application de l'Intelligence Economique dans un Système d'Information Stratégique universitaire : les apports de la modélisation des acteurs", Thèse, Université Nancy 2, 2006

human issues into a singular unit to present the global view of inherent risk in knowledge reconciliation that could result into non-quality of data/information and consequently affect the decision maker adversely in the discharge of his duties. The Models developed for the research include:

- Knowledge Reconciliation and Ontological Framework tagged (KNOREM). This model attempts to determine the level of understanding that results from the interaction between some set of actors (decision maker and watcher) towards the need to deliver strategic decision.
- Decisionability succinctly describes the problems associated with increase volume of information on the ability of a decision maker to adequately perform his roles otherwise referred to as cognitive overload.
- Fuzzontology is a compound word derived from Fuzzy Inference System (FIS) and Ontology. This followed from the result of KNOREM taking into cognizance the opinion of Langefors, (1966) dealing with interpretation. The model thus interprets what ontology captures with fuzzy inference system.
- FUZZYWATCH is the last of the proposition, it combines the tolerance in FIS to address the issue of missing data that could result from missing data (not wrong, but ambiguous), more important missed/spelling errors.

4.4.2.4. Integration of heterogenous data

Participant: Idowu Gbolahan.

Our approach is based on SITE's MOPRIE model to extract information from heterogeneous information sources for integration and storing the integrated information for reuse in resolving a similar decision problem that may arise. The contribution is specifically about integration of heterogenous data from desparate sources considering the semantics of data to the user and the decision problem. We have to solve the problem of ETL (Extract, Transform, Load) heterogeneous informations (data format, data schema, consistency problems etc.) then to integrate data in the data warehouse, according to user model.

5. Software

5.1. METIORE

The system METIORE is the core system that we are using to experiment the various models and methods of our team. Two versions of METIORE are presently under experimentation: METIORE and METIORE-Wisp

5.1.1. Functional characteristics

METIORE is a system used for the management of bibliographic references: bibliographic references of LORIA since 1980. It is used as test base to implement our proposals on user modeling and the functional model *EQuA²te*. It is now implemented using Java programming language (we are presently testing the JAVA version) so that the scientific community (LORIA and outside) can try out the system.

The functional model *EQuA²te* implemented in METIORE is an acronym:

- Explore: Allow the exploration of the data base to discover the content of the information base;
- Query: Allow information retrieval by query;
- Analyze: Allow a global analysis of the data of the system;
- Annotate: Allow the user to annotate the proposed results either to express his evaluation of the proposed solution or to attach some other personal information on the proposed result.

In addition to these functions, the system:

- allows collaborative information retrieval by two users, for example between a person in charge of information resource center and a researcher;
- permits the submission of documents by individual users. These submitted documents can be analysed along with existing documents;
- alerts users of updates on the information base.

5.1.2. Data model

The behavior of the user is represented by his activities: exploration, query, synthesis, and evaluation of the answers of the system. Each activity is regarded as a document. The objects managed in the system are regarded as documents. Each bibliographical reference is represented as a document. XML format is used to represent the objects: users' behavior and bibliographic references. The document representation and the search engine in the current version of METIORE is entirely in XML.

5.2. METIORE-WISP

This prototype implements the wisp model and takes up fundamentally, original characteristics of the earlier METIORE. The goal of this software consists in helping the watcher in his information retrieval process by recording search activities for supervising, understanding and future reuse. The new architecture is composed of different modules surrounded by a data warehouse:

- A GUI that includes in one hand, a full web browser to navigate between web pages and documents stored in the database and in the other hand spaces for annotation and metadatas layers.
- A full text index network for retrieving documents with any information elements.
- Additional modules for visualisation, information mapping, cross-analysing and data mining.

METIORE-Wisp is created with Windev IDE for RAD and its 5GL. Some modules, like the cross-analyzer is developed in C language to optimise the processing speed of co-occurrence analysis. Others are DLL or ActiveX objects. Our approach considers that all objects are treated as documents so the prototype uses entirely XML and DOM.

5.3. DIMS collaborative platform

This software was developed by NetLor-Concept, a young company created by old students from Miage (Computer Science methods applied to Management), Nancy. The objective is to propose to the customer a software for the creation of Web site, convivial and easy to use. This tool is generic i.e. it applies to all the cases of traditional data processing of an organization. Very quickly these young undertakers noted that the essential problem is on the fact that small and medium scale enterprises (SME) wanted to recover their data. The data is generally in heterogeneous form, from heterogeneous sources, files, old data bases or at best old relational bases under Access 1. Consequently they proposed a tool for extracting data which, starting from a " flat " relational table i.e. without really established structure, constitutes a data base of multiple tables after having carried out a "classification" of the attributes and having thus built a whole relational tables, for example Access. Of course the algorithm of classification used is still rudimentary. Thus we think of introducing research results in data mining and classification to make the methodology more generic.

5.4. RUBICUBE platform

We developed a decisional platform called "*RUBI*³" User and user's need representation during querying built on a decisional schema. This open source application offers some innovative perspectives to information content processing because it uses XMLA schema for data analysis. We adopted this new analysis model for our research work in which we used a programming language that allows MDX querying of the database. This free decisional tool relies on Mondrian OLAP engine. We elaborated some analysis schemas in XMLA, which allows by using MDX queries to carry out multidimensional analysis via a web interface according to different actors profiles. Our application described above explains data retrieval for dynamic analysis. The retrieved and analysed data result into data mart views based on actors.

5.5. MECOCIR

MECOCIR is a collaborative information retrieval system which implements the COCIR model. The name MECOCIR is formed from COCIR model and METIORE (which is the mother system in our research team). From our study of the Collaborative Information Behaviour (CIB) of users, we discovered that users exhibit a CIB in their quest to resolve their information problem. The system's objective is to allow users to express their information problem, to choose the information system from which to carry out their information retrieval activities, to interact with other users synchronously and asynchronously, to view past users activities, to exchange synchronous and asynchronous annotation during information retrieval activities. This system facilitates knowledge sharing among users in:

- the definition and clarification of information problem
- the choice of information system
- the formulation and clarification of queries based on the chosen information system
- the evaluation of results

MECOCIR is developed with java, php and Ajax. The system relies on the mozilla XULrunner for rendering static and dynamic web pages. The interprocess communication between our system and the mozilla engine is achieved through XPCOM.

6. New Results

6.1. Overview

The various models and software in the research team are under constant refinement and improvement.

7. Contracts and Grants with Industry

7.1. Institutional partnerships

The research team is in partnership with the following structures:

- GDR-IE: a research group on Economic Intelligence created by French National Center for Scientific Research (CNRS).
- The French senior director in charge of competitive intelligence: Some of the proposals of the research team are exploited in some work groups working with the senior director. The master studies in Economic Intelligence, Nancy 2, has also received a formal support from the director.
- The INIST-CNRS: We are working on a research agreement between the INIST-CNRS and Université Nancy 2 in order to officialize a collaboration between the research teams at INIST-CNRS and our team. Two research subjects at masters level were jointly defined by our research team and two units at INIST-CNRS in 2005 as well as in 2006.
- The CRCIL⁴: We are collaborating with the CRCIL for technology transfer by publication of the results of research in the field of EI, by training in form of central internship offer management thereby putting our students in contact with the companies. We are also studying other means of collaboration. For example The CRCIL has made a formal request to use two models defined by our research team within companies⁵.

⁴CRCIL: Chambre Régionale de Commerce et d'Industrie de Lorraine

⁵DMP (Decision-Maker Problem) model and WISP (Watcher's Information Search Problem)

- The Ministry of Foreign Affairs: We develop our international relations with the French Ministry of Foreign Affairs. Indeed, by collaboration with the ministry, we were able to organize two conferences in Nigeria and obtained 6 PhD study grants since 2003.
- This last collaboration with the French Ministry of Foreign Affairs is evolving towards the proposal of a joint masters degree in Economic Intelligence and in Computer Science that will involve Université Nancy 2 on Economic Intelligence and 4 Nigerian Universities (University of Ibadan, Obafemi Awolowo University, Lagos State University and University of Lagos) on Information Systems.

7.2. Contracts, research agreements and industrial actions

We took part in three European projects with industrial partners in the field of research. Also within the framework of DRT SIO, we supervised about ten applied research projects with some forms of technology transfer. Similarly, within the framework of Master ISTIE (a professional course on Scientific and Technical Information - Economic Intelligence), technology transfer projects are carried out.

We have had four industrial contracts with companies relating to the applications of our proposals for the development of strategic information systems used in the context of EI:

- CIFRE contract with COM-MEDIC, 2006-2009.
- CIFRE contract with NANCIE: 2003-2006.
- CIFRE contract with CEIS for the lorraine project DECILOR: 2002-2005.
- Research agreement with the Materialia competitiveness cluster, France, signed in 2009.
- Research agreement with the Company HAYET, Tunisia, 2002-2006.
- Research agreements with CVCE (Centre Virtuel de la Connaissance sur l'Europe), Luxembourg, signed in 2006.

7.3. Visit, Invitation

Four Nigeria researchers visited us for a month in October 2008:

- Sawyerr Babatunde, Computer Science department, University of Lagos Nigeria.
- Enikuomehin Toyin, Computer Science department, Lagos state university, Nigeria.
- Ajayi Anuoluwapo, Computer Science department, Obafemi Awolowo University, Nigeria.
- Adeyemo Omowunmi, Computer Science department, University of Ibadan, Nigeria.

8. Dissemination

8.1. Animation of scientific community

Members of the team are members of several associations. They take part or are responsible for the organization of several scientific conferences.

- Amos David was nominated as member of the National University Commission (Conseil National des Universités - CNU) section 71 of Information and Communication Sciences.
- The research team organized ISKO 2005 conference on "Knowledge Organisation in Utilisation oriented Information Systems: Watch and Economic Intelligence Context", April 2005, Nancy.
- We take charge of the teaching and evaluation of a master course at the University of Ibadan, Nigeria, since 2004 on "Advanced Data modeling and development". The program involves three other universities/institutions in Nigeria.

- Amos David is a member of the scientific committee of ISKO (International Society for Knowledge Organization), french chapter.
- He is a member of AFDIE (French Association for the Development of Economic Intelligence).
- Odile Thiery is a member of AIM (Association of Information and Management).
- She was some years back a regular member of the program committee of the congress INFORSID which comprises a session on SIS.
- We have collaboration with the University of Malaga, Spain, on user modeling in the context of information retrieval.
- Stéphane Gorla is a member of SFSIC (French Society of Communication and Information Sciences).

8.2. Teaching

We participate in teaching at second and third cycle in the university. The modules we teach relate primarily to the fields developed in our team: economic intelligence process, data modeling and design of traditional and strategic information systems. We intervene in the following degree programmes:

- Master's Degree
 - Domain: Information and Communication sciences, Economic Intelligence
 - Domain: MIAGE (Computer Science methods applied to Management)
 - DRT SIO
- Bachelor's Degree
 - ICN (School of Management) Organisational Information System option
 - Elective courses in Documentation

In all these contexts of teaching, which are most of the time vocational trainings, we are brought to define training courses and internship (up to 5 months in second year of master in Miage and STI-EI⁶). This allows us to have many industrial contacts and collaboration opportunities, for example in the definition of DRT subjects.

8.3. Administrative loads

- Amos DAVID is director of studies for Master's in STI-EI. He is the coordinator of an agreement between University Nancy 2 and University of Ibadan Nigeria. Within the framework of this agreement, a session of summer school is organized each year. And for this specific action of summer school, we drew up a tripartite agreement (Nancy 2, University of Ibadan, and the French Ministry for Foreign Affairs), over 3 years (2004-2006). This programme is under evolution to arrive at a joint Master's degree in STI-EI and subsequently in Computer Science.
- Odile THIERY is responsible for DRT SIO and was director of UFR MI, Nancy 2 (2001-2006). She had some additional responsibilities at LORIA (adviser for information and scientific communication) (1997-2008). She has been elected as member of Nancy 2 University's administrative council (may 2008). She has been elected as the director of common service of PLG for the next 3 years (septembre 2008), She is the director of the Pole Lorrain de Gestion Since the 1st of October, 2005. Since 3 years ago, she has been in charge of « patrimoine immobilier » under the President of Université Nancy 2. She is member of different committees : commission appel doffres, commission budgétaire, vice présidente commission discipline enseignants, conseil de gestion du CUCES, commission d'hygiène et sécurité etc.
- Gérald Duffing is the head of department 'Management Information Systems' at ICN School of Management. He is also in charge of the ICN Master's Degree.

⁶Scientifique and Technical Information - Economic Intelligence

- Stéphane GORIA is responsible of the Preparation to Professional Project for the computer sciences students at Nancy Charlemagne Technology University Institute.

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