

USER GOAL-ORIENTED REQUIREMENTS ELICITATION TO IMPROVE ACCEPTANCE AND USE

A Case Study on Document Management

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Abstract: We present a case study that exemplifies an extension of AWARE, a goal oriented requirement elicitation technique, for a collaborative document management system. The case concerns a multinational fast growing Management Consulting company. The system serves both marketing activities and actual work of the variegated consultant community. The system is loaded at “Zero-cost” by the consultants who, through an editorial model, share the knowledge coming from the document base. The key points of the extension are a stakeholder orientation that allows to create as many document management environments as the professional communities, the use of a goal oriented approach that has actually encouraged active participation of future users, the ever present care in maximizing the value received by each professional community and minimizing the effort required to use the system. The research is still in progress but the first phase of the project has been successful, and the consulting company not only is implementing the system but decided to adopt the methodology for themselves and their customers.

1 INTRODUCTION: USER ACCEPTANCE AND SATISFACTION AS DRIVERS OF IT SUCCESS

Information Systems Science is composed by interconnected tiles, that could be grouped in three main areas, namely Business, IT and Social-Organizational (Spohrer & Riecken, 2006). When designing an IT solution, analysts and managers should consider that the mere implementation of IT can achieve the expected results only if appropriately supported by changes or innovations in other perspectives: indeed, the fear to be replaced by IT systems (Markus, 2004) may generate a resistance against a new technology may drive to unanticipated consequences (Benjamin & Eriksson, 2001).

“IT is an effective implementation vehicle of innovation, but only when coupled with the approach, enablers, and other implementation

factors” (Davenport, 1993) “IT plays a fundamental role in business reengineering, but one that is easily miscast. State-of-art information technology is part of any reengineering effort as, an essential enabler [...], since it permits companies to reengineer business processes. But to paraphrase what often is said about government and money, merely throwing computer on an existing business problem does not cause it to be reengineered” (Hammer & Champy, 1993). The relationships between success of IT projects, user acceptance and satisfaction are a focus of different research streams.

A common research assumption is that user acceptance leads to the actual use of a system. A first research issue is measuring acceptance, by scales and indicators to frame user behaviors when approaching or accepting new IT solutions/innovation (Gibson, 2004; Rogers, 1995). The perceived characteristics of innovation can be described by several classes of variables e.g. ease of use and relative advantage (Davis, 1989), compatibility, image, result demonstrably, visibility,

and trialability (Moore & Benbasat, 1991). These variables have been used to define different acceptance models, that define cause-effect chains and allow to predict acceptance behaviors. The major acceptance models are Technology Acceptance Model - TAM (Davis, 1993), Theory of Planned Behavior - TPB and Decomposed TPB (Ajzen, 1985, 1991). The most effective in predicting the usage is TAM (Davis, 1993). TAM is extended with new indicators and scales (Schepers & Wetzels, 2007; Venkatesh & Davis, 2000) and context variables (or moderation effects) of three main categories: Organizational, Technology and Individual factors (Sun & Zhang, 2006).

Another research assumption assumes User Information Satisfaction (UIS) as a proxy measure for system success (Ives, Olson, & Baroudi, 1983). Of course user satisfaction is one of the success drivers not the only one, as it emerges from several research studies (Delone & McLean, 2003). User satisfaction could be decomposed in Information and System satisfaction (McKinney & Yoon, 2002). Central in the satisfaction field is the concept of disconfirmation (Kettinger & Lee, 1994). Essentially, satisfaction is measured by the gap between ex-post perceptions of the system and ex-ante standard expectations.

User satisfaction appears to be related to the involvement in system design: involvement leads to a deeper understanding of the system and, therefore, it potentially narrows disconfirmation. Based on a comprehensive survey McKeen (McKeen, Guimaraes, & Wetherbe, 1994) finds that "Participation", "Communication with the developers" and "Influence on the design" positively affect the satisfaction of end users.

Finally, user satisfaction could be related to the user acceptance of the IT innovations (Wixom & Todd, 2005).

User oriented analysis techniques are a mean to enhance user acceptance and to some extent user satisfaction, by common sense an ideal technique of this kind should be easy to understand by users as precise for the subsequent phases of the system development. Furthermore it should produce an effective vision of the whole system and for the various user classes.

2 THE ISSUE OF USER PARTICIPATION AND USER ORIENTED REQUIREMENTS ELICITATION

We can easily assume that Requirements Elicitation (RE) is the key design phase to get users involved and participative. According with the Rational Unified Process "A requirement describes a condition or capability to which a system must conform; either derived directly from user needs, or stated in a contract, standard, specification, or other formally imposed document" (Jacobson, Booch, & Rumbaugh, 1999). In a broader perspective "a requirement is just an information unit – a piece of information about the system under construction – that is important to keep" (Stevens, Brook, Jackson, & Arnold, 1998). This definition embraces also constraints, assumptions, plan items, term definitions, etc.

The term "elicitation" is usually preferred to "capture", to avoid the suggestion that requirements are out there to be collected simply by asking the right questions (Jirocka & Goguen, 1994). RE can be defined as the process in which information about "what to get" is obtained from key users. The term "elicitation" implies that the analyst is not directly asking users about their respective information requirement but extracts them from their key variables. A very classic example is CSF (Rockart, 1979) where the analyst asks managers their own Critical Success Factors (CSF), identifies CSF metrics and, finally, identifies information sources and information reports. Actually the analyst does not ask what information manager needs since they probably do not know and/or have no time to perform such analysis. In short CSF offers a well known and classical paradigm of information RE.

A second critical point in RE is the variety of users. Actually users can be regarded as stakeholders of both the business processes the system serves and the process itself. "A stakeholder in an organization is (by definition) any group or individual who can affect or is affected by the achievement of the organization's objectives." (Freeman & McVea, 1984). A similar definition is given by Eric Rhenman (Rhenman, 1968) and, by Pouloudi (Pouloudi & Whitley, 1997) in the IS domain and in the software engineering by (Conger, 1993).

In systems common sense easily identifies different user/stakeholder classes/roles:

- daily users who only operate on the system

- power/key users who are expert of the business logic underlining the systems and to some extent of the software itself
- process owners namely managers who are partially or totally in charge of the process the system supports
- occasional users as it happens with web-oriented applications.

In order to understand the needs of stakeholders, an analyst should explicit their vision and diverse viewpoints (Longo & Motta, 2006; Motta & Pignatelli, 2008). Traditionally RE is accomplished by conceptual modeling techniques which propose an abstract view (Goguen & Linde, 1993), that concentrates on what the system should do. Whereas traditional conceptual modelling allows to understand the semantic of information, it often fails in enabling acceptance by users. Research shows that many large projects fail because of an inadequate understanding of the requirements (Boehm, 1981). This inadequacy is often related to social, political and cultural factors (Schein, 2004), as stated by Davenport "IT is an effective implementation vehicle of innovation, but only when coupled with the approach, enablers, and other implementation factors" (Davenport, 1993). The effort needed to fix these systems has been found to be very high.

In order to get participative and effective RE a possible way is to focus on the goals of stakeholder classes and elicit the implied information requirements. The concept of goal is prominent in recent approaches to RE. Specifically, Goal Oriented Requirements Engineering (GORE) approaches emerge in this research area.

Goals are prescriptive statements of intent whose satisfaction requires the cooperation of actors (or active components) in the software and its environment. According to Pohl (Pohl & Haumer, 1997) a "goals represent the objectives an actor wants to achieve when requesting a certain service" and it is "is used to describe an objective to be achieved in the macrosystem, e.g. business goal, personal goal etc." Rolland links the concept of goal to the concept of stakeholder's hope "A goal is defined as something that some stakeholder hopes to achieve in the future" (Rolland, Souveyet, & Achour, 1998). Other definitions come from Van Lamsweerde (Van Lamsweerde, 2001) and Dardenne (Dardenne, Lamsweerde, & Fickas, 1993).

Goals have different level of granularity from high-level, strategic objectives to fine-grained, technical prescriptions that can be assigned as responsibilities of single actors.

Goal-Oriented Requirements Engineering (GORE) uses goals for eliciting, elaborating, structuring, specifying, analyzing, negotiating, documenting, and modifying requirements (Van Lamsweerde, 2001). GORE focuses on early requirements, when problems are identified, and alternative solutions are explored and evaluated. During goal-oriented analysis, the analyst begins with initial stakeholder goals such as "Fulfil every customer request" and refines them until goals are reduced to alternative collections of functional requirements. Major models that use GORE include:

- Knowledge Acquisition in autOmated Specification – KAOS approach (Dardenne et al., 1993) that consists of a formal framework based on temporal logic and AI refinement techniques.
- Non-Functional Requirements (NFR) approach is based on the notion of soft-goals. A soft-goal is satisfied rather than achieved (Mylopoulos, Chung, & Nixon, 1992).
- i* (Yu, 1997) develops NFR but it is more focused on the current organizational situation. In particular, it relates organizational stakeholders, goals and candidate software architectures.

3 GOAL-ORIENTED REQUIREMENTS LICITATION (GORE) METHODOLOGY TO IMPROVE USER PARTICIPATION

We here describe a methodology developed from Analysis of Web Application Requirements - AWARE (Bolchini & Paolini, 2004), that supports the early interactions between users and analysts. AWARE is very simple, directly links goals to requirements and provides robust and straight definition of requirements categories (Access, Presentation, Operation, Navigation, etc...). AWARE, that rapidly defines requirements, has been already successfully used to elicit requirements for Ubiquitous Web Applications (Perrone & Paolini, 2003).

The targets of this extension are information intensive applications (document management, knowledge base systems, information repositories, etc...). Actually their requirements profile is very similar to the paradigmatic web applications. Indeed in such applications the primary needs of users are to access/navigate and/or load documents. By contrast,

in typical transaction oriented systems, users need to fill electronic forms that are stored in databases and retrieve/process collections of tables. In information intensive applications the range of stakeholder / user is extended and includes all the user classes mentioned in the previous section.

The major novelty of the extension is the proactive role of analyst that drives a specific analysis life cycle and the preliminary identification of system users/stakeholders.

The analysis scenario is not totally usual. First the analysis team groups with a key user who is specifically experienced in the domain. In this phase the group profiles the stakeholder classes of the systems with a broad definition of their roles and of the value they should receive from the system. Based on that profile, the group puts down a draft of the AWARE goal/navigation schema, candidate requirements and mock-ups.

As a second phase analysts interview a specific sample of stakeholder with the objective of validating/reducing disconfirmation between the system picture proposed and the actual needs of users. Users are not asked "What information do you need?" but "Are these the goals you are pursuing?", "Is this the interface you are comfortable with?", "Is this the navigation you want?", "Is the cost of using the system consistent with the benefits you are getting?"

The third phase normalizes collected requirements and defines their priority levels.

A final phase transforms requirements in Use Case diagrams as a first step in design of the system.

4 GORE IN CONSULTING GROUPS: A CASE STUDY

4.1 The Management Consulting Group

Our project refers to a management consulting group. Founded in 2003, Business Integration Partners (BIP) grew so successfully that is now the largest Italian management consulting with over 400 consultants and some 250 projects.

BIP (www.businessintegrationpartners.it) operates in the area of strategy/organization structure & business processes with a focus on IT governance. Customers are very large corporations in Telecommunications and Utilities. BIP is also in Spain, Portugal and Argentina and, through international alliances, in France and the Far East

A management consulting project is quite different from a typical system integration project since it does not include software development activities. Management projects include program management of very large IS projects, audit, business process reengineering, planning, certifications and activities related to IT governance standard such as ITIL and COBIT.

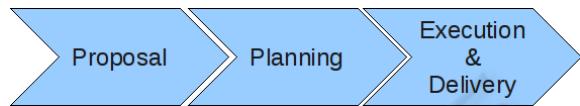


Figure 1: Project Lifecycle in consulting groups.

The management project life cycle includes the following phases that radically differ from the software life cycle:

- **Proposal:** consultants respond to a request made by the management of a customer company. Proposal generally includes a presentation, a quotation, a negotiation activity and the finalization of the actual proposal. Key documents in this phase include:
 - References in similar projects and companies
 - Project plan and organization
 - Technical proposal
 - Project costs
 - Resumes of consultants
- **Planning:** after the proposal is accepted consulting staffs the project and defines in details deliverables and milestones.
- **Execution and delivery:** consultants write documents and/or attend meeting with clients. Generally this phase generates a collection of progress and / or intermediate reports and it ends with the final report.

Stakeholders in BIP reflect very closely professional levels, that very similar to other major consultancies:

- **Business Analyst:** it is the entry in consultancy. They actually write documents
- **Consultant/ Senior Consultant:** with a more extended experience he deals with harder issues and/or coaches Business Analysts.
- **Manager/ Senior Manager:** he manages project teams. Senior managers actually put together proposal and plans.
- **Partner:** it is the highest professional level, he manages large customers grouped by industry and/or a specific domain (e.g. Governance).

4.2 The Issue: Enterprise Content Management (ECM) in a Management Consulting Group

ECM in a Management Consulting company serves a dynamic community that spins around complementary axes, that are the professional profiles and the projects. This twofold dimension multiplies ownerships of documents. For instance, Senior Managers are interested both in general templates and in documents of individual projects. This double ownership is typical to the wide range of project oriented industries as high technology, aerospace, research and alike. While database is typical to project oriented industries, the document is the typical artifact of professional organizations, such as lawyers, notaries, physicians and of course consultants.

BIP top management were persuaded that knowledge is a primary corporate asset. Actually it shortens the time of delivery by providing pre-configured documents and appropriate references, it makes education of junior people much easier by providing best practices and document templates. Finally, it allows cross fertilization between teams and transforms individual knowledge into a corporate asset.

However, from an internal survey, the existing ECM was only a partial success. A cumbersome interface troubled access of users and the effort of loading documents through an highly controlled ad-hoc procedure could not be afforded, in a context where non billable time is considered a waste.

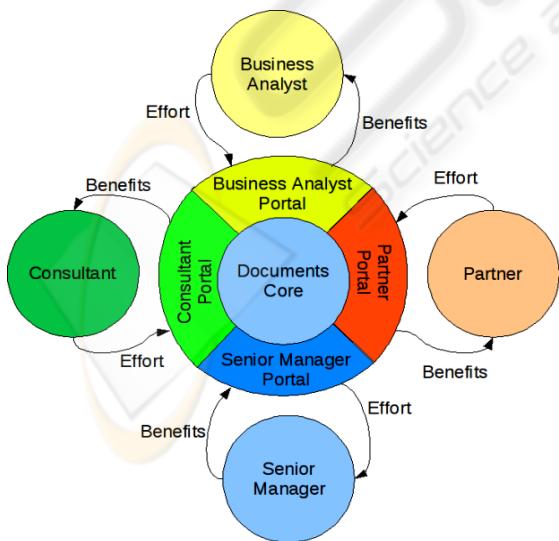


Figure 2: Different perspectives on the Document Repository.

Finally, interviews to senior managers pointed out that the document management system should be profiled on each professional profile. Senior managers when working on a new proposal are interested in finding out similar proposals while business analysts look for templates and document examples to produce new consulting reports.

Based on this experience, the principles of the future ECM system were stated as follows:

- **Zero-cost Tagging and Smart Loading:** loading a project document should be a costless extension of a routine action such as sending an email and/or save a document; tagging should be smart and automatically associate information from project data and document meta-data. Also ubiquity is a must: consultants should access via browser all functions, since they spend most time outside the office
- **Highest Value to Stakeholders:** the systems should provide each professional profile with useful and necessary contents (e.g. best practices). This implies an enterprise repository where each consultant can find his own documents, applicable templates, appropriate selection of documents of the projects he is working on and public documents that are shared by the professional profile community
- **Document and Project Segregation:** the hierarchy of privileges coincides with the hierarchy of projects. The team leader validates / authorizes documents of his team, the senior manager makes the same across teams; this is a key for a consulting company who should keep consulting teams segregated for the sake of customer's privacy. Actually the system tracks downloads and forces planned confidentiality constraints.

4.3 The Analysis

After many discussions with the management, we came out with a short document that really founded the project. The document defined the user scenario of the ECM system. A summary is illustrated in Figure 3: the list of stakeholders was extracted from the organization chart. The needs were defined by informal interviews with a partner and the head of quality. Though apparently simplistic this started a complete user acceptance.

After the laundry list of profiles we decided to use AWARE method because examples made on the fly proved to be very understandable to all

| | NEEDS | HOW |
|---|----------------------------------|--|
| Senior Manager | Proposal | <ul style="list-style-type: none"> ■ Retrieval of previous proposals from similar projects ■ Searching through Meta data or strings |
| Senior Consultant | Planning | <ul style="list-style-type: none"> ■ Project office ■ Best Practices search ■ Collaborative document writing ■ Editorial Model |
| Senior Consultant / Consultant / Business Analyst | Project execution | |
| Business Analyst | Document production and delivery | <ul style="list-style-type: none"> ■ Skeleton / Template retrieval ■ Form and sample documents library ■ Document Versioning |

Figure 3: Preliminary list of Stakeholders and relative needs.

consultants, from partners down to analysts. An example is shown in Figure 4.

AWARE diagrams proved to be not only very rapid to draw but also immediately understood by everybody and easily integrated by screenshot, navigation schemas and use case descriptions. Unexpected results were additional goals added by interviewed people (1-3 for each stakeholder class). An example is the idea of tagging documents based on the dynamic navigation of the documents by the user. Also the system automatically proposes documents that all the colleagues downloaded when performing similar searches. This successful and rich analysis hardly would have been feasible with traditional structured approaches, that lack of participation, or informal participative techniques that lack of structured output.

To foster participation we managed that every interviewed people and every interviewer could

track his own suggestions on a log of proposed changes and additions regardless they were incorporated or not. This was a successful idea for participation and allowed also to prioritize suggestions. Loading ECM by project emails, discussed here below, was one of these suggestions.

Finally we have to mention a philosophy that really drove all the design that we call "Zero-cost" i.e. the user who ever is should spend only a marginal effort to load or access the ECM. High effort is a primary failure cause not only in consulting but in most information intensive systems. Users by instinct balance the value received against the effort spent. In Figure 5 we show the meta data of a document. Administrative meta data are extracted from corporate ERP while document meta-data come from tags of the loading tools, that can be email, web portal and batch for initial population.

In the actual project, after the RE phase, benchmarking and prototype activities gave proof of concept and fit-gap analysis against main proprietary and open source Document Management Systems. The system is now being implemented. BIP has also decided of adopting the extended AWARE methodology as a reference technique to audit / evaluate strategic information requirements.

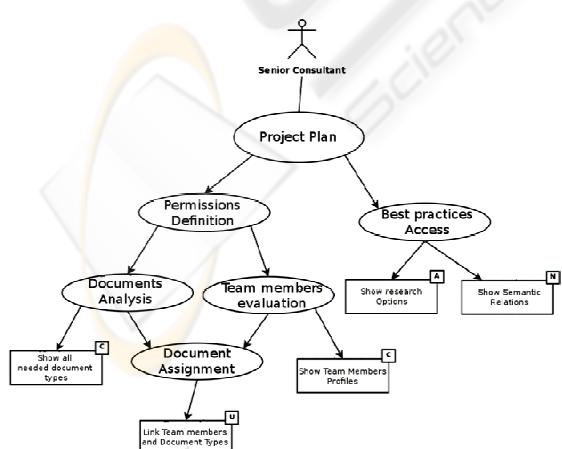


Figure 4: An example of Goal Diagram for the Senior Manager.

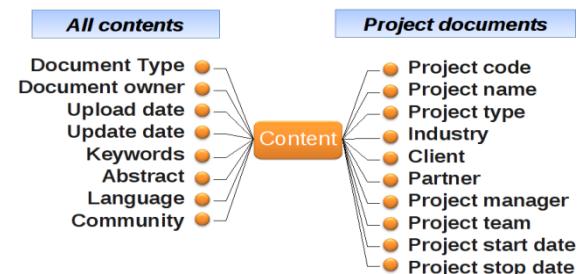


Figure 5: Document Metadata.

5 CONCLUSIONS AND FUTURE DEVELOPMENTS

With the obvious limit of a case study, we have illustrated how much effective can be a goal and stakeholder oriented approach to RE. Of course this applies to document management domain. A comprehensive survey would be necessary to set a contingent theory on the relative effectiveness degree of RE techniques such as UML related techniques, traditional structured requirement collection and analysis, goal oriented techniques unstructured and creative approaches. Nevertheless we can underline some points:

- participative approaches require participative analysts who are really familiar with the domain issues and can imagine the minds of users even without interviewing them
- the participation is only a method but it implies a value aware design epitomized by the “Zero-cost” philosophy
- simple and straight approaches do not mean less rigour or less effectiveness but simply a more efficient and effective analysis
- Stakeholder patterns as represented by AWARE diagrams can be stored in a knowledge base could in turn foster a even faster approach.

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