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Proceedings of

FIWIS 2004

The Finnish-Italian Workshop on Information Systems

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Editors:

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Hannu Salmela

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FIWIS 2004
Finnish-Italian Workshop on Information Systems

The Joint Finnish-Italian Workshop on Information Systems (FIWIS) was held on Sunday 13th June 2004, prior to ECIS2004 in Turku, Finland.

This workshop was originally intended to attract young Finnish and Italian researchers and is designed to be a side event to ECIS2004. The organisers later extended the scope of the workshop so that also participants from Sweden were possible

Hence, FIWIS 2004 is the first major initiative to strengthen the ties between the Scandinavian and Italian IS/IT communities and is addressed especially to PhD students at their first or second year.

The workshop offered an opportunity for all those young Finnish and Italian researchers interested in IS to meet in a specialized venue to discuss research activities, findings and exchange experiences.

Finnish and Italian PhD students were encouraged to submit:
- a research proposal
- a literature review
- a research in progress paper
- a full research paper

Main interest areas of workshop:
- IT innovations
- Knowledge Management
- IS development
- Outsourcing
- Research methods and methodologies

All reports were refereed by reviewers with expertise in the area and the accepted and presented ones were included in the FIWIS Workshop Proceedings.

The proceedings were published in the general publications series of TUCS (Turku Centre for Computer Science) that leaves the copyrights to the author - the same paper can be published elsewhere.

PhD students get 3 ECTS credits, if they submitted a paper, acted as reviewers, participated in the conference, and submitted the final version of their paper.

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TRACK: INFORMATION SYSTEMS DEVELOPMENT

Track Chair

Professor Franca Cantoni, Università Cattolica, del Sacro Cuore and professor Alessandro D'Atri, LUISS Guido Carli in Rome

Participants

Andrea Carugati

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BOUNDARY OBJECTS IN INFORMATION SYSTEMS DEVELOPMENT

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I read and I forget, I see and I remember, I do and I learn.

Confucius

Abstract

The development of proprietary information systems has been and continues to be a very complex activity marked by few successes and clamorous failures. During the last two decades information system development (ISD) methodologies have emerged that consider the development process as a process of social construction of the system's goals rather than a process of discovery of the system's requirements. With this "novel" view, it has become very important to address the specific issue of how to facilitate this process of social construction. The agreement is that using software prototypes as mediators for knowledge exchange represents the best bet for the system' stakeholders to achieve this goal. However questions arise regarding what are the characteristics of these prototypes, what is the process within which they have to be used, and what is the genre of communication to be used in order to support the creation of knowledge. This article addresses these questions adapting to ISD the ideas about boundary objects coming from the literature on new product development and the ideas about the creation of knowledge coming from recent studies on the pragmatic nature of knowledge. It is shown that in order for prototypes to behave as boundary objects they have to be visual, usable, bi-directional, and up-to-date. While two cases support these claims they also point at a broader view of boundary objects indicating that the development process itself can act as a boundary object. This discovery opens new questions about the nature of knowledge boundary and the locus and dynamics of knowledge exchanges.

1 INTRODUCTION

The development of proprietary information systems has been and continues to be a very complex activity marked by few successes and clamorous failures (Gibson and Singer, 1982; Standish Group, 1995). Despite a continuous search for better techniques, as Avison et al. (1998) point out the problem is not in the tools used but in the lack of attention to organizational and individual issues and their interaction with technology. As response to this situation, during the last two decades, research and practice have begun to consider the information system development (ISD) process from an interpretive rather than a positivist perspective (Orlikowski and Baroudi 1991; Checkland and Holwell, 1998). Within this novel view it has become very important to address the issue of how to facilitate the process of knowledge creation and exchange among the stakeholders involved in ISD projects. Knowledge issues in ISD have been treated both explicitly (Richardson and Courtney 2004; Markus, Majchrzak, and Gasser, 2002) and implicitly (Beck 1999; Avison et al., 1998, Winter et al. 1995). In both cases the general agreement is that a social constructivist approach to ISD where systems and requirements emerge from the interaction of multiple stakeholders is to be preferred to an objectivist approach that considers requirements as existing outside the interaction of individuals.

ISD methodologies like the spiral model (Boehm 1988), rapid prototyping (Pries-Heje 1996), and extreme programming (Beck 1999, Fowler 2003) propose iterative approaches and usage of prototypes to support the knowledge exchange necessary for this social construction.

However research carried out in the field of information systems traditionally focuses on the creation of the IT artifact rather than on the creation of knowledge and it is therefore approximate for what regards the specific characteristics of the artifacts that favor or hinder knowledge exchange. Novel theory (Carlile 2002, Hsiao 2003) presents knowledge not as a characteristic of the individual but **as localized and embedded into practice** and as an investment of the community that uses it. This view of knowledge highlights the presence of knowledge boundaries that emerge when work is done that requires knowledge exchange between practices. The research done on eliminating these boundaries (Carlile 2002, Brown and Duguid 2001, Wenger 2000), identifies artifacts with particular characteristics that facilitate the passage of knowledge between individuals and between communities. The artifacts are known as boundary objects. While the above mentioned research has origin in other fields it provides many interesting ideas for improving the ISD process.

The goal of this article is therefore to uncover the applicability and limitations of boundary objects in the ISD process both providing a list of the characteristics that make an IT artifact a boundary object and providing a primer on the process that allows boundary objects to be used constructively. Both goals are aimed at improving the chances of success of ISD projects.

The article is structured in the following way. First, a way of seeing knowledge as emerging from practice is presented. Second, boundary objects and their characteristics are presented. Third, a process for the exploitation of boundary objects is described. These descriptions will be accompanied by two examples of development cases: one in which boundary objects were not used and one in which they were used intentionally. Finally conclusions on the use of boundary objects in ISD are drawn.

2 PRACTICE, BOUNDARIES, AND OBJECTS

The ISD process is carried out by the interacting work of two, broadly defined, groups: the users and the developers of the IS. Methodologies have been mentioned above that focus on improving the relationship between developers and users through the establishment of processes that facilitate the exchange of knowledge. These methodologies provide new ways to approach software development, but in order to understand why these methodologies work better than others and to further improve

their effect it is necessary to look at the ISD process as a learning process or as a process of knowledge exchange between groups.

The reason why knowledge exchange is important is that very often it is difficult for the users to define the requirements of an IS at the beginning of a project. This is because when dealing with a new situation, like it is often the case in projects of development of proprietary software, the possibilities granted by the technology are not clear to the users until they can see the system in operation. At the same time developers often do not have sufficient knowledge of the application domain and the knowledge must be gained from the users in order to clearly understand goals and objectives for the IS.

A dialogue between the development group and the user group is therefore required where the final characteristics of the IS emerge from mutual learning. Despite these warnings, ISD methodologies in general treat the process of knowledge exchange merely as an intermediary, at times an annoying one, to the creation of an information system. In this sense methodologies resemble traditional industrial processes where the production system is the primary source of value creation whereas creativity and informal processes creating knowledge only produce value to the extent that they support the production system.

Considering ISD as a knowledge creation process shifts the focus. Informal processes like conversations, brainstorming and pursuing ideas become the primary source of value creation while formal organizational designs and processes contribute to the value creation to the extent that they are in the service of knowledge processes (Wenger 2000. p. 244).

Independently of where the focus is, the exchange of knowledge between groups is very difficult to achieve. Groups that work together over periods of time begin to develop their own common language, methods, values and beliefs and all together these elements form the groups' view of the world - or weltanschauung. Slowly a group creates its own knowledge and its own recognized ways to create knowledge. Knowledge exists in the act of participation in complex social learning systems where knowledge emerges from the interplay between social competences created over time and the ongoing personal experiences of the people in the group (Wenger 2000). The knowledge boundary emerges because shared practices and weltanschauung are used by groups to strengthen their unique knowledge and in that process the openness towards others is diminished. In the words of Wenger (2000), communities can become: *hostage of their history, insular, defensive, closed in, and oriented to their own focus*.

Another reason why new knowledge is difficult accept is that knowledge is costly to acquire and can be seen as an investment for the individual or the community that holds it (Carlile 2002). Learning from others requires adjusting and transforming the group's current knowledge. This "invested knowledge" (Carlile 2002) phenomenon creates a form of protectionism of one's knowledge.

Though knowledge boundaries are a source of separation, disconnection, and misunderstanding they are areas of unusual learning, places where perspectives meet and new possibilities arise (Wenger 2000, p. 233). Therefore according to Carlile (2002) boundaries also connect communities and offer learning opportunities in their own right. It is on these boundaries that the knowledge exchange of interest in ISD takes place. This will be the topic of the next section.

2.1 Knowledge Boundaries

The first step in exchanging knowledge across boundaries is to identify the various types of boundaries in order to find ways to overcome them. Considering knowledge defined as embedded, localized and invested into practice, Carlile (2002) identifies three 'boundaries' between communities that need to exchange knowledge.

If the knowledge that one group needs is independent from the knowledge that the other group needs and the difference is mainly in the language then the boundary is *syntactic*. Groups need to specify a

common vocabulary in order to exchange knowledge. Once the language is agreed upon the problem becomes one of increasing the bandwidth for the passage of information. This approach, based on an objectivist view of reality, is the most treated in the literature.

If the knowledge that one group needs is partially dependent from the knowledge that the other group needs and the difference is in the meanings attributed to the language then the boundary is *semantic*. The problem becomes one of mutual understanding of meanings. New members of a community slowly learning a trade through peripheral participation represent one way of passing the semantic boundary.

If the knowledge that one group needs is highly dependent from the knowledge that the other group needs and the difference is in the local use of knowledge then the boundary is *pragmatic*. It is only through a dynamic process based on interacting practices that the knowledge about the interconnection emerges. These are cases in which it should be spoken about *knowing* rather than knowledge. According to Hsiao et al. (2003) when we talk about knowing we indicate that knowledge is integral part of practice and of the dynamic interaction of people and their social context. The problem at this level is not passage of knowledge but understanding of practice.

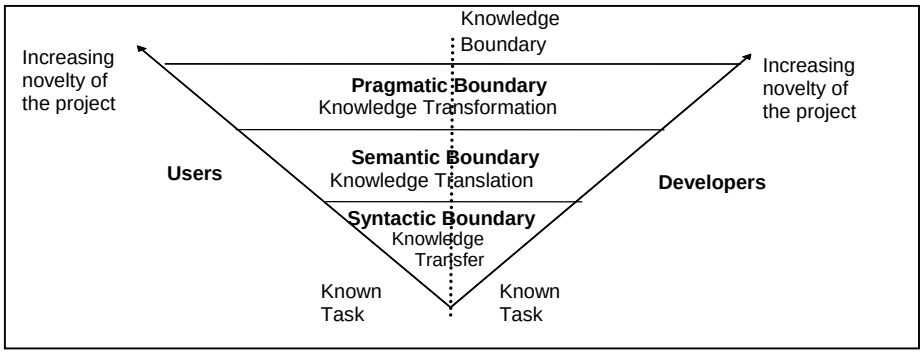

Figure 1. Knowledge Boundaries (from Carlile 2002)

The boundaries, see figure 1, include each other as Russian dolls and are increasingly difficult to overcome. The higher the novelty of the project the greater is the incommensurability of knowledge between communities. Complex knowledge boundaries are especially acute in the early stages of the development of proprietary software, because these usually involve innovative ideas and imply that the knowledge of one group is dynamically dependent on the knowledge the other group. These phases therefore require exchanging knowledge at the pragmatic level.

In these cases knowledge exchange can be facilitated by centering the dialog between developers and users on artifacts, called boundary objects, which can ease the passage of knowledge (Boland and Tenkasi 1995, Brown and Duguid 2001, Carlile 2002). Boundary objects in ISD can be models, documents, diagrams, prototypes or software releases or in general all the artifacts that represent a concretization of group's knowledge into practice. Boundary objects enable conversation presenting a visual representation of practices without enforcing commonly shared meanings. In ISD this is a fundamental characteristic since it is desirable that developers and users, while learning from each other, maintain their own separate understanding of their practices.

However, to become boundary objects, software artifacts must have specific characteristics and have to be used consciously. If this is not the case the boundary object strengthens the power position of one group and reinforces the boundary rather than bridge it (Wenger 2000, Carlile 2002).

2.2 Boundary Objects

Models, documents, diagrams, prototypes or software releases have been used in ISD as demonstrative tools that acted, more or less consciously, as boundary objects. However, the understanding of knowledge presented above provides concepts for their redesign specifically to function as boundary objects.

Wenger (2000) provides three characteristics for objects to work as boundary bridges. First, everybody must be able to use them. This reflects the need to represent knowledge that is localized and embedded in practice. Second, they must show real differences as well as common ground. Real differences are needed to make the object interesting; common ground is needed to clarify the interdependency of the knowledge exchanged. Third, both groups must depend in some way on the knowledge transferred by the boundary objects so that there is the incentive for adjusting experiences and competences.

Let me evidence the characteristics of a boundary object applied to a software prototype created by a development group and tried by the users' group.

The boundary object must be visual (Carlile 2002, Brooks 1987). Visual artifacts are easy to inspect and quick to understand. The software prototype has to resemble the environment of the users so that they can verify whether the developers' understanding of it is accurate enough. The idea of boundary objects comes from new product development and visualization is one way of giving to software a bodily appearance easier to grasp than abstract models usually used in the early phases of ISD.

The boundary object must be usable/functional (Brown and Duguid 2001). Not all knowledge can be made explicit by visualization. Some knowledge that remains tacit can only be demonstrated through action. By working on the prototype the users enact their daily routines and can immediately, through a process of sensemaking (Weick 2001), understand the equivoques of the developers and imagine the new possibilities that the software might provide.

A boundary object must be up-to-date (Carlile 2002). The prototype has to be the latest product of the developers. The main function of the prototype is that the developers can take home the comments, revise their understanding of the problem and create more accurate solutions. If the developers present to the users an obsolete prototype while they are already working on newer versions two problems might arise: first, the developers will be focused on newer problems and will miss the importance of the users' feedback. Second, if the users evidence some flaws in the prototype the developers might get defensive because they will feel they have lost the latest work done. As discussed above, this phenomenon is called "invested knowledge" (Carlile 2002) and up-to-date prototypes help mitigate its effect.

The boundary object must work both ways (Boland and Tenkasi 1995). Prototypes are built for the users to learn about the system's possibilities but also for the developers to collect feedback. Both groups must understand that the final performance of the system depends on their mutual learning. Prototypes must be built to provide both a background for the developers to improve the software but also they should provide elements for the users to challenge their practices and eventually improve them. If software is made by developers in a way that oblige the users to change their practice without providing improvements in the eyes of the users then the users will get defensive and this will increase the boundary instead of decreasing it.

These characteristics allow therefore to "grade" boundary objects according to their potential in facilitating knowledge exchange at the pragmatic level during ISD. Written documents become the less efficient boundary object even though they have value as knowledge repositories. Diagrams and models are more efficient providing a visual representation but are not functional. Prototypes possess all the above characteristics but their use is at an "experimental stage". Software releases provide all characteristics and can generate feedback from actual use. In this sense the use of releases as boundary objects provides the richest feedback. This classification of boundary objects helps explaining why

rapid prototyping and extreme programming can be very effective if the prototypes and releases produced are indeed used as learning opportunities.

This last point indicates that boundary objects alone do not necessarily provide knowledge: they have to be used purposefully for this. The process of knowledge creation and exchange with boundary objects will be explained in the next paragraph.

2.3 A Process to Exploit Boundary Objects

According to the ISD methodology chosen, the ISD process can vary radically. However, there are four basic steps that are shared by all methodologies. First, the groups of developers and users meet and discuss the requirement for the information system. Second, the developers discuss among themselves how to address the requirements. Third, each developer develops the part of the information system of his/her competence. Fourth, the developers and the users meet to test the system and eventually implement it. If the waterfall model is used the four steps will be performed once and if spiral model, prototyping or extreme programming are used the four steps will be performed multiple times.

Independently from the methodology used, there is a continuous evolution in the knowledge of the two groups. Steps two and three are not simply execution of designs agreed upon with the users or among developers but are the arena for the embodiment of previous and new knowledge into IT artifacts. These are processes that contribute to the creation of IT artifacts that can be very different from what is expected by the users. Seeing the process in these terms illustrates how to exploit boundary objects in information systems development.

First, boundary objects can only be used by the users when the two groups interact (Wenger 2000). Therefore boundary objects must be used during step one and four. If these phases are organized as debates then boundary objects can facilitate discussion. In particular users must be given the possibility to use the boundary object and be able to criticize it convincingly (Carugati 2004).

Second, the knowledge transmitted by boundary objects is not automatically accepted by groups (Boland and Tenkasi 1995). It takes time and multiple encounters for one group to understand the others' practices and accept their knowledge as valid. Therefore the process of knowledge exchange via boundary objects must include *multiple iterations* so that groups get better at representing, specifying and transforming knowledge (Carlile 2002).

Third, the time between groups' interactions must be short (Beck 1999). The rule of thumb is to show prototypes when their complexity is not too high, so that the users can relate to the changes and give constructive comments, but yet not so often that the variation becomes trivial (Carugati 2004). As mentioned above prototypes should show real differences and common ground. Proponents of agile methodologies suggest to present software prototypes every three to four weeks (Beck 1999, Fowler 2002).

Fourth, the content and deliverables of each iteration must be planned in advance (Beck 1999). Boundary objects must always represent the latest work of the developers in order to avoid the problem with invested knowledge. Failing to plan the content of the iteration in advance will cause the developers to continue working on their ideas creating increasingly larger systems and to present an obsolete prototype that will create the illusion of being a boundary object but that in reality creates a knowledge barrier (Carlile 2002).

Finally, if the software is implemented, the users have the opportunity to use it for regular work and perhaps request additional features or modifications at the following meetings. In fact, the users' environment is dynamic and therefore users' expectations are likely to change between steps.

Figure 2 (inspired from Remenyi et al. 1997) presents an example that shows the evolution of the perceived goals of the developers of an ideal ISD project. The goals for the ISD project emerging from the developers-users interactions are represented in the figure by the changing oval shapes; these goals

represent the embodiment of the current state of knowledge of the developers and users. At the beginning of the first iteration the developers have an initial understanding of goals and objectives and they proceed to develop the first prototype (the squares in the figure). When the users operate the prototype, critics, and debate new functions, both groups achieve a new understanding of the goals. They realize that a part of the first prototype was out of scope because now they have reached a new understanding of what is needed and other parts of the prototype were developed with errors. In the second iteration, the developers proceed to develop the second prototype and correct the first, represented by the area of overlap of the squares marked with 1 and 2. In the following presentation the situation is repeated. Parts of the second prototype are found to be out of scope and other parts have to be corrected. The process continues in this fashion until the work done satisfies all the emerged goals and objectives (in figure 2 this is shown by the squares progressively covering the oval shape). Obviously the shape of goals and objectives does not only change because the software prototypes help the users to understand what they want from the IS, but they can also change because something in the environment has changed.

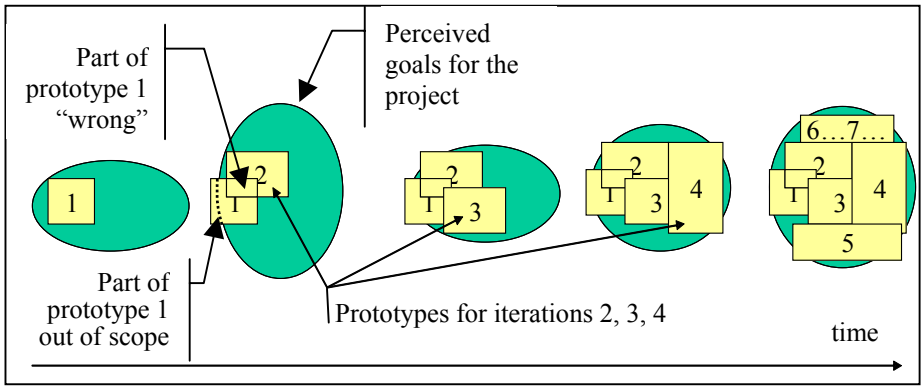

Figure 2. Evolving goals and development efforts

3 TWO ISD EXAMPLES

This article is intended to present a theoretical discussion nonetheless it seems appropriate to present observations from two ISD projects that highlight the effects of explicitly using and not using the ideas about boundary objects.

The first example comes from a project where I was participant observer from 2000 to 2003 where a team was developing software for scheduling and control for a shipyard. The project had two characteristics that made it interesting for being a good example for the argumentations presented in this paper. The first characteristic was that the IS under development was based on a very advanced mathematical technique whose properties in terms of both needs and performances were new to the users. The second characteristic was that the development team was external to the users' company, and the developers were also working from distributed locations. Both characteristics point out that the problem of knowledge creation and exchange was not only relevant but key to the success of the project. The first characteristic made it important for the users to learn about the mathematical technique in order to be able to specify the requirements, the second made it important for the developers to learn from each other about their work. However the learning factor was not considered as important in this case-example where the focus was, as traditionally, on the final product and the software producing activities.

During the development project the development team held three demonstrations of the software at the 16th, 19th, and 21st month of the project. The goals with the demonstrations were multiple. First, it was

a way for the developers to show that there was progress. Second, users could control the correctness of the software. Third, new requirements could eventually be specified. The goals for the demonstrations were in fact to obtain new knowledge but they were not however done in a guise that would have favored the mutual understanding of knowledge in practice. Rather the testing was organized more like a presentation where the developers used the software, a software highly simplified respect to the reality of the users, and showed the results to the users. Not knowing exactly what they were observing the users were not able to sustain the debate required to bring knowledge forward in a pragmatic inquiry. The developers maintained firmly the lead of the discussion and none of the three objectives was achieved. There was apparently no knowledge creation that would bring the software closer to being successfully implemented at the users' site.

As a result, this software was never implemented. When, approaching the end of the project, I interviewed the users' project managers and asked them what they learned about the use of the mathematical technology they replied that their knowledge was still superficial. This answer shows that failure was not only in creating a product but also in creating the knowledge to approach similar problems in future cases with critical spirit. One observation that came out of this final interview was however that the shipyard had started a new project, internally this time, to re-create the planning software. Asked "why" they were pursuing an apparently failed idea the manager told me that that they had along the way learned that they idea was feasible and they believed in this solution: given enough time they had developed faith in this technology.

The second case comes from the implementation of a booking system for a hotel. The owner of the hotel asked a small software house to improve a booking application that the owner himself had created in Microsoft Excel to aid the booking process. The owner's application was extremely basic only proving price offers and the software house could with relatively little effort implement, maintaining Excel as base, few of additional features. The improved version contained reservations and customer databases, facility management, mailing functionalities, templates for communications with customers in multiple languages, and also integrated the accounting system. Since these functions were easy to implement, the developers included them in the first prototype even though it was more than the customer asked for. At the presentation of the first prototype, about one month after the project was commissioned, were present one developer, the owner of the hotel, one hotel employee, and the author. On my request the developer did not seat at the computer to demonstrate but let the employee operate the software. The owner was sitting just beside. I played the part of the client wanting to make a reservation. The employee moved relatively easily through the new application, at times asking the developer where to look for specific things, almost never asking what to do. Two or three times the employee and the owner engaged in conversations about how they could change their processes in the hotel now that the system was providing new functionalities. This generated discussions with the developers about few necessary changes and some extra functionalities. The developer interacted in the discussion while he was seeing the booking process on-going. By the end of a 30 minutes demonstration the developer had marked down two requests for changes and two requests for extra functionalities. One of these requests for changes he could manage to do on the spot also giving a live example to the users about the level of skills necessary to do these operations. The demonstration session enabled users and developers to appreciate first hand the application of knowledge in practice giving an opportunity to both parts to know the daily difficulties of the others.

The software has now undergone a second round of improvements and was already in use one week after the demonstration described here. The customer was happy of the fit between the application and his needs and the software house is now thinking to transform this into a generic application customizable for hotels of any sort.

4 ANALYSIS OF THE EXAMPLES

What did differ between the uses of software prototypes as boundary objects in the two cases? Both cases contained software demonstrations and both demonstrations had the same goals: checking the

correctness of the software and discussing new features. However the first project ended in failure and the second in success. In the first project knowledge was exchanged on a very limited base and in the second there were no problems in discussing new processes and extra features. The analysis can be divided in three topics: characteristics of the boundary objects, development process, and communicative genre of the demonstrations (Yates and Orlikowski, 2002).

Characteristics. The boundary object to function at the pragmatic level has to be visual, usable, up-to-date, and bidirectional. In the case of the shipyard the software was visual but it was too complex to use for the users. It was up-to-date but it contained simplifications with respect to the users' practices and changes in these simplifications were extremely difficult. The developers were therefore very defensive towards making changes to these simplifications. Finally the software had many features that worked as black boxes, for the users it was very difficult to know how things were working and since they could not understand and could not try the software they did not have a possibility to either learn or teach.

In the case of the hotel the software was visual and was based on a known platform, i.e. Excel. This made the software usable by the employee and understandable by the owner facilitating training-less use even though it was more complex than the previous application. The software was up-to-date and the developer was looking forward to new tasks therefore the users comments were taken with enthusiasm. The users immediately saw new possibilities in their business as well as the developer saw the possibility to make a generic product out of this specific case. Both parties were gaining from the newly acquired knowledge.

Process. In both cases it was used a semi-structured methodology were requirements were defined at the project beginning and than software was presented to the users for checking. However in the shipyard case it took 16 months to present the first prototype while in the hotel case it took one month. This partly reflects the difficulty of the shipyard case but also reflects different attitudes towards "perfection". In the shipyard case the demonstrations were continuously delayed to improve the software but the more the software was improved the more knowledge was invested in it and the more complex it became for the users to understand: *by becoming very good and complete the prototype also increased the knowledge barrier*. Furthermore the other two demonstrations, at months 19 and 21, did not show visual improvements only the performances were slightly different. The users at this point began to feel that they were loosing their time. In the case of the hotel the developer showed to the users what he defined: *the first half decent version*. A quick turnaround was seen as important to understand if the software was going in the right direction. Presenting something simple and with a lot of improvement was seen as a better solution to presenting something more complex and less performing, e.g. based on heavy use of visual basic.

Communicative genre. The characteristics of the prototypes made the formats very different. In the shipyard the software was not usable by non experts and therefore the developers had to use it. The software demonstrations turned into presentations where the developers showed and operated the system and presented slides with output performances. The users turned into audience, puzzled and wordless. They were powerless to interact with the developers that kept the lead of the presentation. For the hotel case instead the format was one of simulating a real working situation for the users. Everybody could enter into a role and carry it out till conclusion. There was no visible power difference between the individuals involved. Even the employee and the owner caught in the phase of discovery showed equal engagement in discussing new possibilities for their work. The idea that debate around boundary objects enhances their function is supported by Churchman's (1971) notion of the Singerian inquiring system where debate acts as a mediator for knowledge exchange between people that keep a localized and practically relevant version of the truth.

The shipyard example provides also ground for extending the concept of boundary object from the rather well defined software prototype to a much broader idea that actions over time can act as boundary bridges as well. The fact that over time the users came to believe that the solution was good, they used it as inspiration and set off to develop it themselves indicates that some form of learning

took place. In fact the comment "we came to believe in the solution" indicates that the project itself acted as boundary object. In this case usability, visibility, bi-directionality, and novelty cannot be seen as specific characteristics but as diffused concepts. Project participants worked on the project hence put their knowledge into practice. While the product became slowly visible it highlighted passion, interests, professionalism of the people involved. Bi-directionality and novelty became clear ex-post and finally triggered the decision to re-exhume the project.

This final observation shows that, with knowledge as priority, projects can be used to decrease knowledge barriers. In very complex settings one could even plan a project for failure if new knowledge is retained.

However this final observation also opens up for at least two pungent questions. What objects can act as boundary bridges and what are their characteristics? How do we know that in any specific case we are using the right boundary object? In order to aid practice the basic considerations on boundary objects presented in this paper have to be further investigated.

The other question regards the identification of the type of knowledge barrier to be passed. Barrier crossing requires specific tools to be used and action to be taken. E.g. as said above at the pragmatic level boundary object would be the tool of choice and emergent ISD methodology would be a suitable action. However how do we know that we have to exchange knowledge at the pragmatic level? Iterative and prototype based development requires funds, time and culture that are rarely available in practical settings and therefore it becomes paramount to be able to identify the level of boundary crossing required and being able to identify when enough knowledge has been cumulated to move down the levels and engage in "cheaper" methodologies of the waterfall type. More research in contextual and dynamic approaches is therefore needed not to propose boundary objects and emergent methodologies as a panacea but to be able to identify the level of knowledge boundary, select the appropriate course of action, and adapt as time goes by.

In conclusion to overcome knowledge boundaries at the pragmatic level it is necessary to make software prototypes with the characteristics of boundary objects embedded in a process and be part of a format that allows knowledge barriers to fall. While this conclusion further justifies the recent interest for agile and emergent methodologies (Fowler 2002; Beck 1999; Truex, Baskerville, and Klein 1999) also attention has to be given to the context and its evolution. The case showed that a project can act as boundary objects and that therefore particular cultures and situation might organize projects planning for failure in order to learn.

The results of this article add to previous theoretical results bringing together the established tradition about software prototypes with theory about knowledge boundaries, development processes and communicative genres and hence providing new insights in creating and using prototypes and gauging their effectiveness.

5 SUMMARY AND CONCLUSIONS

In the development of proprietary software knowledge exchange proves to be a critical element to accomplish the project successfully. Boundary objects have received attention lately as means to facilitate knowledge transfer across practices. Therefore boundary objects have been presented as particular instances of software prototypes to bridge the knowledge boundaries in the practices of developers and users of IS. Boundary objects are IT artifacts that are visual, functional, up-to-date and bidirectional. Boundary objects can enable passage of knowledge across very complex boundaries where the knowledge needed by different groups is highly interdependent and highly embedded and localized into everyday practices. Examples have complemented a theoretical presentation where it has been shown that not all prototypes act as boundary objects but that the degree at which boundaries are bridged does not only come from the characteristics of the boundary object itself but also on the process used and on the communicative genre adopted. Besides presenting the above mentioned characteristics, boundary objects have to be embedded in highly reactive processes and be the focus of

debate not the topic of presentations that only strengthen the power of the presenters on the audience. The examples also showed that projects, bringing people together over longer periods of time, act as boundary objects and are therefore one possible way to bridge knowledge boundaries in particularly extreme cases.

Including boundary objects in ISD methodologies presents therefore both advantages and disadvantages and their use or even identification is not as straightforward as it might seem. The identification of projects as boundary object raises more questions for research in terms of objects research and contextual approaches to understand knowledge boundaries and the relative course of action to be taken.

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FROM FORMALISED DEVELOPMENT METHODS TO "METHODS IN ACTION": THE CASE OF 1CITY.BIZ MARKETPLACE

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Abstract

This paper provides a theoretical framework to analyse the complexity of Information Systems Development and the use of methods in practice, versus formalised methods discussed in the literature. The developed model is then discussed in its application to the real development case of Unicredito marketplace. This framework has been created on the basis of a thorough analysis of the literature of Information Systems Development (ISD) and includes the results of detailed empirical research (see, for example, Fitzgerald, 1994; Fitzgerald, 1997; Fitzgerald, 1998; Fitzgerald & O'Kane, 1999; Fitzgerald, Russo & O'Kane, 2002; Russo & Wynekoop, 2000; Russo, Wynekoop & Walz, 1995; Stolterman, 1991; Stolterman, 1992).

This research was carried out in Europe and in the United States and offers an overview of ISD in several contexts, based on a detailed investigation, lengthy interviews and the study of specific cases relating to companies that operate in a variety of industrial sectors such as: banks, software houses, pharmaceutical multinationals, food processing companies, public utility companies, telecommunication companies and governmental offices.

1 A FRAMEWORK FOR ISD METHOD USAGE

At present, there is no generally accepted framework that explains ISD method usage, despite lengthy empirical and theoretical research into this subject. This situation is even more concerning if we consider the high number of existing methods, estimated in the order of hundreds (Longworth, 1985; Avison & Fitzgerald, 1995) or even thousands (Jayaratna, 1994). It should be noted that some methods are very similar, whereas others are based on radically different – or even opposite - paradigms and scope of action. Therefore, there are different types of method that range from highly formalised ones, mainly focusing on techniques, to methods that are more easily adaptable to contingencies and are oriented to people's activities and to the needs of the organisation.

Methods found in the literature also greatly differ according to their scope of action: some of them intentionally ignore preliminary analytical stages, whereas others neglect subsequent implementation activities.

A thorough analysis of ISD literature in combination with empirical research have allowed us to build the framework depicted in Fig. 1 whose components will be briefly discussed in this paper.

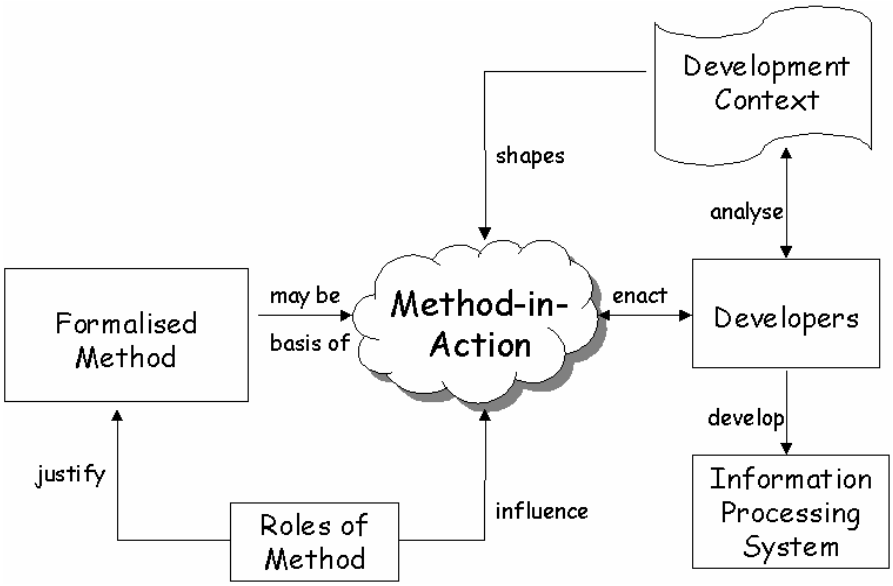

Fig. 1 – A framework for Information Systems Development method (adapted to marketplace)

2 FRAMEWORK DEFINITION

2.1 Formalised Methods

The expression "formalised methods" ('formalism' is the doctrine that frames reality into prescribed or external forms to which a key value has been added) traditionally indicates one of the pillars of Information Systems Development research, that is formally documented integrated methods and commercially available methods which include: Information Engineering, Structures System Analysis

and Design Method (SSADM), Structures Approach, Soft Systems Method (SSM), Multiview, Dynamic Systems Development Method (DSDM)).

Formalised methods are sometimes software tools like, for example, CASEs (Computer Assisted Software Engineering), or application development contexts.

2.2 "Methods-in-action"

In the current development practice, formalised methods are seldom followed in all their steps and they are often changed, so that they differ from their original form, although they provide a useful model to implement development practice. This concept is depicted in the framework shown in Fig. 1 by the dotted line: when a "method-in-action" is used, the formalised method can be a starting point, although this is not essential.

The distinction between the original formalised method and the "method-in-action" resembles the difference described by Argyris & Schon (1974) between "espoused theory" and "theory-in-use". Methods are never applied exactly as they have been originally conceived: a method will always be interpreted and applied differently by different developers; moreover, the same developer will apply the same method differently in different development contexts. In every development project, the developer contributes to shape the "method-in-action" (see cloud-shaped picture in Fig. 1)

In the following sections, we will examine how the "method-in-action" is shaped by the development framework and affected by the roles of method.

2.3 Roles of Method

The roles of method, which are a fundamental component of the framework, can be divided into two large, opposite categories within the development process: *rational roles and political roles.*

Rational roles belong to the conceptual and logical foundations of method usage because:

- they help understand ISD by subdividing a very complex process into simple and consistent steps; they facilitate project management and development process control by making them visible and transparent, thereby reducing risks and uncertainties;
- they form a framework in which techniques (feasibility studies, criticism by steering committees, etc.) can be applied and represent a resource to be used at the suitable time, during the development process. They also play an economic role, because they allow for competence specialisation and division of tasks within the development process (for example analysis, design, encoding and testing); the division into different activities and remuneration allows for substantial economic saving.
- methods also provide a structural framework for knowledge acquisition: past experiences can be captured into a systematic structure and kept as future reference;
- they help standardise the development process, thus facilitating interchangeability between developers; moreover, they can increase productivity and quality in that they allow for greater precision in planning resources needed for development, since such resources can be made available when and where needed.

Our empirical research has identified *political roles* of methods as well.

For example, ISD methods play the role of "comfort factors" since they reassure on the correctness of the procedure followed or they confirm that development decisions have been made on a systematic basis. Methods can be "legitimising factors", when organisations say they use them to win contracts with governmental bodies or to receive the ISO certification; they can also be used to keep track of the evolution process and as a safeguard if ISD decisions should prove wrong in the future; to conclude, they "render development work professional", thereby preventing developers from accepting unreasonable deadlines or requests from users.

A further political role played by methods is that they give a "power basis" to those who use a given method to improve their position within a given organisation.

2.4 Development Scope

The framework takes into consideration the dynamic and complex nature of the economic area where development takes place: the irregular shape in Fig. 1 aims to depict the fact that this real and unique field cannot always be easily analysed to obtain a clear and full picture of user requests.

This problem is one of the critical aspects of purely technical approaches to system development: McMenamin & Palmer (1984, page 77) believe that "*description should contain all real requests, and real requests only*"; this statement stresses the essence of final users' expectations and highlights the complexity of the challenge that analysts and developers face. Most researchers have concluded, however, that identification of "real requirements" might not be concretely possible (Stage, 1991) and that limits might be set from a social and ethical point of view to what is admissible to know (Jones e Walsham, 1992).

Although different development contexts bear some resemblance, the framework is always one: the specific situation where development is performed and the system will be applied creates unique requirements that are critical for the development process itself. Awareness of this unique situation is the precondition for successful development of Information Systems.

Formalised methods usually indicate how to deal with development situations in a methodical way, regardless of the type of framework. We do not agree with this theory. We believe that some characteristics of the development framework can shape and influence the "*method-in-action*", as indicated by the arrow in Fig. 11. For example, the current acceleration of evolution in the economic sphere of organisations is felt throughout contemporary research – "*currently there is a quicker business metabolism*" said Rockart and De Long (1988). This background forces organisations to act more effectively and more rapidly by tailoring formalised methods, that are typically oriented to large-scale development and longer evolution periods.

This picture of continual changes that organisations are forced to face is dominated by contingencies relating to short-term needs: the advantages of formalised method development are therefore decreasing and developers who cannot afford to follow patiently and thoroughly a formalised method risk causing a forced and inevitable interruption of certain steps of the development process; all this contributes to shape the "*method-in-action*".

The well-documented phenomenon of backlog linked to the development of Information Systems in organisations takes two shapes:

- visible backlog
- invisible backlog.

The visible backlog relates to systems that are formally requested and programmed for future development; however, many users are scared by the size of visible backlog and therefore do not expressly request the systems they would really need, thereby creating an invisible backlog that, according to estimates, is three times higher than the visible one. According to estimates, system development productivity should be 10 times higher to meet the current demand for ISD.

Many organisations see this problem as a conflict between productivity and rigour: while rigour could be obtained by strictly adhering to the stages of a formalised method, the need for higher productivity shapes the "method-in-action" (more flexible and productive).

In recent times, the software industry has been deeply restructured: companies rely less and less on in-house system development and follow alternative strategies, such as buying software packages or contracting out system development.

This change in the development profile has persuaded users to build their Information Systems starting from multiple packages, integrated by dedicated software that fulfils their specific needs. This change has also contributed to shape the "method-in-action" since most formalised methods do not fit into this mode of development.

2.5 Developers

Developers are another element of the framework. The term "developer" is used here with a wider meaning than the word programmer and includes the series of stakeholders who are involved in the development process: system users, analysts, designers, programmers, clients and problem owners.

The developer does play a fundamental role within the framework because people – and not methods – build systems. Methods are just tools and contexts that "come into life" through the knowledge of developers and thereupon become effective. The ingenuity and ability of the developer cannot be completely ignored by formalised methods, although these methods do not take into consideration different skill levels possessed by different developers: for example, one of the main goals of the Jackson Systems Development (JSD) method is to eliminate personal creativity from the development process.

Different research fields in literature have confirmed the importance of developer-embodied factors: the importance of differences in skills between individual developers and their subsequent impact on development productivity has long been acknowledged (Brooks, 1987; Peters & Tripp, 1977).

Learning over time is also very important to allow developers to improve their competence and skills; this can be seen, in particular, against the background of application problems or in the economic domain.

These fundamental factors must be taken into consideration in the framework to the extent to which the developer analyses the development context and individually applies the "method-in-action" to develop a real system. Here is the explanation of how the developed framework has been applied to the case of UniCredito marketplace development, 1city.biz.

3 FORMALISED METHOD AND METHOD-IN-ACTION: THE 1CITY.BIZ CASE

The 1city.biz marketplace was developed by i-Faber, a company of the UniCredito banking group, in collaboration with Erg Petroli, Gruppo Impresilo and Oracle.

Interviews were made in collaboration with the project manager of ERP and CRM for the Italian market and with the person in charge of business models for Oracle; first of all, they explained to us the formalised method followed by Oracle, then they gave us the necessary elements to understand the "method-in-action".

The reference formalised method for marketplace development followed by Oracle is AIM (Application Implementation Method). After several years of international experience, the company has defined this method, but it has also become fully aware that the formalised method does not have to be followed strictly, but modelled and tailored to the situation in hand.

3.1 The Formalised Method

For ERP projects, which also include marketplaces, Oracle created a complete method to accelerate the implementation process and ensure its accuracy.

The Application Implementation Method (AIM) can tailor the project to the specific requirements of each organisation: starting from mission and strategy definition up to the new system release. The

AIM contains all the crucial steps for the development project, necessary to minimise risks and ensure fast and high quality implementation.

The fundamental features of AIM stages include both quality check points and tools to co-ordinate all relevant project activities. Each step is characterised by specific deliverables.

We will provide a short description of each step.

Definition

At this stage, the workgroup (or project group) plans the implementation project and creates the infrastructures needed to support necessary activities.

The workgroup defines the steps to be followed in order to lead the project to application implementation: the Project Manager and the Project Group work together to define a suitable work plan.

In order to plan the project, the group reviews the business goals of the organisation and examines the possibility to fulfil such objectives within a given set of deadlines, resources and budget constraints.

During Definition, the Project Group also develops goals, approaches, and architectural, conversion and performance assessment strategies. To achieve clear and easy understanding of current business operations and future processes, the group also creates process and consolidation models.

The following goals are pursued:

- identifying business and system requirements;
- proposing a business model for the future;
- determining the technological architecture of both application and information.

Collected information is used as input to support “downstream” activities during the Solution Design stage.

The group reviews economic, operational, technical, and administrative processes so that detailed business requirements are fully understood and agreed upon.

Operations Analysis

During the Operations Analysis stage, the project group collects technical and management information and requirements relating to the business process of the final user.

The group develops a model for each business process and assesses to which extent it can be tailored to applications. The analysis provides a plan to conduct business operations according to a technical and application architecture.

The project group creates a model for the application structure and proposes an overall technical architecture. The model suggests how business and integration requirements can be tailored to the application architecture.

The technical architecture suggests the use of high level hardware, software and communications to support the future business system.

Solutions may require changes (or customisations) with reference to modules, reports and programmes. Such changes are documented by a general description of required features and an assessment of each customisation.

The project group reviews the assessments and accepts the customisation approach before detailed design can start.

Besides creating models for the new business system, the performance assessment group creates models to test the new performance characteristics of the system. Performance assessment models usually focus on critical points of the system and on key business functions and transactions.

To conclude, the project group develops a transition strategy to lead the company from the current way to do business to the future one: the plan lists all business areas that need preparation and provides a general approach so that change can take place.

Solution Design

The goal of Solution Design is to adopt the best solution for the business process, in order to meet future business requirements.

Unlike the other stages, the Solution Design is based on a technical approach to design customised modules and create support applications and the technical architecture.

During Solution Design, project group members prepare detailed descriptions of process solutions, obtained by mapping application tools to business requirements during the Operation Analysis. First of all, business solution design takes the standard application tools into consideration.

In order to support to business requirements, sometimes applications wider than standard tools must be created. The project group might have already defined different alternative solutions during Operation Analysis. The project group carefully examines these solutions and chooses the best alternative, based on functionality, maintenance, benefits and developments costs.

In order to design a real business solution, the project group must make sure that planned work flows can be followed and measured at function and task levels. During solution planning, the project group evaluates organisational changes, process growth and reengineering initiatives, to the extent to which they do not exceed defined tasks.

While proposed solutions are completed, technical and application architectures begin to take shape as well: the technical staff design a technical architecture that fully supports the standard configuration of the application and the solutions suitable to the client, that takes future company architectural needs into account. The technical staff also design the context and the detailed schedules for performance checks and test execution.

As soon as solutions for business requirements are developed, the group will start developing the basis for operation and user documentation. Documentation will be reviewed during the project development period.

Business process design is an iterative process. Tasks relating to both Operations Analysis and Solution Design shall be jointly performed by a design group. For example, the creation of a business process model, the elaboration of requirements from the model itself, the representation of applications, gap and workaround documentation and recording of proposed applications are all assessed as interrelated operations by the planning and recording group.

Build

During the Build stage, the development group encodes and assesses all clients' enlargements, including enhancements, conversions and interfaces. Business system testing is used to validate solutions found during Solution Design.

Even though customisations, enlargements or conversions are found to be unnecessary, the Build stage is important because it includes the business system final test, which is usually performed as formal conference room pilot. Business system tests are performed in a context that closely resembles the conditions envisaged during Production.

During the Build stage, developers produce programme modules that are tested individually. Integration, performance and tests on the business system are executed and the project group provides an operational solution that is verified at the end of the stage.

Transition

During Transition, the project group transfers all completed solutions inside the organisation. Transition is strictly connected to the Build stage with reference to solution, extensions, conversion programmes, documentation and fully tested training materials. At the end of the Transition stage, "live" data have already been converted and checked and users have started "live" production.

All implementation elements must contribute to reach the objective of real production. The project group trains final users, while the technical group configurates the production context and converts data. The Transition stage ends with production development, when final users begin to perform their tasks.

Transition is a demanding experience for the project group and in particular for final users who have to deal with two systems until production starts. Therefore management of changes and protection of the client's organisation from all negative consequences must be a priority with reference to the Client. Preparation and planning in advance facilitate the transition process.

Certification of the final system provides the written confirmation that the system fulfils business and project goals and objectives.

Production

The Production stage starts together with the development of the Transition stage. Production is the last stage of implementation and marks the beginning of the system support cycle. This final stage includes a series of fine-tuning and assessment steps. The Information System (IS) staff work to stabilise the system and to start regular maintenance. Assistance to the organisation is provided for the remainder of the system working life.

The Production stage guides all support activities for the production system and includes some specific post-production tasks. During Production, the project group assesses and checks if business is growing according to project goals, verifies real statistical techniques against the background of designed statistics and system performance against planned performance.

4 AIM "IN ACTION": 1CITY.BIZ MARKETPLACE

4.1 1city.biz Project Management

At the end of 1990s, in the atmosphere of euphoria generated by the emergence of the Internet, many digital marketplaces were created, most of which based on flimsy business models. This new business seemed easy to accomplish, but it soon proved to be highly selective and more complex than initially expected. Reality has proved that in order to accomplish a successful project, especially if the project is based on web technologies, a solid and economically valid business model must be adopted.

In the successful case we have analysed, 1city.biz, there are some features that render it unique in comparison to all the other marketplace cases that were developed over the same period. In fact, I-Faber chose to realise its project by following crucial preparation stages, without being influenced by the atmosphere of euphoria that was investing this domain and was leading to the emergence of new marketplaces at breath-taking speed.

Therefore, an efficient and successful Business Model was created for 1city.biz, although this led to a delayed launch on the market in comparison to competitors:

The Business Model

To enter into the digital marketplace business domain, whose main characteristic is transforming existing business, it is necessary to create a clearly defined business model that specifies: the people it targets, how it can attract clients, how it can be implemented from an economic point of view by suitably sizing investments. Definition of the business model must be suitable and rigorous and needs continual updates.

In the case of 1city.biz, UniCredito's starting point was its willingness to create a model to loyalise corporate clients, not the intention to create new business. Client involvement was crucial to shape a sustainable business model to fulfil the needs it was intended to support. Being a bank, UniCredito did not possess in-house the abilities necessary to design a chain model for the industrial domain and therefore it asked for its clients' help, who possessed the required skills. Direct dialogue with corporate clients proved to be a fundamental element for the success of the initiative: future users of the service created the guidelines themselves and helped UniCredito understand how negotiations should take place.

First of all, requirements of potential fields and markets were analysed, in order to use this data as a basis to build the marketplace. This analysis was carried out by the "key clients" of the bank and allowed for identification of profitable markets.

The business model that was created can be defined as "buyer-centric", because it is oriented to buyers' requests. However, the most serious problem emerged when suppliers were involved, because at first they were not willing to co-operate. The cultural impact was much stronger than expected since the idea of one-to-one relations was difficult to change.

The Technological Partner

In order to accomplish this project, UniCredito first identified a solid and reliable technological partner among possible alternatives available on the market. Oracle Consulting possessed these characteristics and therefore it was chosen to co-operate throughout the project accomplishment, by realising the technological infrastructure of the marketplace.

Gradualness

The project was developed gradually and continually supervised and updated through many check points planned to cover the whole period, from design to official launch. These decisions were made because Unicredito's goal was to launch a well-structured product on the market, simple to use and functional enough to attract and keep the highest number of clients.

Gradualness translated into the development of prototypes that were continually fine tuned and tested in co-operation with "key clients", who then became shareholders of the company established for this initiative.

From a methodological viewpoint 1city.biz was realised by Oracle Consulting that used AIM (see above) and took advantage of its flexibility and capacity to adapt to the market, the context and the specific type of interlocutor.

However, this methodology was heavily tailored to accomplish the marketplace, because necessarily product development had to take into account a series of fundamental variables that are typically related to this case. The variables that have affected the formalised method and changed it into "method-in-action" are the following:

- domain (the banking context differs from the manufacturing or public sector context);
- type of project (the implementation of a digital market differs from the development of a traditional ERP);
- nature of the company (the needs of a newco greatly differ from the needs of a multinational or a small-medium sized enterprise);
- characteristics of the interlocutor and, in particular, the involvement of the company at which the project is aimed.

Oracle sees this last variable as the crucial factor for success in project realisation. This is why Oracle pays great attention to the correct definition of the *project governance model*. This model must be defined before the project starts and must explain how the project is carried out and checked, by defining responsibilities and escalation levels through the creation of different levels of governance.

At the top level of governance we find a *steering committee* usually composed by:

- project sponsor
- top manager of the client company
- top manager of the supplier
- other people who may be involved (e.g.: the project manager).

The *steering committee* is a body that meets every 2/3 months and holds the highest level of representativeness. This committee has the highest decisional power and in the case of 1city.biz, it was composed by the managing director of I-Faber and by the purchase manager of UniCredito, in order to ensure maximum decisional speed. It monitors project evolution, ensures sponsorship of the initiative, settles disputes (if any) that cannot be solved at a lower level, and makes strategic decisions.

Operational governance, instead, was managed by an *operational committee*, that meets every two weeks. Its main objective is to control and manage special situations and solve problems that cannot be dealt with at project level. It is composed by the project manager of the client company, the project manager of the supplier and sometimes by the sponsor and other people involved.

The management of project standard operationality is the last, but maybe the most important element of overall governance: the project must have a controlled structure, in which each individual knows well his role and, in particular, his responsibilities. Therefore, a precisely defined functional personnel organisation chart is crucial to clarify information and decision flows.

Once decision-making bodies, roles and operational responsibilities are defined, the project is partitioned, taking into consideration the specific elements of each area.

Oracle appoints a project manager (PM), that is someone with wide decisional power and recognised authority within the company: he is the person in charge of the project, continually checks intermediate results and makes sure that resources allocated by the client and made available to functional managers possess the features necessary for the project to proceed well.

If it is a large-scale project, like in this case, the PM is entirely devoted to it and his staff include a project officer (PO) who manages the administrative activities of the project, that is: planning meetings, managing logistical aspects and fulfilling administrative tasks.

There are then several team leaders (TL) - who hierarchically depend on the project manager and have functional autonomy – according to the different elements the project was partitioned into.

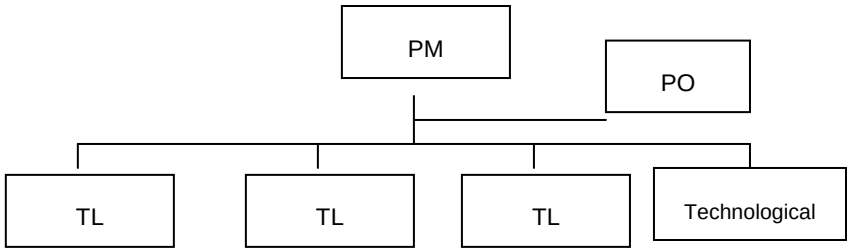

Fig. 2 – Project manager and team leaders: the operational level

From the client's side (1city.biz) a Client Project Manager must be appointed; he plays a key role in Workgroup activities and in subsequent project success: he must receive wide decisional powers from the top management of the client company. Indeed, it is the client PM client who must possess the authority to have functional managers allocate suitable resources: the functional manager believes that it is an investment to assign capable and precious resources to a project that does not involve him directly, therefore the PM must have the necessary authority and authoritativeness to have functional managers allocate their best resources to the project. This is a crucial stage, when the actual level of client commitment and willingness becomes apparent and, consequently, forecasts can be made on how the project should be managed. In collaboration with functional managers, the client PM client identifies Key Users who will have contacts and work closely with Team Leaders.

The crucial element for the success of the whole project is the interaction between Team Leaders and Key Users. Indeed, mutual co-operation allows for solution planning and design for the specific functions into which the project was partitioned. It is therefore evident that the Key User must be a first-rate resource and:

- must know the company very well,
- must be open minded and able to understand potential capabilities of the new system,
- must have the power to make all the decisions required by his function.

IT functions are something different, because they often represent a strong conservative component; in fact, the IT function within the client company tends to resist changes. In this case, as well, it is crucial to understand the importance of the project and also extend commitment to functions that might feel damaged, or at least deprived of part of their authority.

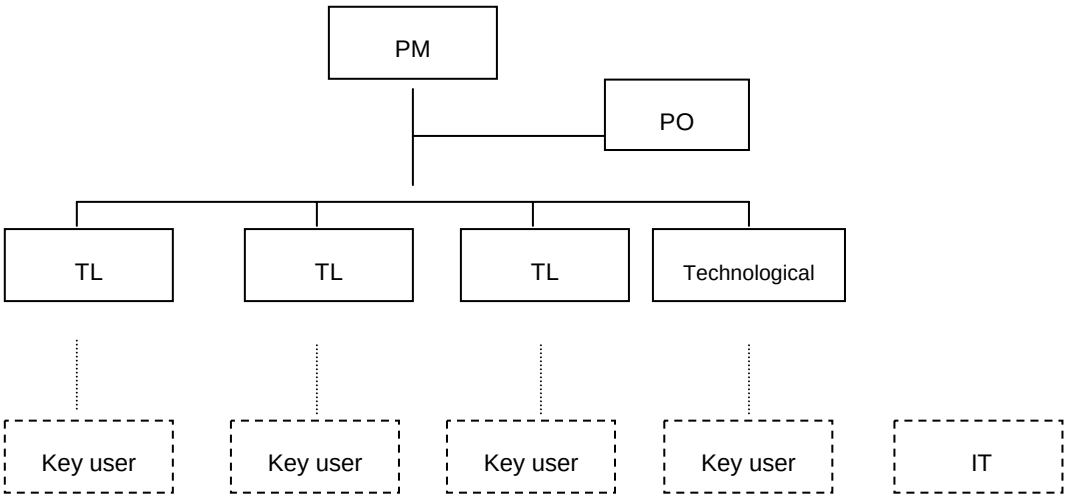

Fig. 3 – Project manager e team leaders: il livello operative e la relazione con il cliente

4.2 1city.biz Accomplishment

In the 1city.biz case, we chose a horizontal marketplace model, to attract a wide community that would allow for satisfactory economic results, and we decided to start the vertical process only in markets characterised by the presence of big-size influential customers able to influence the market (for example ERG in the oil market and Gruppo Impregilo in the construction, engineering and building market).

From the operational viewpoint, given the Business Model, IT fulfilment ensured:
- a scalable and reliable infrastructure
- an application architecture suitable to support this business.

The "Method-in-action"

At the beginning of the Definition stage, a Project Management Plan was prepared, that is a document that defines goals, the Work Group, realisation steps and method used. In the 1city.biz case, as already stated, AIM methodology was adapted because the business type allowed for an "evolution type" methodology: the starting point was the "Exchange" technological platform built by Oracle for marketplaces (and already widely tested by many customers at international level as well), then subsequent functionalities were implemented and a portal was built to offer all services required from time to time. Then following extensions were adopted.

The methodology was adapted to include the following steps:
- bid pilot
- bid extension
- catalogue purchase pilot
- final market goLive

Each step maintains the characteristics illustrated in AIM, where a fundamental role is played by the following steps:
- requirement analysis

- solution design
- test case design for final testing
- execution of the final testing

In order to execute final tests in a prototype stage and before reaching the production and market launch stages, it is indispensable to suitably calibrate the system. UniCredito's commitment was fundamental in this stage as well, because it succeeded in involving some of its major corporate customers in the system test and alignment before starting production.

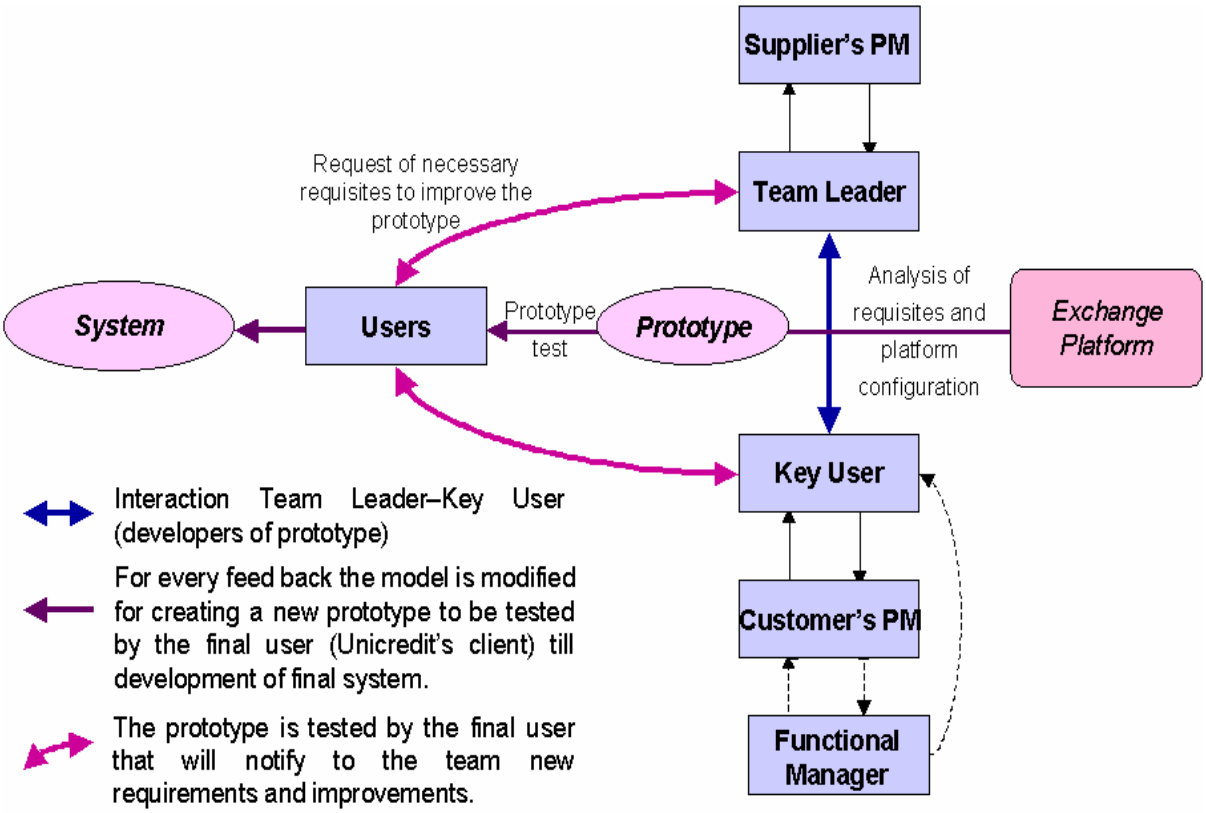

Fig. 4 – The "method in action" for 1city.biz development

5 CONCLUSIONS

In the 1city.biz project, Oracle's strength was its capacity to adapt a formalised and structured methodology (AIM) to a specific context, thus ensuring the maximum level of involvement on the part of its clients and the best reactivity and efficacy-efficiency of the Work Group.

Therefore, we can identify the factors that ensured success to the 1city.biz project.

Business Model

Client involvement was crucial for the creation of a sustainable business model able to fulfil the needs it had to support: Being a bank, UniCredito did not possess in-house the skills that were needed to

design a chain model for the industrial field and obtained those skills outside, from its clients. Direct relations with corporate clients proved to be a fundamental factor for the success of the initiative: in this way, the service user himself designed the flow and helped UniCredito understand how negotiations should take place.

Work Group Management

The Client Project Manager plays a key role in Work Group Management: he must be granted wide decisional powers from the top management of the client company. Indeed, it is the Client PM who must possess the authority to have functional managers allocate suitable resources to the project: the functional manager believes it is an investment to assign capable and precious resources to a project that does not involve him directly, therefore the PM must be have the necessary authority and authoritativeness to have functional managers allocate their best resources to the project. This is a crucial stage, when the actual level of client commitment and willingness becomes apparent and, consequently, forecasts can be made on where the project is heading. In collaboration with functional managers, the Client PM then identifies Key Users who will have contacts and work closely with Team Leaders.

In conclusion, we can safely say that, although the AIM method is formalised by definition, it can be activated or become "method-in-action" because Oracle sees it as an orderly set of formal and formalised guidelines, that can be adapted to each project depending on a series of variables such as context, field, size, and nature of the organisation.

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CONTEMPORARY BUSINESS MODEL CONCEPT AND OPEN SOURCE SOFTWARE

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Abstract

Open source software is becoming more common in the ICT-market, and some previous studies have already discussed the new business opportunities, identifying open source business models. The purpose of this paper is to examine the open source software from the perspective of contemporary business model concept. We begin the discussion with clarifying the concept of business model, its theoretical foundations and elements, based on the previous literature on business models. Then we look at one previous approach to software business models, which serves as the basis to analyse open source phenomenon. We continue with the nature of open source software and take a look at the previous studies made on open source business models. The paper is finished with a concluding part where we discuss contemporary business model concept in the context of open source business models.

1 INTRODUCTION

Open source software (OSS) is a growing force in the ICT-market, noticed also by the largest software companies (Berlecon Research 2002). However, there has been demand for research focusing on the economic effects and possibilities of OSS (Working Group of Libre Software 2000). Previous studies have discussed open source licensing as strategy in competition (Berlecon Research 2002), (West 2003), a tool to influence compatibility and standardisation issues and producing low-cost components (Berlecon Research 2002). On the other hand, one part has focused on explaining the new business opportunities, identifying open source business models (e.g. Hecker (2000), (Spiller and Wichmann 2002)).

The business models concept has developed from a simple explanation of the business idea to a powerful tool to describe, analyse and communicate a firm's business (e.g. Morris et al. (2004), (Osterwalder 2004)). Similarly, the open source business models have so far been quite simple descriptions of how to make money with open source. The purpose of this paper is to take a step further in understanding open source business models, using the contemporary business model concept. The research questions are:

- What are business models and what are they used for?
- Why business models could be used in open source software business?
- What are the aspects unique of open source software that should be considered when creating business models for open source software business?

We begin the discussion with clarifying the concept of business model, its theoretical foundations and elements, based on the previous literature on business models. This part forms the foundation for understanding how the business model concept could serve open source ventures. Then we look at one previous approach to software business models, which serves as the basis to analyse open source phenomenon. We continue with the nature of open source software and take a look at the earlier studies made on open source business models. The paper is finished with a concluding part where we discuss contemporary business model concept in the context of open source business models.

2 BUSINESS MODELS

2.1 The concept of business models

There is no generally accepted definition of the term "business model", but different definitions and emphasis. Magretta (2002) claims that terms *business model* and *strategy* are among the most sloppily used terms in business, and that they are often stretched to mean everything – and end up meaning nothing. The largest volume of business model research focuses on electronic commerce, the early research on this field focusing on revenue streams of web-based firms (Mahadevan 2000). This was evidently because it was often rather unclear how an e-commerce firm created value and/or how the firm would create revenue. Business model research addressed this problem.

In the most rudimentary level, a business model is just the firm's economic model, concerned with the logic of profit generation. At operational level, the model describes the architectural configuration of the firm, the focus being on internal processes and design of value creation infrastructure. Finally, at strategic level, the model represents the overall direction in the firm's market positioning, inter-organisational boundaries, and growth opportunities. Thus at this level the business model construct builds upon central ideas in business strategy and its associated theoretical traditions. These include value chain and value system concepts, resources-based theory, strategic network theory, cooperative strategies and theories of firm boundaries and transaction costs. (Morris et al. 2004.)

Morris et al. (2004) mention that issues of theory have received little attention within business model research. One explanation for this could be that, as Amit and Zott (2001) suggest, no single theory can fully explain the value creation potential of a venture. Instead, each entrepreneurship and strategic management theory offers an important insight, and business models try to unify these views.

According to Osterwalder and Pigneur (2002) a business model is the conceptual and architectural implementation (blueprint) of a business strategy and represents the foundation for the implementation of business processes and information systems (see Figure 1 – note that the rightmost part illustrates issues important mostly for e-Business models). Business models describe the logic of a "business system" for creating value that lies behind the actual models.

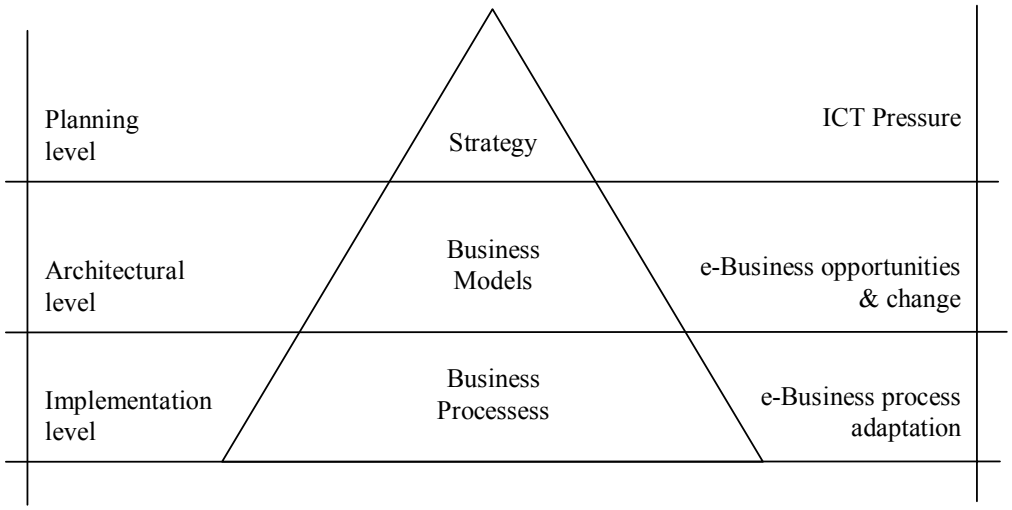

Figure 1 Business Logic Triangle (Osterwalder and Pigneur 2002)

Osterwalder and Pigneur (2002) used their business model construct to analyse e-Business. However, it is possible to exchange the word "e-Business" with the name of any other ICT-technology-driven field of business, and the above figure keeps its consistency.

2.2 The elements of a business model

The progress in the field has been hindered by lack of consensus over the key components of a model (Morris et al. 2004). One part of business model research has focused on creating taxonomies and describing archetypes (e.g. (Timmers 1998), (Hecker 2000)), while the other part has tried to create meta-models to aid in the development of firms' own business models (e.g. (Morris, Schindehutte et al. 2004), (Quadt, Laing et al. 2003), (Osterwalder and Pigneur 2002)).

According to (Timmers 1998), a business model consists of:

- An architecture for the product, service and information flows, including a description of the various business actors and their roles; and
- A description of the potential benefits for the various business actors; and
- A description of the sources of revenue.

However, Timmers mentions that a business model itself doesn't yet provide understanding of how to realise a business mission, but the business model needs to be patched with the marketing strategy of the business actor under consideration. Therefore beyond a business model there is also a "marketing model". Timmers states that the commercial viability of any business model is resolved by marketing model analysis.

Morris et al. (2004) attempted to create a standard framework for characterising a business model, one that is both generalised and also suitable for the use of an individual entrepreneur. They divided the framework in three distinct levels:

- Foundation level – generic decisions regarding the business, permits general comparison across ventures and the identification of universal models
- Proprietary level – enabling development of unique combinations among decision variables, customizable value creation tool
- Rules level – specific guidance for business operations in form of principles and rules

In each of these levels, it is necessary to answer to the following questions:

- Factors related to the offering - How do we create value?
- Market factors - Who do we create value for?
- Internal capability factors - What is our source of competence?
- Competitive strategy factors - How do we competitively position ourselves?
- Economic factors - How we make money?
- Personal/investor factors - What are our time, scope and size ambitions?

In this study we adopt this framework, since it provides a wide understanding of the business model concept. However, in the special context of software industry, we could also use a more precise lens. Rajala et al. (2001) wanted to provide companies and their shareholders with theoretical and practical assistance to understanding and proving their business models in the software industry. They describe the factors affecting software business models as following:

- Competing environment (Industry competition including environmental/infrastructural variables)
- Customers
- Resource environment
- Financing environment (including stakeholders' utilities)
- Corporate and business strategies
- Characteristics of the product or service offering

In the business model itself, they see the following elements:

- Product development approach
- Revenue logic (including revenue stream mechanisms, sales revenue model and a basic idea of pricing)
- Marketing and sales approach (including different sales channel options)
- Servicing and implementation approach (including the set of services and actors implementing them, e.g. physical distribution, implementation and maintenance of offering)

Figure 2 illustrates the generalized classification of software business model with the main elements, their interactions and factors influencing the business model.

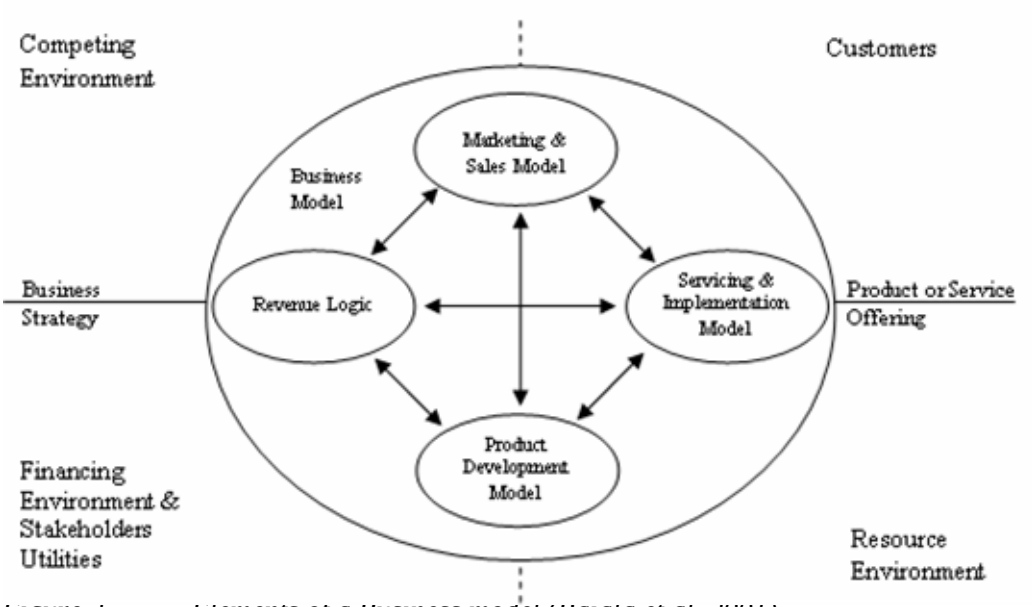

Figure 2 Elements of a Business model (Rajala et al. 2001)

The above model follows the general understanding of the elements and factors of a business model. More interesting are the alternatives for different elements that Rajala et al. used to classify the characteristics of different business models analysed in their study. These alternatives are briefly illustrated in Table 1.

Product Development The focus of product development:	**Project**	**Product Platform**	**Parameterized Product**	**Core Product**	**Product Family**
Revenue Logic The source of revenue and basic idea of pricing:	**Effort-based**	**Profit Sharing**	**Licensing**	**Loss Leader**	**Hybrid/Media**
Sales Channel The basic option for distribution and servicing	**Direct model**	**Reseller / Agent model**	**Republisher model**	**Retail outlet model**	**Distributor / Dealer model**
Sales Approach Basic target in sales contracts:	**Partnership**	**Problem-solving**	**Solution-oriented Consulting**	**Product-oriented Consulting**	**Product-oriented Selling**
Servicing Services included:	**IT Consulting**	**System Integrating**	**Outsourcing, ASP**	**Deployment support**	**Self-serving**
Implementation Main actors implementing services:	**Vendor**	**VAR**	**Distributor**	**Partner**	**Customer**

Table 1 A Combination of Options of Business Model Elements (adapted from Rajala et al. (2001)

In the following part we will discuss open source phenomenon taking in consideration these software industry specific elements.

3 OPEN SOURCE IN THE SOFTWARE BUSINESS

Open source software (OSS) is software fulfilling the terms of distribution given in the Open Source Definition (OSD) and adopting a license approved by the Open Source Initiative (OSI) (Open Source Initiative 2004). The terms are:

1. Free Redistribution. Anyone can redistribute, for free of for a fee by adding guarantee or maintenance services.
2. Availability of the source code: The program must include source code, and must allow distribution in source code as well as compiled form.
3. Derived Works: The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.
4. The license may impose the integrity of the author's source code: The license may restrict source-code from being distributed in modified form only if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time.
5. No discrimination against persons or groups: The license must not discriminate against any person or group of persons.
6. No discrimination against fields of endeavour: The license must not restrict anyone from making use of the program in a specific field of endeavour.
7. Distribution of License: The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.
8. The license must not be specific to a product: The rights attached to the program must not depend on the program's being part of a particular software distribution.
9. The license must not restrict other software: The license must not contaminate other software and cannot place restrictions on other software that is distributed along with the licensed software.

The real essence of OSS is hence in the licensing terms and not just the accessible source code, which is part of the qualities the licensing terms generate. The licensing terms do more: they allow the free use, redistribution and modification of the software. The copyright owner preserves the moral rights and some economic rights to the software, but transfers many important rights to the users and developers of the software, in order to enable the development of the software and to increase its adoption.

Open source software development is literally software development that produces OSS. This development is done in the open source community, a virtual community that consists of individuals and organisations developing and using the software. The active participation of the community is often considered one of the key characteristics of open source phenomenon (e.g. Raymond (2001), von Hippel and von Krogh (2003)), even though all open source projects do not take full advantage of this.

It is common to use terms such as open source development to describe a development method introduced and used widely by the open source community; often called also the bazaar development method or the Linux development method (e.g. Raymond (2001) Ljungberg (2000). The methods and tools vary from project to project, but several characteristics are common to many OSS projects. According to (Feller and Fitzgerald 2002), the generic OSS development process

- is parallel, rather than linear
- involves large communities of globally distributed developers
- utilises truly independent peer review
- provides prompt feedback to user and developer contributors
- includes the participation of highly talented, highly motivated developers
- includes increased levels of user involvement
- makes use of extremely rapid release schedules.

Even thought OSS projects share common characteristics, the development method is unique in every project. Indeed, some open source projects resemble traditional proprietary software development, while some proprietary projects embody many characteristics typical to open source development. It is

not proven that software being open source improves or weakens the quality of the software in any way (Fuggetta 2003). Open source software is also very heterogeneous if we consider the purpose of the software. After all, every kind of software can be licensed with an open source license.

There are even differences between the various open source licences. Perens (1999) identifies four key dimensions that distinguish OSS licenses. These dimensions are represented in Table 2, with some popular licenses.

License	Can be mixed with non-free software	Modifications can be taken private and not returned to author	Can be re-licensed by anyone	Contains special privileges for the original copyright holder over user's modifications
General Public License (GPL)	No	No	No	No
GNU Library General Purpose License	Yes	No	No	No
Berkeley System Distribution	Yes	Yes	No	No
Netscape Public License	Yes	Yes	No	Yes
Mozilla Public License	Yes	Yes	No	No
Public Domain	Yes	Yes	Yes	No

Table 2 Comparison of licensing practises (adapted from Perens (1999))

Deng, Seifert et al. (2003) discuss OSS as part of a non-OSS (proprietary) product. They introduce a categorization of projects based on different architecture types. They distinguish between "tight" and "loose" coupling of OSS and non-OSS components. The license of the OSS components affects this, since some of the license types do not allow mixing with non-OSS software.

In addition, Deng et al. distinguish the projects based on basis of the software products. Usually proprietary software development is based on OSS, and the proprietary part enhances its properties. But there are also projects where OSS development is based on proprietary software; such as OSS framework that requires a commercial database (Deng, Seifert et al. 2003).

These dimensions are illustrated in Figure 3

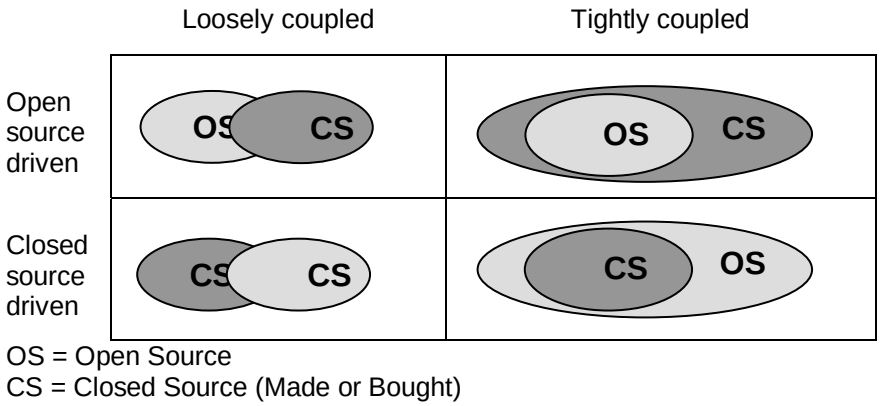

Figure 3 Project classes (adapted from (Deng, Seifert et al. 2003)).

3.1 Open source business models

One of the most critical issues for open source software business is that the licensing terms allow the free redistribution of the licensed software, i.e. the licenser doesn't necessarily gain any revenue of these copies of the software. Therefore it is usually not feasible to base the revenue logic on licensing fees. There is a demand for business models explaining the creation of value and revenue of firms' open source ventures.

Hecker (2000) discusses several business models potentially usable by companies creating or leveraging open-source software products. The models are presented in short in Table 3 below.

Name	Idea behind the model
Support Sellers	Revenue comes from media distribution, branding, training, consulting, custom development, and post-sales support instead of traditional software licensing fees.
Loss Leader	A no-charge open-source product is used as a loss leader for traditional commercial software.
Widget Frosting	For companies that are in business primarily to sell hardware but which use the open-source model for enabling software such as driver and interface code.
Accessorizing	For companies which distribute books, computer hardware and other physical items associated with and supportive of open-source software.
Service Enabler	Open-source software is created and distributed primarily to support access to revenue-generating on-line services.
Brand Licensing	A company charges other companies for the right to use its brand names and trademarks in creating derivative products.
Sell It, Free It	A company's software products start out their product life cycle as traditional commercial products and then are continually converted to open-source products when appropriate.

Software Franchising	A combination of several of the preceding models (in particular "Brand Licensing" and "Support Sellers") in which a company authorizes others to use its brand names and trademarks in creating associated organizations doing custom software development in particular geographic areas or vertical markets, and supplies franchises with training and related services in exchange for franchise fees of some sort.

Table 3 Open source business models (adapted from Hecker (2000))

A research done by Berlecon Research and financed by the European Commission studied also the basics of open source software markets and business models (Spiller and Wichmann 2002). Spiller & Wichmann use the IT market differentiation introduced by (Hock 2000) and presented here in Figure 4. The coloured area is the focus of their study. It is important to notice, however, that even if a company manufactures hardware products or offers services, the products/services of the company may contain software.

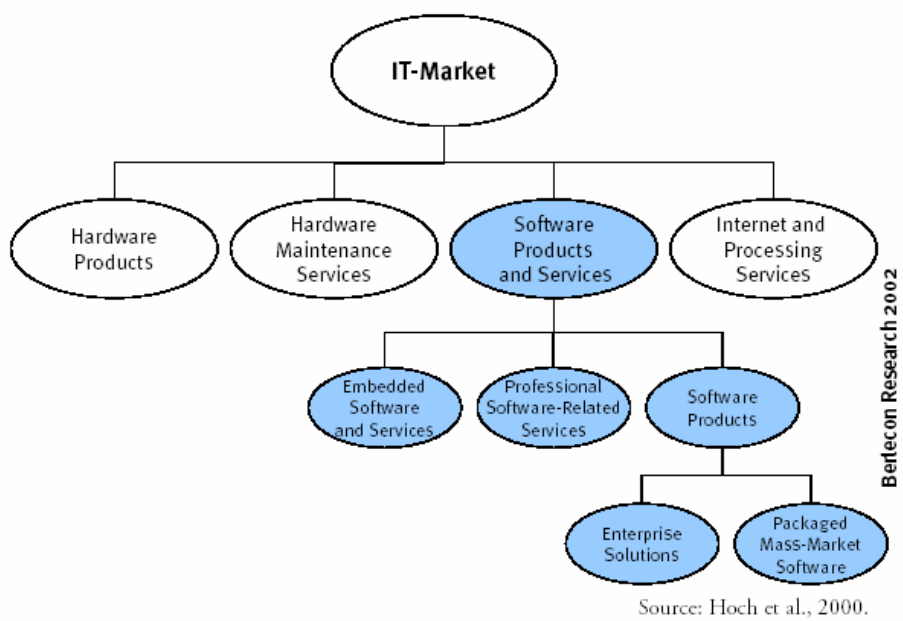

Figure 4 Structure of the IT market (Spiller and Wichmann 2002).

Spiller and Wichmann (2002) introduce a set of archetype business models based on OSS technology illustrated in Figure 5. These models are purely based on OSS, meaning that they would not exist without the OSS phenomenon.

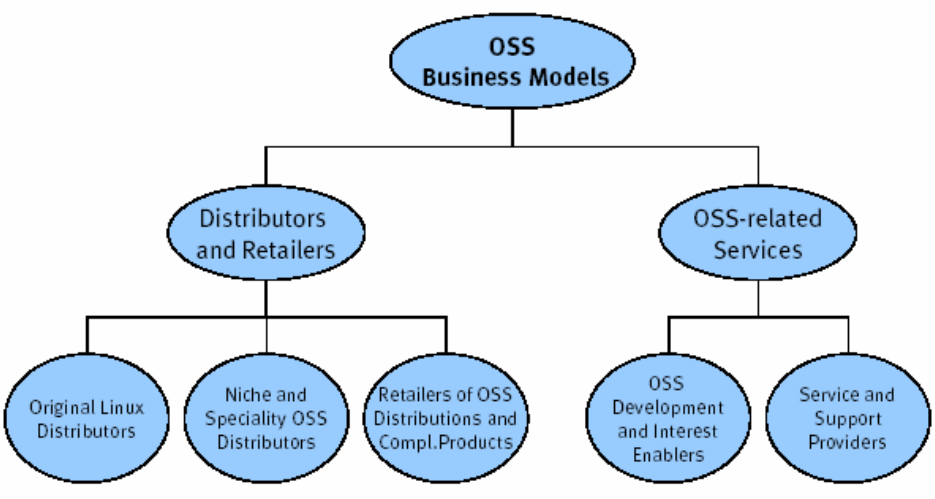

Figure 5 OSS business models (Spiller and Wichmann 2002)

Original Linux distributors package and sell their own version of Linux. To end users they sell software packages and bundles, to IT administrators they sell administration tools and to developers they sell development tools. A critical success factor is brand building.

Niche and specialty OSS distributors develop and distribute other OSS than operating systems. The company collects, maintains and develops OSS in symbiotic relationship with the community. The customers are normally not end users, but VARs (Value Added Resellers) or OEMs (Original Equipment manufacturers).

Retailers of OSS distributions and complementary products sell software products or provide and sell additional documentation etc. They do not develop OSS themselves, but focus on distribution and/or publishing.

OSS development and community enablers are either marketplaces that match potential buyers and sellers, helping the OSS community to work, or conference organisers, who provide opportunities for the OSS community and business partners to meet.

Companies offering OSS-related services and support offer their knowledge (either product or integration and service knowledge) to customers. These companies and their offerings vary greatly.

4 DISCUSSION AND CONCLUSIONS

A business model leans on enterprise strategy theory field when describing the logic of a value creating business system. Business models can be used to describe, analyse and communicate business ventures or create scenarios of novel business ideas. Software business using open source is no exception, and since open source ventures cannot base their revenue stream on licensing fees, there has been several studies identifying the ways to profit from open source software.

Based on previous sections, we can conclude that the key elements of any software business model are

- value creation and revenue logic
- market offerings and positioning
- product development, implementation and servicing

It is, however, challenging to identify the key aspects of open source phenomenon – those important in describing the business logic and feasibility of open source ventures. Open source software differs in many ways from traditional software, but OSS itself is also very heterogeneous. There is variation in licensing, software development style, community involvement etc. Success depends also of the

current state in the market. It is unclear what of combination of these elements creates a successful venture.

When discussing the business models involving open source software, we must take into consideration the following elements:

- The extent of the community involvement in development and review
- The style of development method (cathedral – bazaar continuum)
- The license type (strict – liberal continuum)
- The importance of OSS in the end product (pure OSS – OSS driven – proprietary software driven).

Hecker showed that open source can be used in many ways to generate revenue. A company can sell support, hardware, accessories, services or brand strength with open source software; or to fight against competition, or to share the development costs of software. The business models of Berlecon Research share the same characteristics, while the study analyses the realisation of the models taking into consideration of current market environment.

The business model archetypes created by Hecker and Berlecon Research are useful for creating ideas, but they lack preciseness in order to be used in concrete scenario-building or business analysis. In addition, open source business models should discuss the varying open source elements mentioned above, in order to attain feasibility. Licensing issues are especially important, since the license type can enable some business models obstruct other. Licensing is also closely connected to architectural choices.

The business model concept provides a valuable tool to analyse open source business, but there is still much work to be done in developing complete open source business models. Open source differs from traditional proprietary software in many ways, and these unique properties should be taken in consideration when designing and using open source business models.

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TRACK: INDUSTRIAL SYSTEMS

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RESEARCH PLAN "INTEGRATING INFORMATION SYSTEMS AFTER A MERGER"

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Abstract

This paper presents the research plan for my doctoral dissertation. The paper first presents the motivation for the study; stating that even though the post-merger integration of information systems seems to among the main explanations for merger failure/success together with the cultural integration, this topic seems to be somewhat neglected by the researchers.

Secondly, objective, research question and expected results of the dissertation are presented and discussed. The third chapter of this paper presents relevant theoretical background on post-merger integration, post-merger integration of the IS, and success of both. Fourthly, the methodological choice of using multiple case study and elite interviews to collect the empirical evidence is presented and discussed.

1 INTRODUCTION

1.1 Motivation For The Study

Post-merger integration is a gradual and interactive process in which the individuals from two or more organisations learn to co-operate in the transfer of strategic capabilities. The importance of the post-merger integration is derived from the fact that the value creation can only begin when the organisations begin to work towards the purpose of the acquisition. In other words, the integration is the source of value creation. Besides this, faulty integration is a significant cause for merger failures. (Habeck et al. 2000; Haspeslagh – Jemison 1991; Shrivastava 1986)

Research shows that the corporate culture and other "softer" organisational issues are among the main causes behind the success or failure of a merger situation, or at least some negative outcomes. On top of this, in comparison to the cultural issues, post-merger integration of the information systems (IS) is predicted to have an even more important role in determining whether the post-merger integration succeeds or fails. This seems to be applicable especially in cases where the business is IS intensive. Since the information systems are of utmost importance in the operation of (large) business, a merger or acquisition may not succeed if the information systems planning is inappropriate. Besides this, potential counter-synergies can be concealed in information systems. (I/S Analyzer 1989, 3; Franck 1990, 41)

The integration of the information systems in a post-merger situation faces contradictory pressures. For example, the information systems personnel are expected to reconcile the systems quickly (Stylianou et al. 1996, 204) but they are often excluded from the pre-merger negotiations and planning. Also, as different procedures and processes should be harmonised, cultural clashes – e.g. power struggles over whose system will be chosen – may arise.

Even though several authors recognise the importance and difficulty of IS in the post-merger integration (See e.g. Franck 1990; I/S Analyzer 1989), the academic literature on the post-merger integration of the IS has been claimed to remain scarce. (E.g. McKiernan - Merali 1995; Goodwin 1999; Cossey 1991; I/S Analyzer 1989)

All this makes post-merger integration of the information systems both a challenging task, and an interesting topic for academic studies.

2 OBJECTIVE, RESEARCH QUESTION AND EXPECTED RESULTS

The aim of the dissertation is to study how should post-merger integration (PMI) of the information systems (IS) be managed in order to succeed. Hence, the research question is:

RQ: How should post-merger integration of information systems be conducted in order to succeed?

In order to answer this question, it is necessary to answer the following sub-questions:

SQ1: How can success in IS integration be defined?

SQ2a: What factors affect the success of IS integration?

SQ2b: How do these factors interrelate to each other and the success of IS integration?

SQ3: What managerial interventions facilitate success in PMI of IS, and how?

Expected results of this study include in-depth understanding of the factors behind the success or failure of post-merger integration of the information systems. Based on this, a framework for post-

merger integration of the enterprise systems will be developed. Figure 1 shows a preliminary version of this framework.

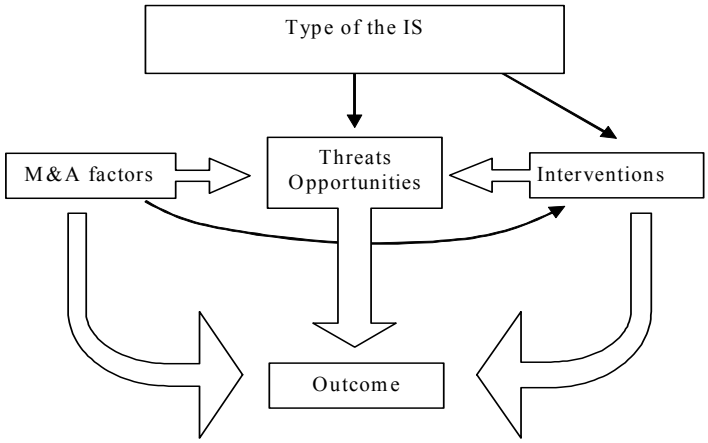

Figure 1. Framework for post-merger integration of the IS – a preliminary version

The determinants of success in post-merger integration stem from the change needs (M&A factors), type of the information system(s) to be integrated, the threats and opportunities caused my these two, and the managerial responses to the threats and opportunities. This framework can be modified to be used for post-merger integration of the IS staff, user and user cultures, and other related aspects.

The final version of this framework should have both explanatory (theoretical) value, as well as clear prescriptive (managerial) use.

3 THEORETICAL BACKGROUND

3.1 Post-Merger Integration

The depth of post-merger integration may vary from maintaining the status quo in both companies to annexation (or merger of equals), and the need for it is derived from the motives behind the merger. Motives such as increasing the overall size of the firm or deriving synergies in marketing require different degrees of integration. (Haspeslagh – Jemison 1991; Datta 1991; Shrivastava 1986)

With regard to the post-merger integration, the merger/acquisition has two central dimensions: the need for strategic interdependence, and the need for organisational autonomy. (Haspeslagh – Jemison 1991) The figure below combines these two in order to obtain the appropriate type of integration in each case.

		Need for Strategic Interdependence	
		Low	*High*
Need for Organisational Autonomy	*High*	Preservation	Symbiosis
	Low	[Holding]	Absorption

Figure 2. Types of acquisition integration approaches (Haspeslagh – Jemison 1991)

In the case of absorption, the need for organisational autonomy is low, and the need for strategic interdependence is high. In this case, integration tends to full consolidation of the operations, organisations and cultures. On the other hand, in preservation acquisitions, the need for organisational autonomy is high, and the need for strategic interdependence is low. In this case the acquired firm is left intact in order to avoid endangering success. The symbiotic acquisition brings along the most complex managerial challenges. The two companies first coexist and then gradually become increasingly mutually dependent. In order to succeed, both companies must take on the original qualities of each other. (Haspeslagh – Jemison 1991)

Other factors that affect the post-merger integration – and complicate it – include e.g.: the different motives behind the merger, the quality of the acquired company, the size of the merging companies, the diverse strategies used to acquire the firms, and complex technologies and production systems that need to be integrated after the merger. Besides these, the acquisition target is often selected on strategic or financial basis, and the issues of organisational and cultural fit are omitted. (Shrivastava 1996; McKiernan – Merali 1995; Haspeslagh – Jemison 1991)

The post-merger integration takes place at three levels. Shrivastava (1986) calls these *procedural, physical*, and *managerial/sociocultural*, whereas Birkinshaw et al. (2000) use the terms *task integration* and *human integration*. The following table defines the three levels of integration.

	Coordination	**Control**	**Conflict Resolution**
Procedural	Design accounting systems and procedures	Design management controlling systems	Eliminate contradictory rules and procedures Rationalise systems
Physical	Encourage sharing of resources	Measure and manage the sharing of resources	Resource allocations Asset redeployment
Managerial and sociocultural	Establish integrator roles Change organisation structure	Design compensation and reward systems Allocate authority and responsibility	Stabilise power sharing

Table 1. Post-merger integration tasks (Shrivastava 1986)

Procedural integration is the most basic integration. Its objective is to homogenise and standardise work procedures. It means combining systems and procedures of operating, management control, and strategic planning levels. This includes among others the legal and accounting integration, and e.g. integration of inventory control, MRP, sales analysis etc. (Shrivastava 1986).

Physical integration includes combining the product lines, production technologies, R&D projects, plant and equipment, and real estate assets. This is where the operational synergies are identified and realised. In addition to this, it is also the most time-consuming and laborious task. (Shrivastava 1986; Birkinshaw et al. 2000).

Birkinshaw et al. (2000) use the term human integration to describe the process of generating satisfaction, and ultimately shared identity among the employees from both companies. The literature also suggests other terms such as managerial and sociocultural integration referring to selection or transfer of managers, the changes in the organisational structure, the development of a consistent corporate culture, and establishing a new leadership. (Birkinshaw et al. 2000; Shrivastava 1986)

3.2 Success in Post-Merger Integration

Both explanations and indicators of merger success are varied, multifaceted, and debated over. The most commonly used indicators of success are: (1) stock prices, (2) financial performance, (3) evaluations of the managers of the companies involved in mergers and acquisitions and (4) synergy. In

addition to these, also other approaches are also used. For example, mergers and acquisitions are regarded as failures if they were later divested or liquidated, and in some studies the indicators of success appear implicitly in the case descriptions. Also, several studies use multiple indicators of success. (Vaara 1996)

As the general patterns in M&A activity have changed, the explanations for merger success or failure have evolved. In the great merger boom in the 1960s and early 1970s, most combinations were of conglomerate type. (Cartwright – Cooper 1995) Cartwright and Cooper state that the earlier merger research and speculation concluded that "*merger failure was largely attributable to factors such as: continued power struggles at the top, relative partner size, context (i.e. the degree of hostility surrounding the bid), post merger managerial exhaustion and apathy as a result of difficult and protracted negotiations and insensitivity towards grieving and anxious managers/employees.*" (Cartwright – Cooper 1995)

Vaara (1996) revises past studies on mergers and acquisitions success. His findings on traditional approaches are summarised in the table below.

	Traditional Approach
What is success in mergers and acquisitions?	–Success is a real phenomenon; some mergers and acquisitions are more successful than others; consequently, research concerning success of mergers and acquisitions is meaningful.
What are the indicators of success?	–Indicators of the objective reality, either explicit or implicit
How can success be measured?	–By determining the success of each case of mergers and acquisitions on the continuum of success-failure
How can success be explained?	–By discovering success factors that have an impact on the success of mergers and acquisitions
How can the research results be applied in practise?	–As more and more success factors are revealed, mergers and acquisitions can be managed in a better way; the research results can be applied more or less universally

Table 2. Approaches in the prior studies on merger success (Vaara 1996)

The M&As of the next wave in the 1980s and 1990s are more frequently of horizontal or related type, and involve partnerships between the organisations in the same business branch. These M&As tend to perform more successfully as they have more possibilities to transfer product knowledge and expertise, and offer more potential for achieving economies of scale. However, this also requires deeper and wider integration of people; their systems, procedures, practices and organisational cultures. Hence, the organisational culture becomes a noticeable factor affecting merger outcomes. (Cartwright – Cooper 1995).

The emergence of the "softer" or human side in the M&A research is apparent. In his review of prior research, Vaara found out that the explanations for success or failure in mergers had been: (1) strategic fit, (2) cultural fit, (3) the management of a merger or acquisition process, (4) employee resistance, and (5) other explanations, such as: environmental factors, management turnover, method of financing, relative sizes of the organisations, prior acquisition experience, pre-merger performance of the acquiree, and organisational age. (Vaara 1996)

Research shows that the corporate culture and other "softer" organisational issues are among the main causes behind the success or failure of a merger situation. Most people resist change, and cultural change is among the most difficult because culture provides the foundation for one's life. Because of this, attempts to implement organisational, procedural, and other merger-related changes are resisted or even "sabotaged". Besides these, high levels of layoffs bring along insecurity, anxiety and stress that corrupt moral and decrease productivity. Also the personnel that is most employable elsewhere –

and probably most wanted to stay – may leave the company. (e.g. Buono et al. 1985; McKiernan – Merali 1995; Franck 1990; I/S Analyzer 1989)

Other factors complicating the cultural integration are e.g. the fact that the culture is multifaceted and complex. Subcultures and countercultures are likely to exist, and hence for example the IS department may have a different culture than the rest of the organisation. (Chan – Land 1999; Buono et al. 1985).

However complicated and important the cultural factors, the strategic fit, financial leverage and tax loss tend to play a far greater role in the analysis of the potential advantages and disadvantages of the merger. (See e.g. McKiernan – Meral 1995; Franck 1990; Buono et al. 1985)

Besides the explanations above, several recent studies have presented multifaceted models of M&A success. For example, Birkinshaw et al. (2000) study the dynamics of how human integration and task integration contribute to acquisition performance. According to Birkinshaw et al (2000), the level of human integration already completed mediates the relationship between the task integration and acquisition success. Weber – Pliskin (1996) found corresponding results in their study on banks. They show that the organisations that engage in high levels of IS integration outperform those that do not integrate, and that the IS integration is strongly affected by cultural issues. (Weber – Pliskin 1996).

However, perhaps the most appreciated integrative study is by Larsson and Finkelstein (1999) in which they integrate the three major antecedents to M&A success: combination potential, organizational integration, and employee resistance. Besides the integration of the three antecedents, another major departure from previous work is the use of synergy realisation as a measure of success. (Larsson – Finkelstein 1999) The figure below presents their model of M&A performance.

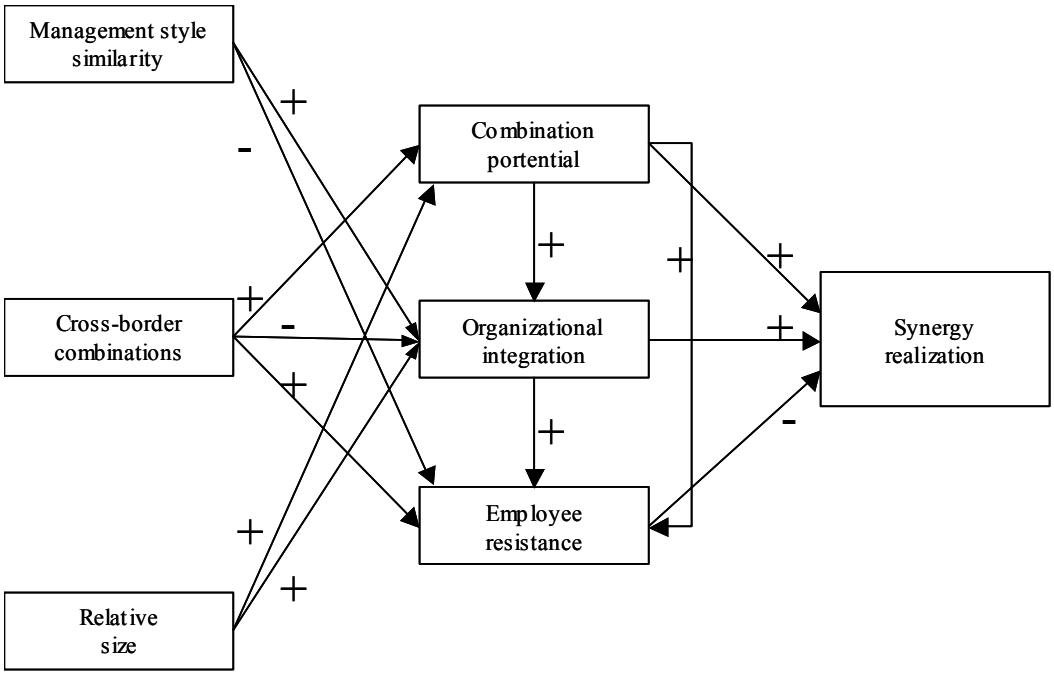

Figure 3. Model of M&A performance (Larsson – Finkelstein 1999)

The model describes how the three antecedents and also other critical aspects of M&A affect synergy realisation. Combination potential – no matter whether derived from the similarity or complementarity of the two organisations – increases the probability of acquisition success. Nevertheless, organisational integration was discovered to be the strongest predictor of merger success, and its greatest effect on M&A performance is realised when combination potential is high. On the other hand, employee resistance reduces synergy realisation. (Larsson – Finkelstein 1999)

Managerial style similarity, cross-border combination and relative size affect acquisition performance through the three antecedents described above. Managerial style similarity was found to reduce employee resistance but had only little effect on organisational integration. It was also discovered that the combination potential was higher when the target was larger in relation to the bidder company, but on the other hand, organisational integration was not affected by the size. This implies that even though making small acquisitions enables devoting enough managerial time for the integration, it may not offer the levels of combination potential that would otherwise be achievable. (Larsson – Finkelstein 1999)

Yet another integrative model presented by Singh and Zollo (1998) uses acquiring firm's return on assets as a measure of success. According to Singh and Zollo (1998), value creation can be explained by (1) characteristics of the target firm, (2) the factors related to post-acquisition decision making, and (3) factors related to learning to manage integration processes. The characteristics of the target firm also have an impact on both the post-acquisition decisions and the acquisition performance. The quality of the target firm refers to the pre-acquisition performance, and relatedness stands for the geographical overlap of the two firms. With regard to post-acquisition decisions, integration stands for the level of integration, and replacement refers to replacement of existing resources (especially its top management team) in the target firm. Learning can be accumulated by having experience of previous acquisitions, and the process of articulation and codification of the lessons learned in past.

As presented in this chapter, the effects of various aspects of the M&A phenomenon on the performance have been discussed in the literature; either separately or in an integrated manner. Besides the new integrative models, a bulk of academic literature has concentrated on the cultural issues and their relationship with (poor) post-merger performance recently. Nevertheless, in comparison to the cultural issues, post-merger integration of the IS is predicted to have an even more important role in determining whether the post-merger integration succeeds or fails. This seems to be applicable especially in cases where the business is IS intensive. But, literature on the post-merger integration of the IS remains scarce. (e.g. McKiernan - Merali 1995; Goodwin 1999; Cossey 1991; I/S Analyzer 1989; Parvinen 2002. See also: e.g. Buono et al. 1985; Weber – Pliskin 1996, Buck-Lew et al. 1992)

3.3 Post-Merger Integration of IS

As in investments in transactional (operational) IS generally, post-merger integration of the IS is usually pursued to increase synergies and cutting costs; especially in the areas of inventory control, order processing, and other data processing including financial systems. Another motivation for the integration may be the desire to impose more control and co-ordination. Integration is also pursued when the motivation for the merger is acquiring the target company's strategic expertise in IS and hence gaining competitive advantage. The IS integration is required especially in absorption and symbiotic acquisitions (see Chapter 2.1) where strategic interdependence is high. (McKiernan – Merali 1995; Merali – McKiernan 1993; Weber – Pliskin 1996)

The depth of post-merger integration of the IS varies from maintaining the status quo to total consolidation of the systems. When striving for a single technology base, the business processes are unified, and all applications standardised. This may be accomplished by adopting one of the existing systems or implementing a totally new one. In partial integration only those software packages supporting the same business processes are used across the company. This may be done e.g. by using the "pick and mix" strategy where the best applications are taken from each system, and then integrated. Other options between the two extremes include e.g. front-end integration where the customer feels s/he is dealing with one merged entity but the back-end systems are kept separate. If all components of the information systems are intentionally kept independent, the only linkages required are those needed for combining financial reporting level. Yet another type of industry restructuring is divesting which may require downsizing and limiting centralised systems. (Giacomazzi et al. 1997; Bentley 2002; Goodwin 1999, I/S Analyzer 1989)

According to KPMG Management's study, 25% of the companies that had been through a merger, decided to discard the acquired company's information systems. Another option is to use middleware that, however, has limited possibilities to transmit information between the two systems, and may become complicated and expensive to run. Despite this, 37% of the companies had chosen this path to integrate the two different information systems. Of those remaining, 15% chose to install a completely new system, and 6% took over the acquired company's IS infrastructure. (Goodwin 1999)

In most cases, the post-merger integration of the IS seems to take place rather quickly. Typically, the IS is not considered in the pre-merger phase but the IS integration is only planned after the merger, within a relatively short period of time. When integration is the path chosen, the majority of the companies integrate the IS immediately, and in almost all cases it takes place within a year. Examples of integration periods as short as 60 days are also reported, but also those longer than one year can be found. (Merali – McKiernan 1993; McKiernan – Merali 1995; I/S Analyzer 1989)

The IS integration may have either a reactive or a proactive role in the merger. The role is reactive when the IS needs to accommodate, and proactive when it facilitates the organisational change or when acquiring the target company's IS is the motivation for the deal. In absorption acquisitions, the role of the IS is reactive. Full operational and cultural consolidation is pursued, and hence, the consolidation of the two IS architectures is usually a top priority. The role of the IS is reactive also in symbiotic acquisitions, but in this situation the IS integration is the most challenging due to the high autonomy between the organisations. It may be possible to centralise certain systems or build bridges across unchanged systems. (McKiernan – Merali 1995; Merali – McKiernan 1993. See also: I/S Analyzer 1989)

When in a proactive role, the IS creates opportunities for gaining advantages or drives the organisational change process. By providing a common language, common sets of performance measures and operating methods and a common horizontal and vertical distribution of power, a common IS infrastructure may serve as a basis for a single new corporate style, or at least ratify and implement the changes in visible ways in the combined organisation. (McKiernan – Merali 1995; Merali – McKiernan 1993)

As stated above, the depth of integration is derived from the type of the acquisition integration approach, and hence it depends mainly on the number and kinds of business processes supported by the same software packages. (Giacomazzi et al. 1997. See also: McKiernan – Merali 1995; I/S Analyzer 1989, etc.)

In addition to this, Giacomazzi et al. (1997) offer a more detailed view to the choice between the different IS integration strategies (i.e. depth of integration). In their descriptive model, the choice is determined by 4 groups of variables which are: (1) growth objectives, (2) interventions on the company's structure, (3) situation variables, and (4) information systems requirements. (Giacomazzi et al. 1997) The figure below illustrates how these groups are involved in the choice.

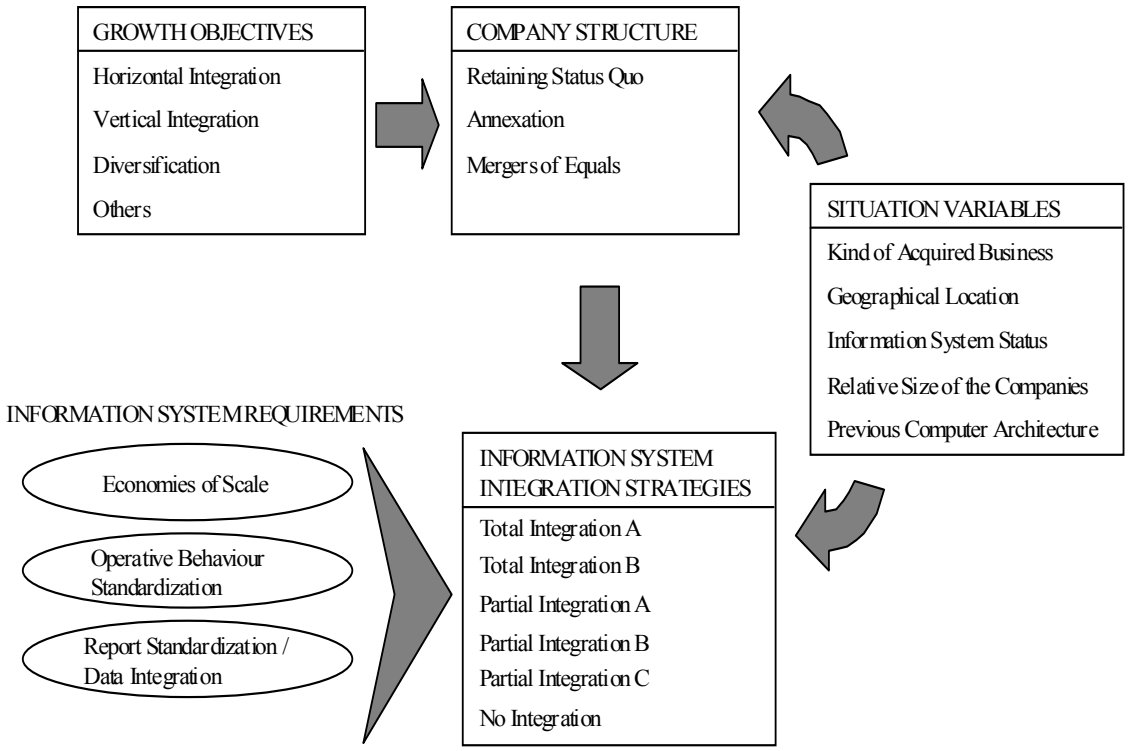

Figure 4. The influence of different variables on information systems integration decision. (Giacomazzi et al. 1997)

Each group of variables has a different role in the process of decision-making, and not all these variables have the same importance for all integration strategies. The type of industrial strategy (growth objectives) does not affect IS configuration directly, but it influences the type of organisation that emerges from the transaction, and hence the IS. The situation variables describe the 'border conditions' of the merger, and may be considered constant in short to medium term, and the IS requirements inherently influence the IS architecture and configuration directly. (Giacomazzi et al. 1997)

3.4 Success in Post-Merger Integration of IS

Success in post-merger integration of the IS is an ambiguous, multifaceted phenomenon that can be addressed with various measures. In practice, there are nearly as many measures as there are studies. IS success has often been defined as a result or outcome, or a favourable result or outcome. However, already defining how this outcome should be characterised, or for whom should the result be favourable, is ambiguous. Furthermore, there may exist complicated contextual effects on what is considered favourable or satisfactory. (Saarinen 1996)

Similarly to determining IS success in general, finding reliable measures for it is likely to be very problematic. Hence, the measures used are often surrogate and criticised for lacking strong theoretical underpinnings. One of the roots of these problems is the fact that the IS investments often have corporate-wide, intangible and long-lasting effects. Because of this, quantitative measures and economic evaluation tend to be difficult to obtain and easy to manipulate. (Saarinen 1996. See also: Brynjolfsson – Hitt 1998; DeLone-McLean 1992; Goodhue 1995; Kortteinen et al. 1995 etc.)

In fact, “There are no generally acceptable measures available to quantitatively and objectively assess an information systems’ success. Researchers have, therefore, developed surrogate measures based on subjective evaluation approaches.” (Saarinen 1996)

Robbins et al. (1999) suggest the following measures for addressing the success in post-merger integration of the IS:

- The ability to exploit opportunities arising from the merger,
- The ability to avoid problems stemming from the merger,
- The end user satisfaction with the integration process and integrated system,
- Improved IS capabilities that help support the underlying motives for the merger, and
- Efficiency and effectiveness of resource utilisation during the integration process.

(See also: Stylianou et al. 1996)

Some authors address the success implicitly, stating that the IS integration is expected to be carried out within a pre-defined timeframe, and without disrupting the work of employees or inconveniencing the customers. (I/S Analyzer 1989; Merali – McKiernan 1993; Kubilus 1991)

A fairly different indicator is presented in Main – Short (1989). In their study, a key result of IS integration is increased partnership between the IS and general managers, including (1) alignment of the firms business strategies and the IS, (2) better understanding of line managers’ information requirements and readiness to manage IS locally, and (3) better determination of future systems needs. (Main – Short 1989)

Even though these measures outline desired or favourable outcomes for IS integration, they still leave ambiguous for whom should the result be favourable, and in which manner to decide when and how the criteria is met.

Also the explanations for IS integration success vary. Political and power structure issues as well as organisational and especially management IS maturity have been suggested as determinants of IS integration success. On the other hand, technical integration difficulties have been blamed for the failure in less IS dependent sectors. Besides these, in highly IS intensive firms, issues such as cultural fit and integration management may determine the success of the IS integration and ultimately the merger itself. Also, problems such as high IS employee turnover or collapse of morale of the IS personnel have been quoted. (Merali – McKiernan 1993; McKiernan-Merali 1995; Weber et al. 1996; Kubilus 1991)

Nevertheless, perhaps the most comprehensive explanation for IS integration success is presented in Stylianou et al. (1996) and developed further in Robbins et al. (1999). Styalianou et al. (1996) divide the factors affecting the IS integration success in organisational attributes, organisational merger management, IS attributes, and IS integration management. The following table presents some examples of each group.

Organisational Attributes	Organisational Merger Management	IS Attributes	IS Integration Management
Company size Industry type Organisational structure Distribution of decision making The pre-merger relationship between the acquiring and the acquired companies	Prior merger experience The degree of IS participation in the merger planning Planning quality	The number of IS employees Personnel skill levels Structure (distribution of activities) Distribution of hardware Data sharing Degree of compatibility between acquiring and acquired organisations	The desired degree of integration The current status of integration process Integration planning activities including audits prior to integration and the development of integration priorities IS personnel issues

Table 3. Factors influencing the IS integration success. (Stylianou et al. 1996; see also Robbins et al. 1999)

Robbins et al. (1999) regroup these into "Organisational factors" and "Information Systems Factors", and propose the following model for combining the influences and measures of IS integration success.

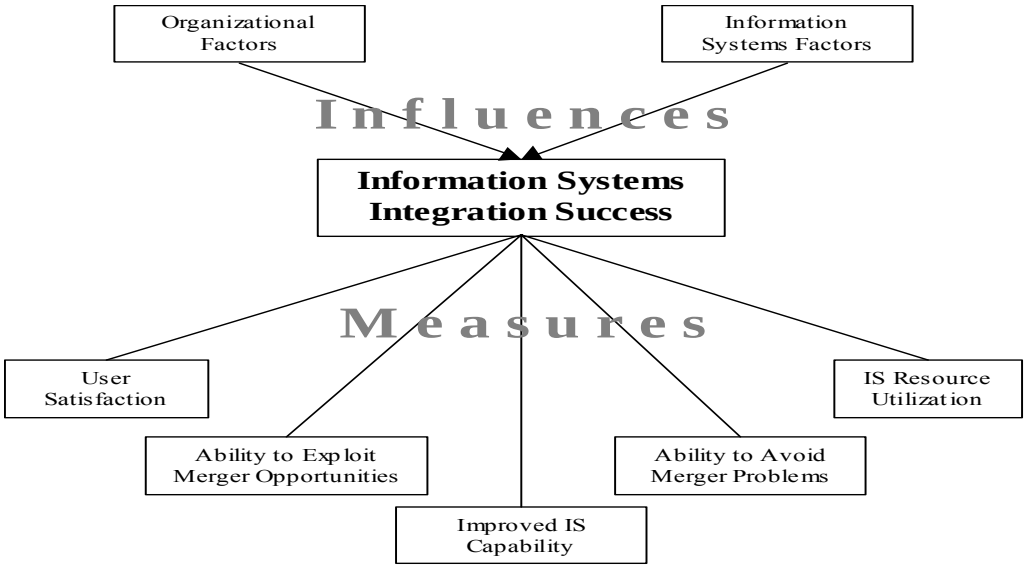

Figure 5. Influences and measures of information systems integration success (Robbins et al. 1999)

Robbins et al. (1999) used improved IS capabilities that help support the underlying motives for the merger as a measure of success. Using this measure, they found out that the factors critical for achieving a positive outcome in post-merger integration of the IS are managerial in nature, and moreover, largely controllable. They conclude that in order to integrate the information systems successfully, a high quality merger as well as IS integration planning, positive support by executive management, high-quality communication to the end-users, and a high level of end user involvement in strategic IS decision making during the process are required. In addition to these, they recognised the emphasis on IS standardisation as a positive factor. (See also: Stylianou et al. 1996)

4 RESEARCH STRATEGY

In order to find the answers to the sub-questions SQ1 [How can success in IS integration be defined?], SQ2a [What factors affect the success of IS integration?] and SQ2b [How do these factors interrelate to each other and the success of IS integration?] , relevant literature will be reviewed.

In order to answer the sub-question SQ3 [What managerial interventions facilitate success in PMI of IS, and how?] as well as the Research Question (RQ) [How should post-merger integration of information systems be conducted in order to succeed?], I will collect empirical evidence consisting of a multiple case study and elite interviews with consultants that have work experience from several cases of post-merger integration of the IS. The empirical evidence will also used to verify the answers found for the sub-questions SQ1 and SQ2.

This empirical approach enables gaining in-depth understanding of the dynamics of such a rare and special situation. Besides this, the area of study is relatively sensitive (Merali – McKiernan 1993). Hence, the respondents may be reluctant to answer impersonal questionnaires – whereas with the case study approach it is possible to establish more personal contact, and issues like security, anonymity etc may even be clarified to every respondent personally. (Yin 1993)

In order to gain sufficient insight to the problem, the case study evidence will be collected from 4 – 8 companies. The evidence will consist mainly of interviews and documents. The sites will be located mainly in Finland. If possible, also cases from Germany and Brazil will be included in order to allow comparison over cultural boundaries. Consultants will be interviewed in Finland and Germany, and possibly also in Brazil.

For this study, it would be fruitful if the case sites could be selected so that different cases would represent the different acquisition types – preservation, symbiosis, absorption, holding – and hence strategic positions (reactive/ proactive role) the IS integration can have in the post-merger management (Haspeslagh – Jemison, 1991; Merali-McKiernan 1993). However, due to the sensitive nature of this area of study, access may turn out to be an important criteria for selecting the case sites (see e.g. Yin 1993).

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INNOVATION AND FLEXIBILITY IN SECOND GENERATION ERP SYSTEMS

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Abstract

It is well known that ERP systems (Enterprise Resource Planning) are a very complex type of software, which aim at automating business processes and codifying organisational procedures and routines.

This paper examines the nature, consequences and some possibilities for solving ERP system "rigidity" and the relative "organisational freezing" caused by information process and flow coding.

Such rigidity makes traditional ERP systems suitable for the more stable areas of organisations (technical core, back-office) than for areas that are now "emerging" i.e. those with a higher rate of change and innovation (buffers, front-office).

In order to give ERP systems a greater capacity of adaptation and innovation, the characteristics of a new technology, Web Services, have been suggested which virtually allow the functions of any compatible application to be extended by using a standard component software accessible through the Web. The Author of this contribution is carrying out research aimed at examining a series of concrete cases where this technology is currently being adopted.

1 INTRODUCTION

ERP systems (Enterprise Resource Planning) are very complex, standard management software applications suitable for medium to large organisations. These packages can integrally cover several functional areas that were traditionally managed previously by so called Legacy systems.

Generally, ERP systems lead to a good intra-organisational integration where all the value chain phases can be managed as a whole. Moreover, they also allow for a re-orientation towards process logic systems of those managerial systems that are still too tied to the functional-hierarchical logic (Beretta, Polo, 2002).

Some of the main critical aspects of ERP systems arise from the fact that such systems are complex with limited and costly adaptability. Their introduction into an organisation represents a considerable investment in terms of resources, time and organisational costs.

Question 1: Do ERP systems favour organisational innovation or are they more of a hindrance?

Question 2: What influence does an ERP system have on the decisional processes of an organisation?

If the decisional process classification by Simon (Simon, 1970) is used, furthered by those of Scott-Morton (Scott-Morton, 1971), it is possible to affirm that a significant share of structured and semi-structured decisions within an organisation are directly decided and/or conditioned by the presence of an ERP system.

The use of an ERP system has important implications on the organisation's decisional processes and is typically accompanied by significant interventions at the organisational project level, especially in process re-engineering. on the one hand, all this brings about adaptation of the more or less standard procedures and models incorporated within the ERP system to deal with the specific needs and special characteristics of the adopting organisation. On the other hand it requires a reorganisation and restructuring of processes, procedures and roles within the organisation itself in accordance with the new models embedded in an ERP system.

This process of mutual adaptation is considerably costly and tends to be concentrated in the system adoption/implementation phase that, once successfully functioning, tends to be permanently "frozen" in its adopted form (Ravagnani, 2000), as often happens in the development of traditional information systems (Truex, Baskerville e Klein 1999; Bello, Sorrentino e Virili 2002).

This paper proposes to delve further into the organisational implications of this "freezing" of decisional processes and, more generally, of the organisational set-up. The main objective is to evaluate the characteristics, critical aspects and possibility to avoid the disadvantages by using a new ICT technology known as Web Services, which is presently still in the development and consolidation phase. This new technology should make integration of the different systems in a common platform easier, so that the process of organisational innovation becomes smoother by means of the ERP system's continual adaptation to the "emerging" needs of a constantly evolving environment.

2 ANALYTIC FRAMEWORK

The idea that links the technological and organisational aspects in the field of study discussed in this paper is the concept of decisional process flexibility. The organisations that typically have little need of continual adaptation (for example, where areas are stable and uncertainty is low) will suffer less damage by the "freezing" that ERP systems introduce than will other organisations that have a high level of flexibility in their decisional processes (for example, where there is a high level of uncertainty). In the literature on organisation, this concept has been explored referring to the nature of the decisional processes themselves (March, 1994). To be very brief, it is possible to affirm that those

decisional processes with a higher level of flexibility are also the least structured (cfr. Simon classification 1970). Another useful critical reference framework could be the one identified by Decastri, De Marco and Rajola, (Decastri, De Marco and Rajola, 2001) on the basis of contributions from Thompson, Burns and Stalker, (Thompson, 1967, Burns, Stalker, 1961) and Lawrence and Lorsch (Lawrence, Lorsch, 1967), referring to *Customer Relationship Management* applications. The theory of these authors is that there are two areas within every organisation where the needs and characteristics contrast to some extent. On the one hand there is a *back-office centre* operating with well-structured and defined decisional processes characterised by stability and focusing on efficiency, while on the other hand, there is a "*front-office*" area which is instead orientated towards interaction with the outside, adaptability and effective interpretation of market and competition conditions. This dualism is expressed in Thompson by the existence of a technical centre equipped with organisational units that act as "buffers". To simplify, we could say that the precise role of these buffers units is to absorb any external uncertainty. While the operational centre deals with productive activities, the buffers units put the organisation in touch with the outside.

Lawrence and Lorsch, however, have confronted the argument from the point of view of the different degree of differentiation and organisational integration required in terms of the relationship with the external environment, adopting the “organic” and “mechanic” paradigm identified by Burns and Stalker.

The presence of *back-office* areas within organisations (technical core) with little interaction with the outside, low level differentiation-integration and mechanical-type paradigm compared to *front-office* areas (buffers) with a higher level of differentiation-integration and organic-type processes, could be hypothesised. This is the argument on the basis of which Decastri, De Marco and Rajola declared the need for highly flexible decisional processes and support instruments for more flexible decisions compared to those idealised for the *back-office*. *Front-office* applications taken into consideration by the Authors were, in the example referred to by Rajola et. al., CRMs (Customer Relationship Management).

Thus, the question that springs to mind is: given the aforesaid dualism, how can the dilemma that arises every time an ERP system is introduced into an organisation with standardisation on the one hand and innovation/flexibility of decisional processes on the other, be resolved?

The hypothesis, which this study proposes, is the adoption of a new Web-based technology that could be the “link” between the traditional "*hard*", stable and standardised part and a new "*soft*" part that is open to the changes and continual innovations of an ERP system.

This new infrastructure technology, known as "*Web Services*", is therefore briefly described and analysed to interpret the role it could play to equip ERP systems with an "*emergent structure*" that is particularly important in front office areas. To support this observation, a critical illustration will be given of the new ERP architecture proposed for the near future by one of the main producers operating in the Italian market and which seems to apply to the question in hand.

Since the technology has not yet been consolidated, the empirical-descriptive part of this paper is limited to the analysis of the documents based on specific techniques and architectural strategies supplied by the producer and made available to the public as a study case that is still in its embryonic stage.

3 WHAT ARE WED SERVICES

Web Services could be seen as an evolution of the “component based” software development paradigm. According to this paradigm, software applications may be “assembled” combining several standard software “bricks” (Virili 2003). In the past, the component-based software development was severely limited by the fact that the small “software bricks were not documented and often difficult to use.

A software component is basically a black box which accepts data and messages in input and gives back results as output. What is usually difficult, is to deeply understand the component functionalities and how it is intended to be used. Therefore, it is not easy to build a software application as a "merger of single parts", just assembling software components built by third parties (Virili 2003).

The architecture of the Web Services has the potential to overcome the limitations of the traditional component based software, adding new potential uses, leveraging the Web as a mean of communication. One of the envisioned benefits of its widespread adoption would be the creation an on line market of software components, based on three elements:

- an on line directory;
- a standard system of documentation to describe the software component;
- a set of communication rules to access the software components via Web.

Using Web Services it is possible to decide that a specific part of a software application (for instance the function that control the credit line of a client) could be located out of the application itself: when it is necessary to call for the functionality, the application sends data to be elaborated over the Web to the remote software component (e.g. the customer details) and gets back the results (e.g. the credit profile). This idea, briefly mentioned here, is called by the experts "functional decomposition" (Castro-Leon 2002).

In synthesis the Web services standard is based on two fundamental principles:

- the functional decomposition of the applications in several independent software components;
- the use of the WWW infrastructure for inter-application communication: software application are enabled to access remote software components over the Web.

4 WEB SERVICES AND ERP

In a recent study, Mabert et al. (Mabert et alii. 2000) report that 44% of the firms interviewed had already installed an ERP system, while close to 30% was using, or planned to use, a similar system. Another study indicates that 53% of large companies and only 9% of small ones have installed an ERP system. Moreover, the study reports that these companies intend to make significant investments into ERP over the next 2 years (Duplaga, 2003).

Despite a standstill that has occurred in the last 18 months due to the negative economic conjuncture, analysis by AMR Research in Boston forecasts that ERP systems will be the main component of large company investments in ICT in 2004.

It therefore would seem that confronting themes about the design and development of company information systems today really means considering the question from the point of view of customising an ERP system.

One of the characteristics of ERP systems is, in fact, that they contain their own organisational logic within, which has already been adopted by other businesses that operate in the same environment.

This often forces companies that adopt an ERP system to "bend" their own organisational models to fit the characteristics of the system. Obviously the aim is to facilitate the use into a logic where "technological imperative" seems to triumph (Markus, Robey 1998).

Nevertheless, their diffusion can reach such levels as to transform these systems into independent actors able to carry out a very profound role within the contexts where they themselves operate and, above all, where they are able to resist organisational changes. Once ERP has begun to function, every change will be considered as too costly both in financial and human terms. These kinds of systems have been compared to cement: processes and flows can be manipulated until they become definite. From that moment on, it is no longer possible to modify the flows or organisational processes that have been consolidated or "cemented" (Ciborra 1998).

The “monolithic” logic with which these systems have been designed, the factor that gave the concrete possibility of real integration of company data, has had the direct result of putting internal organisation procedures into plaster casts.

To this can be added the difficulties met in the implementation phase, especially those connected to the need for complex integration between the current system and the other applications with their pre-existing databases (Holland, Light and Gibson, 1999). Considering that ERP systems substitute approximately 80% of applicative software now present in companies, it is easy to understand how these systems provoke significant changes in terms of all organisational variables (Davenport, 1998). Holland Light and Gibson estimate that 90% of implementation projects experience delays or have a higher cost than expected.

If, therefore, ERP systems are now quite common and their use consolidated as the heart of company information systems, the doubts of those who consider these systems too rigid and difficult to use still remain high, if not to mention, fearful.

In an attempt to overcome these doubts, to beat implementation costs and to entice small and medium-sized industries towards this type of integrated system, the producers of ERP systems are now introducing so-called “ready to go” solutions onto the market. These packages not only provide the information system infrastructure but also the proposal of a pre-configurated organisational and behavioural model. At this point it would seem appropriate to determine what might be the advantages of adopting the innovative development methods of systems like Web Services. Quite often managerial areas are excluded from ERP system implementation (business areas, functions, processes) and are entrusted to the management of local applications. In these cases, the non-activation of some modules significantly cripples the potential of company integration available in the original systems (Morris, 1996; Beretta, Polo, 2002).

Web Services lead to the substitution of ad hoc implementation interface development with integrated standard exchange of information.

In fact, in the border areas of software, “engines” are being built that are able to process and exchange the necessary data for feeding other systems. At the same time, applicative software is being built which is designed to manage information coming in from external systems. This standard could be represented by *Web Services*.

An example of a practical application of this approach is the integration architecture adopted by Gruppo Formula, an Italian company that develops, sells and supplies ERP system implementation services and Business Process Automation.

5 THE IMPLEMENTATION OF WEB SERVICES

Gruppo Formula combines its activity as a software producer to that of a supplier of consultancy services and management of implementation projects. Furthermore, it produces and sells systems for CRM, Supply Chain, Sale Force Automation.

The adoption of *Web Services* technology has a double purpose. On the one hand there is a project underway for re-writing the Diapason ERP system into Java language, which foresees the use of Web Services with the aim of achieving an architecture where every module is the outcome of standard re-usable and interchangeable components or sub-components. The aim of this project is to obtain a system that, while maintaining the level of integration pertaining to ERP systems, increases the scalabilità, making system maintenance and updating activities easier.

On the other hand, *Web Services* are used in projects where the company is asked to carry out the function of System Integrator between Diapason and the specialist applications supplied by other companies in cases of inter-organisational integration, with other information systems.

The choice of *Web Services* is therefore referable to the flexibility that this architecture allows.

The possibility of "exposing" selected and well-determined functioning of a software has facilitated integration with:

- CRM systems
- Supply Chain systems
- specialist departmental systems.

To date, Gruppo Formula has a work unit called Enterprise Integration Applications, which mainly deals with projects on the inter-operability between the different systems. The architecture proposed is the evolution of a point-to-point approach for integration between systems towards a services oriented hub [1]-type architecture. With this paradigm, the component (logic) of the integration server and Web Services are introduced as a standard integration model between systems.

As shown in Figure 1, the integration server is created by a framework that represents the middleware responsible for integration.

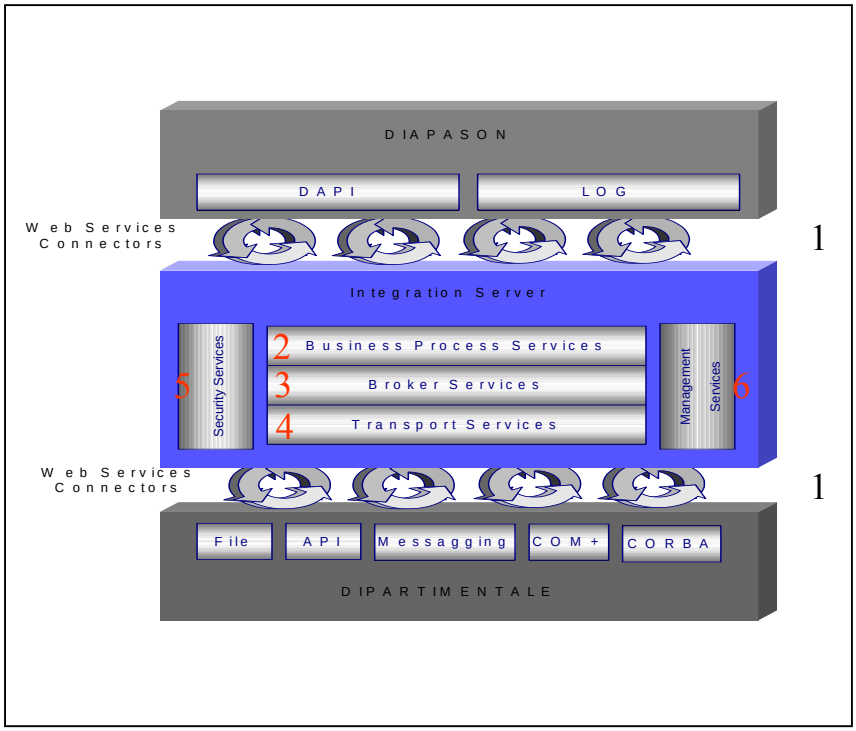

FIGURE 1 – Integration architecture between the "Diapason" ERP system and a departmental information system. Web Services allow the ERP system to communicate with the pre-existing applications, adding an "emerging" part at a high rate of innovation to a stable and standardised system.

1. Given an initial information system, the information to be published is selected and then normalised through the use of *Web Services*. The feature of the Web Services used here is that they let the functioning of an information system be exposed. Once the data is available they are adequately managed in such a way as to resolve the process problems.
2. "Business process services" are services that lead to the resolution of management problems of events, timing and correlation between several processes.
3. Formal correctness, data format, data validation, filters, directing and mapping are therefore managed by "broker services" that administer the semantic rules, the data format coming from the different information systems and their distribution rules.

4. A “transport services” system manages the problems linked to the integration of heterogeneous platforms. They make it possible for the information systems that intervene in the integration to communicate if their platforms are heterogeneous.
5. The “security services” are those services that allow an integration architecture to be built which uses the security level necessary for the client’s needs. They can resolve problems concerning authentification, authorisation and the management of certificates and signatures.
6. Lastly, the “management services” monitor, control and manage the integration architecture functioning.

A similar architecture beats the cost of interfacing. Once the basic rules about the exchange of data have been established, it will be necessary to supply the systems to be connected with the rules for hooking up to the communication system. This means that special interfaces will not have to be written for every type of communication.

6 CONCLUSIONS

The problems concerning the “rigidity” of ERP systems and how to avoid the limitations arising from “freezing” the knowledge encapsuled inside the software that codifies processes, behaviours, information flows, etc. have been the argument of this paper.

It is well known that ERP systems are specially designed software for the automation of “routine organisation” (Nelson, Winter, 1982) and for modelling strategic business processes, considering that these are either more internal or close to the technical centre (finance or storage), or more external (marketing or sales). The aim is to integrate the available information between them in its various formats within the company and share it with those who are on the borders of the organisation (Morabito, 1999). The intention is to reduce company complexity and costs deriving from the management of a traditional type of information structure where the system is the result of a series of information technology applications that are often not always well aligned and which have been introduced into the company bit by bit over the years.

Thus, the adoption of *Web Services* technology has tried to solve the problem of ERP rigidity, highlighting how the use of such systems should make integration of the various systems in one common platform easier and the continual adaptation process of ERP to the organisational set-up smoother.

On the other hand, innovations that are emerging on the ICT front (Information and Communication Technology) are changing the panorama of opportunities in the field of information system research, shifting the attention from internal systems towards more external ones orientated to the client and the stakeholder (Straub, Watson, 2001).

The brief indications that we have taken from some classic organisational theories which identify areas of high stability and the need of standardisation (technical core, back-office) and areas more orientated towards innovation and change (buffers units, front-office) give us an initial simple interpretation of some of the main critical aspects found in ERP systems (rigidity and cost adaptation) and this suggests that “Web Services” technology could potentially be a very effective means to remedy this. The empiric indications described herein, based on some of the first existing Web Services applications for ERP systems, seem to confirm the theory’s indications. However, further experience is necessary and more extensive studies will have to be done to evaluate the effective capacity of Web Services as an instrument to make “elephants fly”. In fact, if elephants only fly in Walt Disney stories (Weinberg 2002), someone, in IBM, has at least been able to make them dance (Gerstner 2002). And, as Louis Gerstner well knows, new technologies can be of great help.

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A RESEARCH PROPOSAL – ICT AND PRODUCTIVITY DEVELOPMENT. RESEARCH ON SWEDISH INDUSTRIAL SYSTEMS

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Abstract

In 2003 the research project IToP (IT on Productivity) was established at the department of Computer and Information Science at Linköping University in Sweden. The project is looking into the possible connection between the use of Information and Communication Technology (ICT) in industries and businesses and productivity development. The research group consists of two professors and three PhD-students and the plan is to present research results in the form of licentiate and doctorial thesis and articles.

This paper consists of a description of how the licentiate thesis are planned to be carried out. They all have the common purpose of the ITOP project as a starting point, which is formulated as follows:

The purpose of the research project is to increase the understanding of ICTs contribution to the development of productivity in the community and its role for the development of productivity and profitability in companies and businesses. The research also aims at developing theories about the role of the information and the role of ICT in the economical development.

The dissertations are going to be based on studies of three different industrial systems in Sweden; the retailing industry, the forest industry and the graphical industry. The common focus in the different studies will be to look at the role of ICT on productivity growth at an industry and a process level. Another important focus in the studies is that they will have a historical perspective. This means that they will look at the development of processes and the implementation of ICT during 25 to 35 years.

The licentiate dissertations will hopefully contribute to a better understanding of the influence of ICT usage on productivity and profitability development within industrial systems. The dissertations might also bring some light to the academic debate that has its root in the so called "productivity paradox". More and more result from academic research these days points to the fact that ICT investments has a positive effect on the productivity development, but there are still areas that have to be discovered before the results can be viewed as unanimous.

Keywords: *Information and Communication Technology (ICT), Productivity, Industrial systems.*

1 INTRODUCTION

This paper consists of a common research proposal that is supposed to result in three different licentiate dissertations in the summer of 2005. The work will be carried out within the research project of IT on Productivity (IToP), a project that was initiated in 2003 at the Department of Computer and Information Science, at Linköping University.

The question, about which implications ICT has had on economic development in companies and businesses, has been debated in the academics for quite a while (Brynjolfsson and Hitt 2003, Carr 2003, Dedrick et al 2003). One problem in this context is that previous research is often based on aggregated data that suffers from quality problems e.g. difficulties to grasp all aspects of ICT on an aggregated level. The IToP project has the ambition to attack the underlying research question from a partly new angle. Empirical studies will examine the development of critical processes based on new possibilities gained through the investments and use of ICT. How the processes were performed 25-35 years ago, before any implications of ICT were seen, and how are they performed today.

The first part of this paper presents some of the main issues of the common project and after that there will follow more detailed information about the different studies that are planned within the project.

1.1 Project Purpose

The common purpose of the ITOP project is as follows:

> *The purpose of the research project is to increase the understanding of ICTs contribution to the development of productivity in the community and its role for the development of productivity and profitability in companies and businesses. The research also aims to develop theories about the role of the information and the role of ICT in the economical development.*

The project is planned to last four years and the final reports will be presented during 2007. These licentiate dissertations should therefore be looked at as a halfway report within the project. The dissertations are going to be based on studies of three different industrial systems in Sweden; the retailing industry, the forest industry and the graphical industry. The common focus in the different studies will be to look at the role of ICT on productivity growth at an industry and a process level.

As a starting point we plan to develop a research model within the project. The purpose with this model is among others to take a common stand in some definitions that can be seen as fundamental for the research. Another important aspect is that the model is one way to assure that we in the end have the possibility to compare our results from the different studies.

Although there is a clear ambition of cooperation in the project, the main part of the work with the licentiate dissertations will be carried out on individual basis. This means e.g. that the research questions in the dissertation proposals that are presented further on in this paper, differ from each other when it comes to structure. This can bee seen as one of the challenges with the project, to keep the balance between not interfering to much with the individual performance as a PhD student and the demands for comparable results.

1.2 Contributions

The dissertations will hopefully contribute to a better understanding of the influence of ICT usage on productivity and profitability development within industrial systems. A contribution that can be seen

as a small piece to the academic puzzle which motive is to gain the big picture on how ICT has and will affect and change our society. We will hopefully also be able to bring some light to the academic debate that has its root in the so called "productivity paradox". More and more result from academic research these days points to the fact that ICT investments has a positive effect on the productivity development, but there are still areas that has to be discovered before the results can be viewed as unanimous.

2 THE SWEDISH RETAILING INDUSTRY

This study will focus on the implications of ICT usage on productivity and profitability development in the Swedish retailing industry. It will originate in a high-level industry analysis in order to get an overall picture of the development of the importance of different subsystems (processes) within the industrial system, the development of the roles of different actors on the arena and the role of ICT and major ICT breakthroughs. A suitable process will thereafter be selected and studied more in detail.

2.1 Research Questions

The research project will be based on the following research questions:

In which way does ICT usage contribute to productivity and profitability growth in the Swedish retailing industry?

- What are the implications of ICT usage on other indicators of economic performance?
- What is the role of productivity measures and measurement?
- What other effects has ICT had and how can the value of these effects be measured?

2.2 Research Design

The ambition is to structure the thesis as a monograph. The theoretical framework will include an introduction to earlier research in ICT and productivity and identification of key parameters to be considered during the realisation of the study. Some key concepts are also defined such as macroeconomic and microeconomic perspectives, industrial system, process studies, economic performance measures and ICT.

The empirical study are planned to be divided into two parts. The first part is supposed to be based on secondary data such as statistics, material from industry organizations etc. The aim of this part is to perform a comprehensive study of the role of ICT investments and usage within the Swedish retailing industry during the last 25-30 years. This part of the study will hopefully gain an understanding of the industrial system, the role of ICT, the role of productivity and productivity measurements within it.

The second part of the empirical study are planned to include a more detailed discussion of the development and measurement of a specific process within the industry. It also aims at visualizing the design of the process before any implications of ICT, estimate the productivity at that point and compare this to later designs and productivity measurements and discuss the role of ICT in this development.

The analysis chapter is also planned to be divided into two main parts. First I will conduct an analysis of the material presented earlier on in the thesis. Second I will make a comparative analysis on different industrial systems, based on the research results that my doctorial colleagues within the project have gained.

3 THE SWEDISH FOREST INDUSTRY

The focus of this study is to analyze processes within the Swedish forest industry. Today's activities will be traced back as long as 30 years, allowing an analysis of performance development over time. The focus of the analysis will be on the effects of ICT use in activities and its connection to measures for economic performance such as productivity and profitability. The study therefore includes the use of ICT and performance development of a typical production process within the forest industry.

3.1 Research Questions

The purpose of this study is to show the specific characteristics of the relation between IT and productivity in an industry context by investigating the effects of digitisation in a typical process within the Swedish forest industry. This is achieved through an empirical description of the development of key production processes within the industry over the last decades.

This study is based upon two research questions:

- How do effects of digitisation appear in a typical process within the forest industry?
- What implications do these effects have in terms of productivity?

3.2 Research Design

This dissertation will also be structured as a monograph. The theoretical framework is mainly focused on ICT investments and productivity discussion from the perspective of the selected industrial system. Some key questions within these areas include: Why do organizations invest in ICT? How do they calculate on returns of ICT investments? How is ICT used within the industrial system? How has the use of ICT developed within the industrial system? Why are productivity measures important? How can productivity be measured? Which measures are used to measure the effects of ICT investments? How is the productivity measure used or perceived on a microeconomic level? On the basis of this, the theoretical framework will include an introduction to earlier research in ICT and productivity and identification of key parameters to be considered during the realization of the individual studies. Some key concepts are also defined.

The empirical part is based on a study of ICT use and performance development over 30 years in a relevant production process within the industry. It is realised as a case study describing activities in a production process and analysing the effects of ICT including mapping the characteristics of different effects and identifying different types of effects. The final discussion includes an evaluation of the impact of these effects on productivity.

4 THE GRAPHICAL INDUSTRY

The Graphical industry is an system which processes have developed relatively much during the last decades and there are many indications that ICT applications has played a central part in this development. Today are almost all types of materials in the industry, e.g. text and pictures, developing into a digital form. Some of the demands that are common in the industry are that the materials should be adaptable for the channel in which it will be presented. Among others it should be able to use the same digital picture for publication in both printed papers and on the Internet, with the same demands on the quality of colours. Furthermore it’s important for companies in the industry to be able to communicate safely, regardless of the media and with a preserved graphic profile (The Swedish graphical industry association, http://www.grafiska.se/, 2004).

4.1 Research Questions

On the basis of the IToP project and the chosen research object, the licentiate thesis will be based on the following questions:

> In which way has the digitisation of information affected the development of key processes in the Graphical industrial system?

How has the productivity statistics of the Graphical industrial system changed when the information has been digitised?

4.2 Research Design

As the case of the other two licentiate dissertations in the project, this one will also have a monograph structure.

The theoretical framework will among other things contain a discussion about productivity, processes and industrial systems.

The empirical study is planned to contribute to the research questions in different ways. Question number 1 is intended to be answered by the realization of a case study of the Graphical industrial system where important changes within significant processes in the system are going to be highlighted and modeled. This description will mainly focus on the development of the processes over the last decades by identifying and comparing important input and output factors within them. The survey will furthermore have a focus on ICTs part in this development and the ambition is to consider both visible an embedded systems. Question number 2 is intended to be answered by studies of statistics that shows the economical development of the Graphical industry during the chosen period.

The focus in the analyse part will be to identify in which way ICT investment seems to have/ have not contribute to the economical development of the Graphical industry. Among others will the results of the statistics study be compared to the changes in the industry's processes that have been identified. The results from the analysis will also be compared to the ones that have emerged from the other studies in the project.

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TRACK: NETWORK

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THE CONVERGENCE PROCESS BETWEEN BUSINESS NETWORK APPROACH, INTER ORGANIZATIONAL INFORMATION SYSTEMS (IOSS) AND ICT IN SMALL SERVICE FIRMS - AN EMPIRICAL RESEARCH ON MOUNTAIN TOURISM

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Abstract

Today, small service enterprises represent a rich field of research for theoretical and empirical studies about innovation processes in terms of organization and information systems. Such enterprises seem embedded in three important trends: 1) increasing inter-organizational business relationships to design a wide and flexible service offer; 2) the search for effective and efficient flow of information and knowledge between them; 3) the exploiting of ICT and web-based technologies. This paper emphasizes the convergence of these three trends, absolutely complementary and able to influence each other; using a survey on mountain tourism networks extracted from a wider research developed by the Business Research Department of Pavia State University (Italy), the aim of this paper is to achieve a better understanding about this trends by an integrated perspective.

1 INTRODUCTION AND RESEARCH QUESTIONS

The theoretical topics proposed in this paper are strengthened using the results we obtained from empirical studies on the Italian mountain tourism sector, where a large number of small service enterprises (hotels, ski schools, travel agencies, etc.) cooperates in giving a wide range of services to the final consumer: the tourist. In particular, service enterprises seem embedded in three business trends that probably converge in a unique innovation process; this three trends are:

- an increasing and fine-tuning of network strategies between small and medium service enterprises;
- an increasing sharing of knowledge and information between different service firms;
- new opportunities and more accessibility to web-based business solutions for small enterprises.

The central aim of this paper is to deepen this convergence phenomenon and describe some factors of success for this process by an integrated perspective.

Therefore, our research concerns all the inter-organizational relationships created in a "mountain tourism network" intended as *a social local cluster where different and legally independent mountain tourism service enterprises work and interface with each other co-generating value with and for the tourist through business relationships economically, naturalistically and historically determined* (Denicolai 2003). In terms of organizational thinking, the interest about integrated and flexible management of different services in economic literature has grown in the last decade, opening a lively debate about this concept, its relevance for economic analysis and its theoretical modeling (Normann & Ramirez, 1994; Perrone, 2001; Rispoli 2002; Denicolai and Gramegna, 2002); however the consolidation process of theories that lead to *a set of inter-organizational forms* (as associations, consortia, joint ventures, etc.) and design paradigms is still in progress; it is useful to understand the complexity of the involvement of actors in networks, especially when such relations are integrated using ICTs (information and communication technologies). Therefore, the paper develops this three trends starting from paragraph two, that shows a theoretical underground and some empirical results about service networks; then, paragraph three completes the examination in terms of inter-organizational information system and ICTs. Finally we will try to integrate l the most important results in a unique perspective.

2 NETWORK APPROACH IN MOUNTAIN TOURISM

A network between enterprises need an effective and efficient balance of organizational coordination systems to activate a really connected network where each actor contributes to co-produce value with and for the final customer (Norman & Ramirez, 1994); such coordination systems are various and complex and a first classification distinguishes between formal and informal ones. The survey on Italian mountain tourism shows that the most frequently **formal coordination systems** are the following:

a) no-equity contractual systems:

- collaboration contracts, i.e. agreements about opening/closing tourist season dates;
- temporary associations between actors, i.e. to organize cultural and sport events;
- travel agencies;

b) equity contractual systems:

- owner or shareholder control;
- joint venture;
- consortia between one (i.e. common ski-pass) or various kinds of public/private stakeholders.

c) associate systems

- gategory associations; very spread in Italian mountain tourism but also weak in terms of effective coordination power.

d) external systems:
- legal norms.

In particular, mountain tourist consortia (MTC) seems to be the most interesting formal instrument of coordination in this sector in terms of diffusion and future perspectives; however it seems that their evolutionary stage is not complete, so they need a managerial fine-tuning, especially focused in terms of organizational competences. As in a *joint-venture*, in a consortia there is a distribution of capital share between associates and a coordination of resources led by a different and autonomous structure; the main difference between consortia and joint-venture is that the former is oriented only to the *development and suppor*t of core-business, without a direct commitment and involvement in central activities (Mercurio, 2000). The main task of MTC structure is to encourage an inter-organizational thinking and create a really systemic offer, guaranteeing involvement of all *network* actors and an equal partition of benefits realized (Spedale, 1996).

The aims achieved from a consortia in Italian mountain tourism could be classified in four macro-categories:
- to increase contractual power in negotiation with other stakeholders;
- to propose an integrated development and promotion of entire tourist destination;
- to realize an effective planning and management of contents like, for instance, sport and cultural events or development of innovative services;
- to propose an integrated and flexible sales of systemic services offer of tourist destination.

Figure 1 shows the different percentages in terms of objectives achieved and obtained from 21 mountain tourist consortia: we can find a lack in terms of integrated sales.

A critical factor of success concerns the right balance of organizational power between private and public member of consortia. It is difficult to understand the right needed degree of public presence in a MTC, but an effective collaboration between these two elements is desirable. The geographic area interested by a consortia can also be wide, concerning more than only a unique tourist area[1]. Another factor of success of MTC concerns behaviour towards "non-associates": according to the results of our survey, when a consortia in mountain tourism tries to penalize too strongly those enterprises which decided to remain outside the network agreements and when consortia isolates them from taking part in the most important decisional processes that interest all tourist areas there are negative effects for all enterprises in general. Instead, an observed best practice is that of trying to overcome conflicts between tourist service enterprises showing good results of consortia and encouraging new entering in consortia. The results show how it is reductive to identify the network only as a formal inter-organizational agreement. Informal and social relations increase network borders and above all change the distinctive characteristics of net structures between enterprises. In order to join advantages deriving from the efficiency and flexibility of small service enterprises with the need to work in an integrated way as members of connected enterprises collectivity, these small service enterprises must have the ability to reduce costs of inter-organizational collaboration (Perrone, 2001). Such ability can be found in the web of social relations embedded in the network, taking advantage in terms of good exploitation of social capital (Nahapiet and Goshal, 1998) like an **informal coordination system**.

[1] An example of this kind of MTC is "Dolomiti Superski ", which integrates and coordinates a very large number of Italian Dolomiti ski-passes, and at the same time supplies various services to support associate enterprise activities.

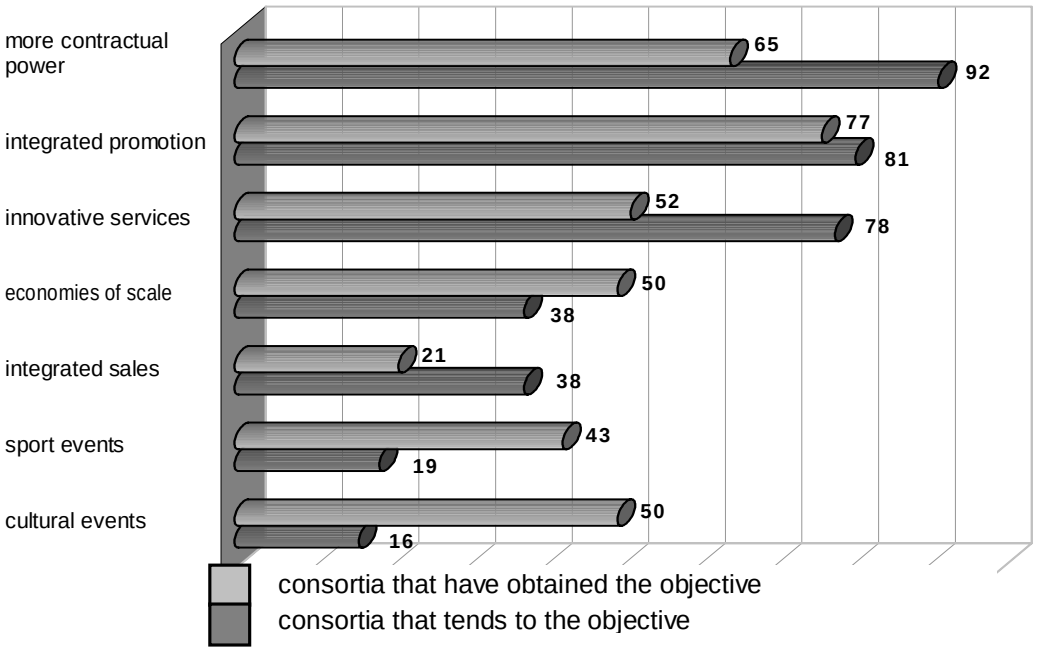

Figure 1. Objectives of Italian mountain tourism consortia (percentages).

In particular, we mean "organizational social capital", which is a "web" of relations possessed by individuals and social units. In this way they qualify contacts and the connection in which the resources are made available and recombined to create value, which reflects the social relation structure (Leana and Van Buren III, 1999). The social capital gives a sustainable competitive advantage to systemic service offer because it is unique and difficultly imitable; in particular, the main attention of the survey has been focused on "trust" because it plays a central role as a relationship guarantee, reducing coordination costs. We adopted the following definition of "trust": *"expectation, not directly supported by formal agreements and reward or endorsement system, that the agreement will be maintained and that behavior of the other people involved in this type of relation will be fair and predictable"* (Bromiley and Cummings, 1992).

The network analysis carried out during our survey on some Italian mountain destinations[2] shows that a high trust degree is a strong factor of success for an effective and efficient network system of small service enterprises, where social and informal relationships are diffused. The survey also outlines a low trust degree and a bad exploitation of social capital in general; perhaps the most interesting results underline how the trust development is influenced from an existing reticular structure, and how trust could change the same reticular structure of network, creating a circuit of self-influencing factors (Granovetter 1985). Gulati (1995) agrees with this theory and adds that new alliances alter the social structure that created them.

3 IOSS AND THE ROLE OF WEB IN MOUNTAIN TOURISM: AN INTEGRATED PERSPECTIVE

An adequate exchange of information and knowledge among the knots of a network developed by service enterprises is absolutely complementary to the inter-organizational systems of coordination illustrated before. The Italian delay, compared to other European countries, and the differences

[2] For details and methodology about developed network analysis see Cioccarelli, 2003.

between small and isolated enterprises and clusters of small enterprises in industrial districts (Becattini, 1987 and 1989, Visconti, 1996) lead to the possible importance of the context as an element that affects the process of technology diffusion and adoption; context and imitation phenomenon can help better to comprise decisional processes of adoption (Abrahamson, 1991 and 1999). Moreover, some studies having as object SMEs (Franch, Zaninotto, 1995) and digital districts evidenced the important role of "agents" (physical persons, agencies for development, centres for innovation, etc.) in order to support innovation processes. Earlier research works on Italian mountain tourism field seem to confirm the importance of peculiar elements of context, like existing fragmentation (geographic, sectional, functional), culture, rites, myths, traditions and managerial/technological skills (Cioccarelli, 2003). Such elements, in addition to high variety of actors that defines the tourist offer, emphasize the necessity and the complexity to identify ways and forms of coordination to transform available factors of attraction into an integrated and flexible tourist product to satisfy the evolution of tourist behaviour, habits and expectations (Cioccarelli, 2003). In other words, from an organizational point of view it is not possible to use a deterministic approach in the adoption of ICTs. This means that other ways should be found within a route which is a socio-technical and relational undertaking; it requires both technology and relationships between trusted actors with a shared strategic guidance, that takes into consideration the peculiarity of each mountain tourist destination, in terms of barriers, regulations, norms, culture, lack of confidence (knowledge and experience) with ICTs, lack of financial resources and managerial skills, resistance to change, and, above all, inter-organizational relationships existing (Cioccarelli, 2003). Many barriers still inhibit SMEs from fully capitalising on ICT and the Internet.

Starting from these assumptions, it is possible to operate a first distinction between three macro-areas of deepening research and theoretical refinement:

- configurations of integrated and flexible mountain tourist offer that exploit the capacity of ICTs;
- diffusion and adoption processes of ICTs;
- coordination and inter-organizational relationships between service enterprises supported by ICTs.

This paper is focused on the first one.

With reference to the information role in the development of an integrated and flexible mountain tourist offer it is crucial to emphasize that:

- tourist products are typically composed of many heterogeneous components (goods and services, natural and human elements of the environmental context, information);
- design and "construction" of tourist products are both made by tourists (that autonomously can identify, choose and combine the components of the tourist product) and tourist actors (tour operators, travel agencies, hotels, restaurants, carriers, cultural organizations and tourist offices) giving rise to production and consumption situations more or less structured and organized (Tamma, 2001).

From earlier research works on Italian mountain tourism field (Cioccarelli, 2003), promotion and selling are emerged like very critical factors because a tourist is more and more interested in a global service, where accommodation services represent a basic element to which to link supplementary services proposed on the spot. This also shows the need for a more effective coordination of services and information by a CRM (Customer Relationship Management) point of view, requiring a redesign of processes of communication, promotion and selling. The availability of information to value all attraction factors is particularly delicate when the tourist is searching for a new mountain tourist destination (Martini, 2002); in absence of coordination of the information by tourist actors, the tourist could have a representation of the tourist product which is not in line with the capacity of the destination, even if this is not the sole factor that affect it[3] ; the possibility of driving information flows

[3] Tourist destinations that want to do international business on the web, for instance, should consider the impact of different cultures on the understanding and use of web-based communication, content, and tools.

on tourist resources during the sojourn can be outstanding for the tourist satisfaction, in the qualitative perception and in the construction of the competitive advantage of the destination. Such necessity of coordination is therefore clear because the availability of information (i.e. accommodation availability and prices, dedicated services, ski-pass prices, etc.) is the result of a coordination process, often after an agreement between tourist actors.

From a technological point of view, in addition to "more traditional means" of information, the call centres represent a first example of tools which the tourist is able to use directly at home or during the journey; today these tools can also distribute services in a entirely automated way, thanks to ICTs. Nevertheless, from an organizational point of view, one of the main requirements in the accomplishment of such solutions seems to be the collaboration between actors to reach a sufficient "critical mass", to support investments and management costs, to increase the visibility and to guarantee a service with a wide range of choices; the existence of a minimum degree of co-operative orientation between the local operators based on mutual trust with a shared strategic objective seems to precede the solution of specific problems of coordination; nevertheless, from earlier research works on Italian mountain tourism field (Denicolai, Gramegna 2002; Cioccarelli, 2003) is emerged that a declared will often does not drive to concrete initiatives, and a reason can be led back to a low predisposition to reciprocal collaboration, even if with peculiar local differences.

Another field of application of ICTs is represented by mobile business which can support flows of information, communication, and transaction processes with mobile devices; this potentially increases both the possibility of driving information flows on tourist resources during the sojourn and the possibility offered to the tourist to autonomously combine the components of the tourist product on the spot. Practical solutions are being introduced in alpine tourist destinations, often under the lead of the local or regional tourist office or another co-ordinating actor[4]. Even if mobile business needs specialized mobile contents rather than repurposed website ones (Nielsen, 2003), when compared to e-business it offers at least four potential additional functions (Kliger, 2000):

- mobility: a tourist can be addressed more frequently and cross-selling opportunities during the sojourn increase;
- accessibility: it is possible to use push-mechanisms, by which tourist actors launch context-based and individualised offers and pull-mechanism, by which tourists can find out what is available in a certain tourist destination under the current conditions;
- localization: a tourist can access route planner, tour guides and other functions to know what services are available in a specific spot;
- identification: SIM-cards can be used as electronic signature for electronic payment.

The search for integration processes between tourist actors as well as the tourist participation in the personalization process of the tourist product drive to the following perspective: ICTs, electronic-business and mobile-business can support the accomplishment of an integrated and flexible mountain tourist offer with a multi-channel approach (Cioccarelli, 2003); they can support multimedia interactive products and the exploitation of DMSs (Destination Management Systems)[5] (Buhalis, 1996; Laubenheimer & Carlsson, 1998; Pollock, 1998; Werthner & Klein, 1999; Frew & O'Connor, 1999), through which final users carry out one or more phases of the on-line purchase process.

[4] For an example see the recent experiences of different mountain destinations across Switzerland (Beritelli, Jufer, 2003)

[5] A universally accepted definition of a DMS does not exist; this is reflected in the number of synonyms by which such systems are commonly known:
Destination Databases, Destination Marketing Systems, Visitor Information Systems and a variety of other names have been used when referring to the DMS concept over the past years (Frew and O'Connor, 1999). The difference in approach is further complicated by the fact that both public (government funded regional and/or national systems) and commercial (privately funded systems) systems are now on the market. Frew and O'Connor (1999) state that the basic theme and common dominator across each of these systems is the distribution of information about all tourism operations and attractions in a given geographical area and the capacity of supporting the management of reservation processes. An agreed definition is provided by Pollock (2001): 'the IT infrastructure used by a destination organisation for the collection, storage, manipulation and distribution of information in all its forms, and for the transaction of reservations and other commercial activities'.

All the same, such aspects have to correctly be led back to broader topics of adoption, diffusion and exploitation of ICTs by an organizational point of view. In fact, in order to achieve successful development of a DMS, closer partnership and cooperation is required among tourist actors (Martini, 2000); SME's weaknesses can be overcome through co-operating by pooling their resources and hiring expertise in strategic planning, finance, marketing and information technology. Moreover, a formulate body of literature has been recently critical and sceptical about some of the assumptions made previously because a high failure rate has been observed as several DMSs failed to attract the support and commitment required from both the private and public actors (Buhalis D, Deimezi R., 2003).

Starting from these assumptions, it seems quite obvious that the presence on the web of a whole mountain destination and the creation of DMSs represent pieces of a broader mosaic, where the interaction between enterprises is a *process* which depends on participants, available resources, regulations, norms, culture, context and atmosphere (in terms of conflict or collaboration, trust, closeness or distance in the objective singly persecuted). We retain that the main element to clarify consists in the recognition of peculiar inter-organizational forms in the mountain tourist field, where ICTs have a role of stimulus to facilitate the inter-organizational relationships.

But how do we concretely recognize integrated and flexible tourist offer configurations that really exploit the capacity of ICTs?

A first answer, even if superficial and incomplete, consists in the analysis of the web presence of the main Italian mountain tourist destinations to find real DMSs or excellent reality.

We also used the quality of information contents on attraction factors and their supplying way on the web as *proxy*[6] to deduce the degree of coordination between tourist actors.

Prior to discussing the implications of our findings, it is important to acknowledge that the goal of this analysis was not to offer a usability-centric perspective on purchase behaviour in electronic channels and that we used self-report measures to evaluate the different web sites. Clearly, even if a first managerial recommendation is the importance of paying close attention to the usability of a web site that is to be used by customers for transaction purposes (Nielsen, 2000), our scope was not to adopt a specific web marketing approach.

The empirical evaluation was conducted in summer 2003 on 22 web sites chosen in a way to involve all the Italian alpine regions. The web sites were different for the geographic extension (region, area or individual valleys/spots). In this first phase the focus was on the first two "levels" (to limit the survey sample) plus some interesting web presence emerged during the interviews to key managers and operators and the content analysis of articles, books, reports, etc.

A first empirical result was the variety of contents and typologies of on-line services[7]; this leads to a difficult comparison between different realities; so we focused on three simple qualitative dimensions: completeness of information to do a comparison between alpine destinations to plan autonomously a vacation/sojourn, homogeneousness of information and information integration.

Partial, incomplete or "loose" and not homogenous information supplied from more sources the tourist must pursue across a non-structured "route" (for example with frequent links to outside web sites with different graphics, contents organization, etc.), with different levels of information updating, allow to deduce a deficit of coordination between tourist operators about the on-line offer.

Full, homogenous and updated information in a more structured way allows to hypothesize a higher level of coordination (figure 2).

[6] As a matter of fact, an high degree of coordination already existing between tourist operators could be still non-existent as an effective supplying way of information and services on the Web

[7] Nevertheless, regulations affect - for instance - the possibility of doing e-commerce for local public tourist organizations.

The "partial information offer" type was verified on web sites characterized by an elementary offer of information within the investigated categories (description of places, main attractions, geographic maps, events, simple list of hotels, food & beverage, restaurants and telephone numbers, FAX, e-mail addresses and links to other web sites – for example single hotel web sites – etc.). Information always incomplete, generic or vague and non-integrated are combined with a non-existent integration of the tourist product, a minimal level of innovation (the simple web presence) and allow to hypothesize a low level of on-line offer coordination. The low strategic importance of the web presence which is deduced could coincide with an initial exploration of a more complex project feasibility. Information contents often incomplete are replaced by e-mail addresses and, above all, they address to other web sites (typically for hotels and lift-plan company).

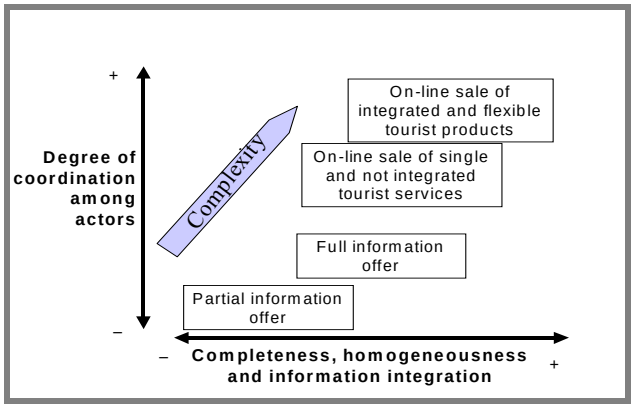

Figure 2. Typology of mountain tourist destination presences on the web.

The "full information offer" type was the most widespread; this kind of web site allow the tourist to collect almost every information about tourist destination; full, deepened and homogenous information requires continuous updating and more organizational and technological complexity; the strategic importance of the web presence is higher but the innovation level is still low; also, it is still absent the projection of an integrated tourist product on the web; nevertheless the level of coordination of the tourist offer is probably higher if compared to the previous type. E-mail addresses are widespread (with an high frequency for hotels and many lift-plant companies and ski schools, with a very lower frequency in food & beverage and restaurants).

The "on-line sale of single and not integrated tourist services" type is remarkable because (Martini, 2000):

- the "strategic content" increases and the business model is very different because it is a real e-commerce project;
- this way cannot be still considered a real DMS because only some services can be purchased on-line; nevertheless, it could represent an exploratory strategy to acquire know-how through a process of learning by doing to sharpen organizational mechanisms of coordination, getting ready for the next evolution.

This type has been found three times only.

The last type is "on-line sale of integrated and flexible tourist products", with an higher level of service integration; it requires high coordination between tourist actors to allow the definition of an integrated product through the web. It represents the accomplishment of a full DMS but it has not been found in any web site. Results are summarized in table 2.

4 DISCUSSION AND CONCLUSION

The theoretical topics and empirical results shown in the paper lead to some conclusions, focused on convergence of organizational and information technology themes in the mountain tourism sector, which are probably useful also for other business network of small and medium service enterprises. First of all, Italian mountain tourism managers need to improve their knowledge about inter-organizational forms (associations, consortia, joint venture, etc.) in order to hit success factors about the designing and planning of tourist development processes, processes which are strongly characterized in terms of local context. Moreover, such managers should adopt dedicated tools and methodologies, coherent and concretely applicable regarding their aims and peculiarities (George and Allen, 1989; Krackhardt, 1990; Soda, 1998; Perrone, 2001) and they should pay attention to the different dynamics between enterprises and to the knowledge and information sharing structures. This is necessary to individualize the main barriers towards the acceptance of network strategies and the factors of success which are able to create a culture oriented to innovation. In effect, the tourist perceives the entire system offer, a unique offer, before he/she perceives the specific services of a single enterprise.

DESTI-NATION	PARTIAL INFORMATION OFFER		FULL INFORMATION OFFER		ON-LINE SALE[8]	
	-	+	-	+	-	+
Region	Lombardia: www.inlombardia.it	Piemonte: www.regione.piemonte.it/turismo Friuli Venezia Giulia: www.turismo.fvg.it Veneto: http://turismo.regione.veneto.it	Valle D'Aosta: www.regione.vda.it/turismo Trentino: www.trentino.to www.infotrentino.com			Alto Adige: www.hallo.com (booking) Valle D'Aosta www.skivallee.it (ski-pass)
Area	Friuli (Piancavallo, Cellina, Livenza): www.piancavallo.com	Veneto: www.infodolomiti.it Lombardia e Trentino: www.adamelloski.com	Piemonte (Susa Valleys, Sangone and Pinerolese): www.montagnedoc.it	Alto Adige, Trento and Belluno: www.dolomitisuperski.com		
Valley/Spot			Alto Adige (Alta Badia): www.altabadia.it Trentino (Val di Fiemme): www.valdifiemme.com (Val di Fassa): www.valdifassa.com	Lombardia (Livigno): www.aptlivigno.it Alto Adige (Val Gardena): www.val-gardena.com Trentino: (S. Martino di Castrozza, Primiero, Passo Rolle): www.sanmartino.com (Valli di Sole Pejo e Rabbi): www.valdisole.net	Valle D'Aosta (Breuil-Cervinia Valtournenche): www.cervinia.it (ski-pass)	

Table 1. Classification of 22 web presence of Italian alpine tourist destinations (July 2003).

[8] Single and not integrated tourist services (in brackets services purchasable).

All the resources of a tourist area develop a cognitive subjective experience in the customer, influencing its experiences and its interactions with the area and the service enterprises, independently from the service bought (Rispoli and Tamma 1995; Perrone, 2001). It is just the consciousness that are the tourist offers and not the tourist enterprises that compete on the market which appears to be the gap that must be covered by the entrepreneurial culture in Italian mountain tourism; undoubtedly the coordination and the inter-organizational relationships between mountain tourist SMEs supported by ICTs represent other challenging topics both in terms of analysis, because of the considerable heterogeneity and complexity of the context, and in terms of specific "solutions". According to Pollock (1999), one of the main context factors that contributes to the coordination complexity is the structural fragmentation of the mountain tourist offer. There is a geographic fragmentation due to the territory, separated in valleys, correlated to a socio-cultural context that emphasizes phenomena of "parochialism". There is a sectional fragmentation and a lack in the integration of characteristic business processes. Finally there is a functional fragmentation: local tourist organizations traditionally separate their activity in offices that operate in a relatively autonomous way, developing functions of marketing, information and tourist welcome, data collection and elaboration of tourist flows and tourist offer in their own area of competence. Such fragmentation behaves limited capacity to develop and to share knowledge about the changeable tourist behaviour; it leads to a lack in the capacity of supplying information to tourists *where and when they want*, before and/or during the use of tourist services; it also leads to an objective difficulty in the management of characteristic business processes (Cioccarelli, 2003).

Even if ICTs and web technologies already existing can support the accomplishment of inter-organizational information systems and real full DMSs, our empirical findings seems to highlight that *the real obstacle is not the technology, but the will to co-operate of all the actors involved*; our proposition is that ICTs do not guarantee success; they should be considered like important organizational tools because it is not possible to ignore the interdependence connections between strategic, organizational and socio-cultural factors that are capable to restrain and to undermine projects which are *technologically* perfect. This is the reason why in this working paper we refer to a "convergence process" of such topics; this process now appears more "theoretical and wished" rather than "concrete and visible". The background of all topics and results shown in this paper could be also individualized in an entrepreneurial culture gap that seems to be a strong barrier to change. The small service enterprises should understand the concept of "system success", and not only the concept of "individual success". Probably, this is the main obstacle for the consolidation of a network which is really integrated "at the same time" in terms of logic organizational structure, inter-organizational information systems and web-technologies.

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RESEARCH PROPOSAL: INFORMATION SYSTEMS MANAGEMENT IN INTER-ORGANIZATIONAL CONTEXT - CASE SOCIAL SERVICE NETWORK

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1 INTRODUCTION

It is important to distinguish between "network of organizations" and "networked organizations". In this paper is term "network of organizations" used in meaning interconnected organizations in exchange relationship. So this can understand as market where organizations make macro level network. Networked organization is defined to be an intentional network of restricted group of actors. The relationship is long lasting and therefore it can understand as strategic network. In this paper is used term strategic net in the meaning of strategic network. This follows terminology of Möller and Swahn (Möller and Svahn 2003). They have expanded strategic net use in non-profit organizations too.

Miles and Snow (Miles and Snow 1992) have classified 4 organizational form: functional, divisional, matrix, and network. Network form has emerged in the 1980's when big company downsized and outsourced to the core competencies and de-layering management hierarchies. Network can see as a historical continuum from functional to the network model. Generally when environment chances traditional organizational forms' become deficiency and new forms emerged. It has been argued that information systems are one reason for downsizing and networking (Brynjolfsson, Malone et al. 1994).

The focus in my research is in term networked organizations and what kind of requirements it will set to information systems and especially it's long range planning.

2 NETWORK THEORY

Araujo and Easton have identified 10 different schools of networks thought. Those schools are: Social Networks, Interorganization theory, Actor-Network theory, Network of Innovators, Network Organization, Policy Networks, Networks in Economic Geography, Comparative Studies, Entrepneurship Studies and Industrial Networks (Araujo and Easton 1996). Next is Interorganization theory, Network of Innovators, Actor-Network theory and Industrial Network approaches presented more accurate.

Interorganization theory has its disciplinary background in sociology and social policies. Actors in this thought are mainly government agencies and non-profit organizations. In the area like health and welfare many issues are too complex to be managed by one agency. Example of those is homeless. Their primary need are for temporary shelter, food, physical health care and perhaps mental health and substance abuse treatment.

Originally in interorganizational theories has the focus been in non-profit organizations. Currently it has been expanded to profit organizations. One example of this new approach is called interorganizational relations. (Araujo and Easton 1996).

It is argument (Provan and Sebastian 1998) that organizations become network member to enhance their own individual performance. In interorganizational theories is one important research question the efficiency of the whole network.

Network of Innovators theories are interested in how an innovation is made by a network of many firms. The actors in this theory are innovation itself, individuals and organizations. Networks of innovation approach is moving its focus from issue of sharing know-how to a focus on interorganizational relationships and innovation which occurs within and across organizations. The theory has some overlapping with Social Networks and Industrial theories

Actor-Network theory can be presented as an attempt to build on earlier insight in the sociology of science and technologies. The network consists of social relationship according traditional social

relations. In addition the network has material, that is in non-human form. This approach has many similarities sociotechnical approach, which is quite common in the field of information systems research. Perhaps the most important difference between actor-network theory and other network approach is the emphasis on process rather than structure. The social relations are now both medium alike outcome.

Industrial network has originally been constructed as a network approach to industrial marketing and purchasing. The scope has broadened all forms interdependencies and relationship in organizational markets. The approach hasn't clear disciplinary home.

3 WHY ORGANIZATIONS FORMULATE INTERORGANIZATIONAL NETWORK?

Oliver distinguished between three different interorganizational structures, mutual adjustments (voluntary), alliance structures (intermediate) and corporate structures of coordination (mandated). Oliver has identified six critical "contingencies" for interorganizational network(Oliver 1990):

- Asymmetry, where organizations are motivated to control other organizations or theirs resource and to preserve own power.
- Reciprocity, where organizations jointly to pursue common or mutually beneficial goals
- Efficiency contingencies are internally rather than externally oriented. Those can be increases in return of assets or reduction in unit cost or cost per client.
- Stability or predictability is critical contingency of relationship formation. Interorganizational network serve as coping strategy to chance in environment.
- Legitimacy, where organizations attempt to justify their activities and outputs to institutional environment and to be seen law-abiding and socially responsible.
- Organizational learning is one important reason too. Firms collaborate with other firm or organization. Product developing is rare made by one firm. In developing process involve firm's customer, supplier and even competitors. Information technology is one facilitator in interorganizational learning (Scott 2000).

Firm's strategy researchers have searched sources of competitive advantage(Dyer and Singh 1998). Two prominent views have emerges regarding the sources of supernormal returns. Porter has suggested that they are more industry depend than firm depend. The resource-based view (RBV) of the firm sees that the supernormal returns are a matter of the firm's internal resources. The RPV scholars consider competitive advanced by capabilities of one firms- not as a result a network. Dyer and Sing have another look to competitive advantage. Firms can gain it with co-operation with other. By other ways: Firm's critical resource can be beyond firm's boundaries. Dyer and Sing call their view as Relational View. They have expanded Oliver's framework from company level to the network level.

Strategic nets are "inter-organizational" ties, which are strategically important to participation firms or other organizations Relationships can be strategic alliances, joint venture, long-term buyer-supplier and other ties (Gulati, Nohria et al. 2000)

The main questions that strategic network theorists seek to answer are as follows(Amit and Zott 2001):

- Why and how are strategic networks of firms organized?
- What is the set of inter-firms relationship that allows firm to in the marketplace?
- How is value created in networks?
- How do firms' differential positions and relationship in networks affect their performance?

The work will consist from two parts. In first is presented literature review of strategic information system planning and networking theories. In second part will handled and analyse presented case organization.

4 HOW ORGANIZATIONS CREATE INTERORGANIZATIONAL NETWORK?

Venkatraman and Henderson (Venkatraman and Henderson 1996) have argued, that virtual organization isn't one form of structure like functional or hierarchical. They call it with term virtual organizing, virtualness as a strategic characteristic applicable to every organization. The question is more on architecture than structure. They three dimension or vector which have some overlapping and interdependencies. Those vectors are divided into three temporal stages. IT role is increasing later stages.

- The customer interaction vector (Virtual encounter) deals with new challenges and opportunities to company-to-customer interactions. The stages are: Remote experience of products and services, Dynamic customization and as third Customer communities.
- The asset configuration vector (Virtual sourcing) focuses on firm's requirements to be virtually integrated in a business network. First stage is Sourcing modules, second Process interdepencies and third Resource coalition.
- Knowledge Leverage (Virtual Expertice) is concerned with the opportunities for leveraging diverse sources of expertise within and across organizational boundaries.

5 POTENTIAL INTERESTED AREAS

There are some approaches, that are not undergone in this paper and should be concerned later. Those are at least trust and knowledge management.

6 RESEARCH QUESTION

The aim of the paper is to research how networked organization should manage their information system in networked context. The research area is in strategic level. The question is what kind of information systems strategy is needed to maintain strategic net. While information systems can understand, as infrastructure of strategic net should issues related how information system and its strategy improve building strategic net.

The information systems in strategic nets can be based on information sharing or knowledge sharing. Information sharing system means traditional inter-organizational information systems (IOS). Those are typically transaction base system like supplier-buyer system. Knowledge management system shares knowledge between different organizations. In the area of strategic net is inter-organizational learning important question. (Khanna, Gulati et al. 1998). Therefore is important task to consider what aspect inter-organizational learning has to strategic level of IS management.

In this research I try to find to answer to the question, why and how are strategic nets organized. Why question will answer for what purpose is strategic nets created. So what are the vision and goals of it. This question is important when defining IS strategy. Answering how question will give answer how to create strategic nets. Both answers are critical while formalizing strategic information system plan.

In research area of network organization is going intensive debate on how to manage or control inter-organisational nets or it is impossible due of self-organizing nature networks. In research I have believe that management is possible. Inter-organizational information systems are one part of portfolio to manage those nets. Anyhow this question must be concerned carefully.

Another important factor is how should strategic net create? Current studies do not adequately cover the issues how to mobilize and coordinate group of autonomous actors. (Möller and Svahn 2003). The research question in that context is how information system strategy and the process to development it will help to create strategic nets.

7 RESEARCH AREA

This research touches many scientific areas: e-government, strategic information systems management, strategic management, relationship marketing, knowledge management and networking theory. Main interest is in strategic management field. Operationaliosation of strategic nets we can define generic requirements for strategic information system planning.

8 MOTIVATION OF RESEARCH

Business networks have been the subjects of many different approaches. Araujo and Easton have identified 10 different school or tradition (Araujo and Easton 1996). The majority of research has focused on the general characteristics of originally evolved network. Much less intention has noted to intentionally developed network, their management and management of information systems.(Möller and Halinen 1999)

In the field of information systems and its strategic planning has done research in the area of inter-organizational networks. Those net have been typically based on transaction systems. In IS field has done lot of research in knowledge management. The focus in this paper is not only in knowledge sharing among different organization but also how to improve learning between organizations. How will long-term information system plan support those goals.

9 PRACTICE MOTIVATION

Many authors argument that network is 21st century's organizational form. To understand how and why network are organized is important question for manager. Information system has essential role in those networks. Networks and especially strategic nets are new phenomenon and need therefore research. If strategic nets are on the whole manageable and if those need information systems for different purpose is obvious that strategic nets need strategic information system planning.

Main issue of this paper is to develop theories of strategic IS planning in strategic net.

10 CASE DESCRIPTION

We have now one case. It is joint venture owned by municipalities in southwest part of Finland. The firm is concentrated on social care and it is non-profit organization. The name of firm is Vasso. Its aim is share and pass information between actors in social care. The firm is quite new. It is established in 2002. Municipalities and 3rd sectors mainly run social care in Finland.

We see Vasso some sort of hub in inter-organizational network in social care. It is too early to estimate how will the inter-organizational network develop. Creating strategic net is challenging but not impossible task (Loeser 1999; Möller and Svahn 2003).

The main goals are to form loose integrated network, where Vasso is hub or facilitator of this strategic nets.

We have done 10 interviews among different organization in Vasso. The scope in those interviews has been in evaluating current status of their information systems.

11 FUTURE PLAN

Next steps are to analyze those 10 interviews and to write literature review.

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ARE INNOVATIVE MOBILE BUSINESS MODELS INCLUDING ASSETS COMPLEMENTARITIES?

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Abstract

Drawing from the consolidated resource based view, dynamic capabilities are considered among the main driver to foster innovation. Underlying is the assumption that the performance of a corporation is ultimately affected by the ability to either match over time its set of resources and competencies to the changing environment, or to implement effective strategic alliances with external actors. Complementarities are to be sought when changes in the strategic configuration of resources and competences are required, especially within information intensive industries. Dynamic environments suggest adopting a systems dynamics perspective, when it comes to investigate business-related behaviour. Business models analysis combined with systems dynamics approach provides powerful frameworks of analysis to study non-linear dynamic networks, which are at the basis of resources acquisition or development processes.

1 INTRODUCTION

With competition posing new challenges over firms, and as business landscape becomes more and more dynamic, the understanding of the factors leading to a sustainable competitive advantage is considered as an essential end of researches on strategic management. Moreover, interrelation among diverse actors operating within the same industry is more frequent, and coopetition rather than competition has proven to be more powerful to depict the strategic processes that shape the form of certain industries.

Drawing from the consolidated resource based view (Rumelt, 1984, 1987, 1991; Wernerfelt, 1984; Dierickx and Cool, 1989; Barney, 1986 and 1991; Amit and Schoemaker, 1993; Peteraf, 1993), dynamic capabilities are considered among the main driver to foster innovation within organizations (Teece et al., 1997; Iansiti and Clark, 1994; Eisenhardt and Martin, 2000), necessary for firms to upgrade with environment requirements. Underlying is the assumption that the performance of a corporation is ultimately affected by the ability to either match over time its set of resources and competencies to the changing environment, or to implement effective strategic alliances with external actors. Accordingly, several empirical studies have tried to assess the relevance of factors operating at industry- vs. firm-level for the competitive advantage (e.g. Schmalensee, 1985; Rumelt, 1991).

Very close to the concept of dynamic capabilities, in our view, is the issue of complementary assets. In fact, complementarities are to be sought when changes in the strategic configuration of resources and competences are required. With a special remark on information intensive industries, complementary systems are especially relevant. Dynamic environments suggest adopting a system dynamics perspective, when it comes to investigate business-related behaviour. Complexity theory combined with system dynamics approach provides a powerful framework of analysis for the study of non-linear dynamic networks in which unclear and distant cause-effect consequences often arise (Forrester, 1969; Senge, 1990).

We apply our theoretical framework to the Italian mobile phone industry. Over the last decade the latter has been experiencing a fast growing penetration rate, due to the interplay of several phenomena. Indeed, at the dawn of a new era for mobile communications and in face of a relevant uncertainty on the development and diffusion of the third generation services, a deeper understanding of the critical success factors in the mobile business is needed for the formulation of the strategies to compete in the emerging scenario. The choice of the country is due to the relevance of the Italian market in terms of diffusion and usage intensity of mobile services that depict a particularly profitable market. As in all the European markets, also in Italy the industry structure was originally characterized by the monopoly of a firm. This structure has rapidly changed due to the progressive liberalization of the market, leading to a greater variety of designs, in which the existing business model underwent a deep reorganization, and new ones emerged. This scenario offered a great challenge for the mobile operators, which had the chance to engage a fierce competition in order to gain competitive advantage and win a greater market share and thus greater profits. Such a context gave us the chance to deploy an intense research that could unravel the diverse facets of the strategic rules, which are related to the competitive phenomena of the Italian mobile industry. When it comes to mobile services and products, it is arguable that they are supported by networked technologies, whose complexity lays on the need of coordination among a number of actors. As innovation is pursued and new value added services and products are launched, competition between actors (network operators, content providers, vendors) increases. Moreover, cooperation, collaboration and consolidation are key issues, as alliances are built between firms in complementary industries. As a consequence, we pose the question whether integration of external strategic inputs may be preferable than the choice to maintain control over the strategic factors.

This paper is organized as follows: firstly, a brief literature review is offered both on dynamic capabilities and business models, and on dynamic systems approach. Subsequently, an overview of the

research setting is drawn, namely the Italian mobile telecommunications market. Based on both the theoretical review and the description of the market, in the third section the design of the research is proposed in order to verify the role of complementarities on the effectiveness of business models.

2 THEORETICAL FRAMEWORK

Firm performance has been at the core of researches within the field of strategic management and industrial organization for decades. Studies on why do firms differ vary from Schumpeter's process of creative destruction, refined in the evolutionary theory proposed by Nelson and Winter, to the framework on dynamic capabilities systemized by Teece, Pisano, and Shuen (1990). Scholars stressed the impact of firm-specific factors for corporate performance, proposing the so-called 'resource-based theory' of the firm. A main argument of this theory is that resources, that are unique, scarce and difficult to imitate should be leveraged to obtain superior rents (Rumelt, 1984, 1987, 1991; Wernerfelt, 1984; Dierickx and Cool, 1989; Barney, 1986 and 1991; Amit and Schoemaker, 1993; Peteraf, 1993). When those specific resources are appropriately coordinated and integrated, the development of core competencies or strategic assets may arise (Amit and Schoemaker, 1993; Selznick, 1957; Nelson and Winter, 1982; Prahalad and Hamel, 1990), and the firm's competitive advantage ultimately stems from overlapping its internal capabilities with "strategic industry factors" (Amit and Schoemaker, 1993). The theory on firm dynamic capabilities can be presented in different ways; nevertheless a focus on strategy, structure, and core capabilities of a firm is effective in explaining firm character (Nelson, 1990). Although the development of certain core capabilities would be of value over a specific slot of time, dynamic environments cannot assure a durable advantage over competitors. To be successful for any length of time a firm must innovate. From this perspective, innovation is viewed as the ability to reshape its core competencies in order to cope with newly challenging environments (Teece et al., 1997; Iansiti and Clark, 1994; Eisenhardt and Martin, 2000). In Teece's terms, the firm capabilities must include control over, or access to, the complementary assets and activities. A relevant type of capabilities is constituted by the organizational ones, in that they allow firm to develop complementary assets, rather than taking them as given (Teece et al., 1997). Moreover, emphasis is posed on the issue of fit, which stems from the competence to overlap firm's assets with strategic industry factors (Amit and Schoemacker, 1993; Nelson and Winter, 1982).

The process of assets development led scholars to distinguish between stock- and flow-resources (Dierickx and Cool, 1989). Within a dynamic perspective of resource-configuration, the acquisition/development of resources can be considered as an investment to bestow flow features to the company's set of assets. Those features imply that existent assets could be modified either in an incremental way or by destroying those assets which no longer fit with the environment. In this way, an optimal configuration is always sought, which matches the environmental dynamics at its best. Furthermore, reiterating managing resources and capabilities over time may allow for the arise of relevant learning effects. The latter, which stems from an ongoing process of accumulation of managerial knowledge, increase the efficiency of managing the dynamics of stock and flow resources (Boccardelli, 2002).

As far as complementarities are concerned, it has been noted that the rise of information-based industries boosted the strategic importance of complementary systems (Shapiro and Varian, 1990). Technical systems are linked to each other and to applications. Products have value not in isolation but only when combined with other products (Katz and Shapiro, 1994; Christensen, 1997).

Accordingly, strategic interaction among firms has been boosted. In fact, strategic alliances have become increasingly common in recent years. In terms of the resource-based view, strategic alliances are extremely powerful for a firm to gain access to other firms' valuable resources. More specifically, firms engage in a strategic alliance sharing their own system of property and knowledge-based resources, which are valuable to the market. In this way, systems of resources are combined and integrated, to provide an improved strategic fit.

In keeping with other authors in the field, the current research assumes systems integration stems from either the combination of complementary resources and competencies owned by a focal firm, or via the integration of diverse firms' stock of assets within a strategic alliance framework. In our research, business models are considered from a strategic perspective, and they are regarded as a framework in which assets are combined and integrated. Far from being stable, this framework can be viewed as a dynamic system, where changes and a re-combination of assets and relationships are required and encouraged. This in also in line with the notion of technological systems, which refer to them as a network of agents interacting in a specific technology area under a particular institutional infrastructure or set of infrastructures, and involved in the generation, diffusion, and utilization of technology (Carlsson and Stankievicz, 1991).

Under these premises, we found useful insights in the systems dynamic approach. Systems Dynamics applied to the Social Sciences provide us with innovative understanding of the strategy process. System dynamics are characterized by positive and negative feedbacks as systems co-evolve far from equilibrium, in a self-organizing manner, toward unpredictable long-term outcomes. When a dynamic systems is modelled to fit a topic relevant for social sciences, it can be noted that, unlike in physics, where current parameters may determine the future course of event, in the social sciences, knowing all the current parameter does not, in general, suffice to predict the future with certainty (Mashler, 1995).

As strategic studies evolved time after time, the need for analytical frameworks have become to be required, which accommodate the full dynamic complexity and uncertainty, which characterise contemporary strategic management. A shift has been made from the analytical perspective known as "design" or prescriptive school, towards the "emergent" or crafting school (Mintzberg, 1990; Ansoff, 1991; Lynch, 1997). The prescriptive model can be seen as a linear, sequential process (Fowler, 2003), whilst the crafting school would rather comprise more systemic with cause and effect linkages and sequence of action that are iterative, dynamic and non-linear (Mintzberg, 1987). More recently, new insights have been added to the complex dynamic processes by the complexity theorists (Kauffman, 1993; Stacey, 1996). Firstly, strategic planning and control have been pondered within the paradigm of the "stable equilibrium" (Stacey, 1995). Such equilibrium is reached setting a target linked to the mission statement, and then monitoring the actual performance or outcomes for comparative purposes. Mechanisms of feedback and feed-forward control are activated to ensure that the actual performances are in line with the target requirements.

Some part of the literature recognizes that the system is always pushed towards some equilibrium conditions, by means of stable attractors (Stacey, 1995), or "equilibrium magnets" toward which strategic behaviour is inevitably drawn. Nevertheless, it may happen that the path between two feasible end-states may prove to be unviable.

In the same way, within the context of strategic management, planned alliances may result to be ineffective, in that either the integration of competencies does not arise or is incomplete, or required complementarities among assets are not verified. In managerial-life, unlike in physical settings, complexity deals not only with the number of components of the system. It rather involves non deterministic and non linear characteristics of the components, as well as the interconnections amongst them. A notion of complexity that fits the domain of organisational dynamics is provided by Stacey (1996, p. 10):

The science of complexity studies the fundamental properties of non-linear-feedback networks, and particularly of complex adaptive networks [They] consist of a number of components, or agents, which interact with each other according to a set of rules […].

In particular, complex systems are characterized by feedback loops. Those loops may be natural, but are often created to reduce the diversity between actual performance and the desired target. Output may be fed back, in order to create either a negative configuration, when the system is guided towards a defined equilibrium condition, or a positive configuration, when a multiplier effect is sought.

Inertia is a second property of complex systems (Larsen and Lomi, 1996), by which elements within the system maintain their current state over time.

The third character of complexity is nonlinearity, as outputs are neither directly referred nor directly proportional to given inputs. In particular, butterfly effects may arise, when unclear and distant cause-effect consequences arise (Forrester, 1969; Senge, 1990). Advances in complexity theories are most prominent in the physical and biological sciences but it has been increasingly proving its potential impact on social science in general and management in particular. Complexity theory combined with system dynamics approach provides a powerful framework of analysis for the study of non-linear dynamic networks in which unclear and distant cause-effect consequences often arise (Forrester, 1969; Senge, 1990).

3 RESEARCH SETTING

The Italian market saw the birth of the mobile TLC industry in the late '80s. Though being relatively young, the mobile industry has faced several innovative waves: either technological, or regulatory, or else market driven. Albeit our study of firm- and product-level data set covers just a few decades of time, the intrinsic dynamic nature of the industry has to be considered. Technological innovations related to the TLC industry have been introduced very often, replacing each other at a generally high speed. In this way, in our research we encountered a particularly good setting in which to understand the effect of exogenous shocks on competition. The research question particularly assessed is related to the nature of the competitive advantage, and therefore we focused on the factors that granted the success for some competitors and decreed the failure of others. By exploring each of these waves in depth, this paper gives insight of the competitive dynamics. It furthermore helps unraveling the process of firm-specific resources exploitation, which is fundamental in order to win the competitive game.

The Italian mobile TLC industry has been characterized by an astounding diffusion. On the other hand, the liberalization of the telecommunication industry drove the competitive pressure, which in turn remodeled its structure, formerly characterized by the monopoly of the one state backed firm. Driving such an upward diffusion have been also the deployment of innovative technologies, as well as the evolution of the competitive issues. A boon to the penetration rate was provided at the beginning of the '90s, when the TACS technology, labeled as first- generation type appeared, replacing the analogue technology. In addiction, the operator began to focus its offering on the differentiation of targets and of tariffs, which turned out to be more affordable, and thus settled the activation of a development phase in the PLC model. In 1995 a wave of radical technological change made the TACS technology enter its maturity phase, when a digital mobile technology, labeled GSM or second-generation type, was deployed. More recently, the third generation of mobile technology has been set through the definition of the UMTS standard.

A second shock to the industry was provided by the entry of the second mobile operator: Omnitel Pronto Italia. Not only it posed the question of competition for the first time ever in the story of the industry, it also pushed a redefinition of the strategic set and of the resource and capabilities needed for succeeding. At odds with the incumbent, OPI's strategy has always been focused on a consumer-centric orientation, as well as a high commitment on the quality of the services offered. The cellular services market has continually evolved as operators seek new sources of competitive advantage. However, a key issue within the industry is the introduction of the pre-paid charging concept for voice telephony. Not only it was a boon for mobile operators, who previously couldn't provide access to those they considered to present credit risks, but it was also another reason mobile penetration has increased so quickly. The mobile industry was then more profitable than ever, attracting new competitors, namely Wind, which entered in 1999 and Blu, the last mobile operators that entered the market in 2001.

Besides voice calls, mobile communications comprise data services. The most widely used mobile data service involves person-to-person data communications: the success of mobile messaging has been phenomenal and a surprise to both operators and users. The most widely used mobile messaging service is SMS, which allows users to send messages up to 160 characters long via their mobile phone. Although it is possible to trace back the causes of the tremendous success of this service, we are mostly concerned with the managerial implication that such an innovation brought to the industry. Operators hardly expected this simple technology to become a popular service and a significant revenue booster. We, then argue that innovative Value Adding Services (VAS), which have become to be offered as an innovation of SMS, represent an application of a disruptive technology (Christensen, 1997), which have the strength to modify the predefined evolutionary path of the industry. Innovation brought by new technological platforms, in fact, gave to new actors the chance to enter the market, constituting a shakeout of the industry.

4 METHODS AND MEASURE

The above presented brief overview of the industry evolution allows a first understanding of the dynamics of the mobile phone industry within the Italian context. The increasing competition within the industry came along with an intensification of the innovation rate. In fact, as the market became more mature, users have developed a better understanding of the mobile services. Accordingly, a consistent market segment has proved to be interested in value added services. The latter are data-based services, which are developed by content and service providers, and are delivered by network operators. Such a sophistication in the tastes of the users calls for a better integration of different actors in the supply side. In fact, providing value added services gives suppliers the chance to charge the users with premium price, thus driving wealthier streams of revenues.

In our research we take business models as focal units of analysis. More in particular, we are interested in investigating the role of complementarity within the resources and competences required to develop certain business models. We focus on the specific resources and capabilities owned by each competitor in the market, in order to deepen the understanding of mobile products and services, with a focus on the underlying business models.

By integrating a strategic theoretical background with a dynamic systems perspective, we aim at the creation of subsystem model using “stock and flows” to represent accumulations of certain entities or state variable on one side (stocks), and the flows that create or deplete them on the other (flows). Not only tangible factors are examples of stock and flow. Indeed, also intangible factors, such as competencies, can be addressed to as stocks that can gradually rise or fall over time. Upwards and downwards movements may be caused by net flows that arise from within the organisation but also from outside.

When it comes to mobile services and products, it is arguable that they are supported by networked technologies, whose complexity lays on the need of coordination among a number of actors. As innovation is pursued and new value added services and products are launched, competition between actors (network operators, content providers, manufacturers, system developers) increases. Moreover, cooperation, collaboration and consolidation are key issues, as alliances are built between firms in complementary industries. As a consequence, redefinition of the balance of economic power among actors occurs. In conducting our study, we pose the question whether integration of external strategic inputs may be preferable than the choice to maintain control over the strategic factors. As far as the business models are concerned, we refer to these alternatives as proprietary business models vs. open business models (Figure 1).

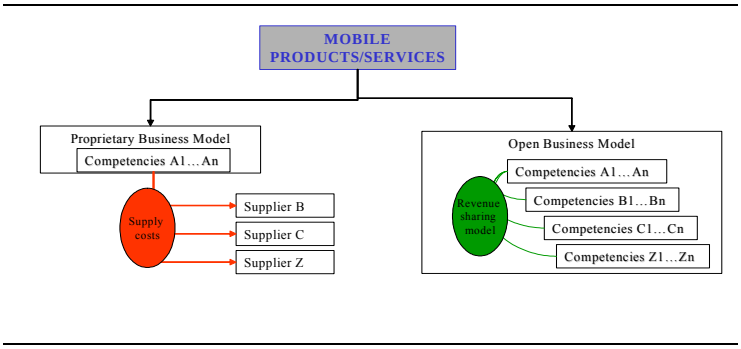

Figure 1. Proprietary vs. Open business model

We refer to the value-chain integration model, as it has been defined by Tsalgatidou and Pitoura (2001).

From a systems dynamic perspective, it is possible to investigate how the two types of business model would work when placed in an experimental environment.

As shown in figure 2, the proprietary business model would predict that an internal combination would happen, once the right competencies to fit the market requirements are defined. In fact, the focal organization, namely the network operator would try to internally combine the required competencies, which could stem either from its own baggage or from external sources. Through the internal combination, a value offering is delivered to the market, in term of mobile services which are marketed by the network operator, and branded by the operator itself.

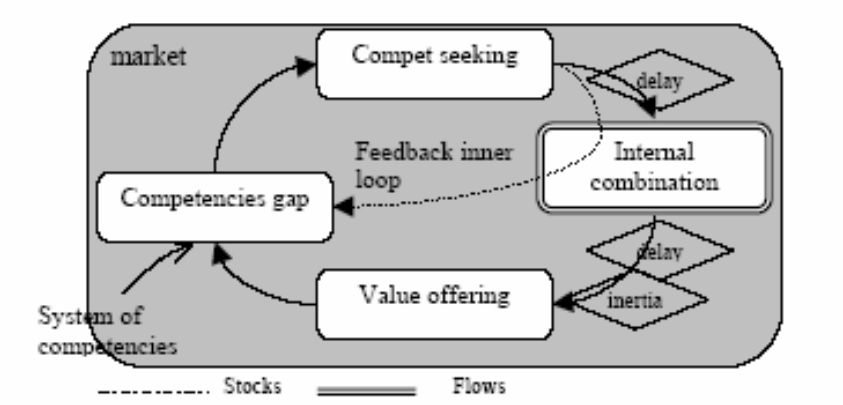

Figure 2. Dynamic of the Proprietary business model

On the other hand, when the open business model is taken into account, integration of competencies appears to be the crucial phase of the process (figure 3). In fact, the network operator, who understands that she does not possess all the required competencies, turns to the group of possible coopetitors. Here, integration between actors makes it possible to reach the configuration of competencies that best fits the market requirement. Thus, the mobile services are offered to the market through the value offering. At odds with the previous case, though, value offering here is clearly referred to all the actors of the business-model based interfirm alliance. This means that the ultimate users themselves acknowledge the value of all the suppliers of the services.

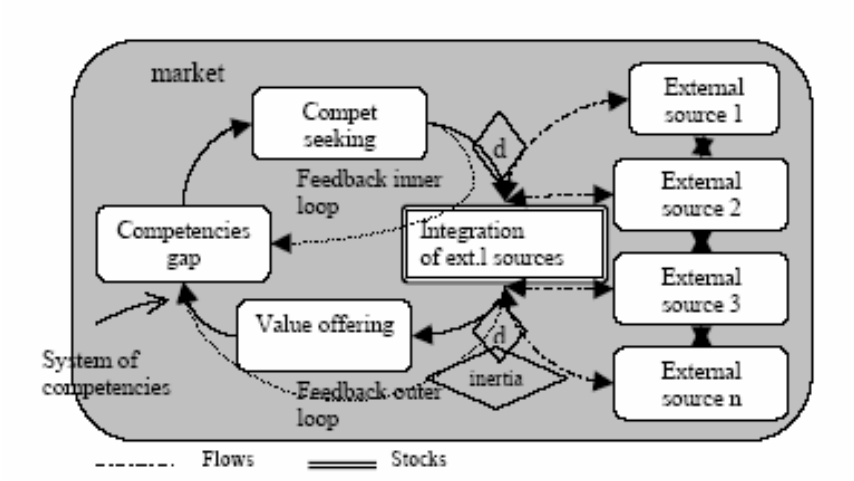

Figure 3 Dynamic of the Open business model

5 DISCUSSION

In both the cases presented in figure 3 and 4, the process starts with problem recognition. This is in fact a classical element of the systems dynamic approach.

The loops are characterized by stages of:

Information gathering, when the network operator deploy business intelligence activity in order to understand what the market is demanding, and to what degree it is mature to adopt innovative mobile services;

Analysis, when the operator analyzes the required competencies behind the market requirements;

Decision-making, when the operator chooses between internal combination and integration of competencies;

Implementation, when the value offering is eventually delivered to the market.

However, this is not necessarily a linear, open-ended sequence. In fact, both figures enlighten loop feedback system and inertia mechanism. Nevertheless, a dynamic iterative approach towards strategy development is presented. This approach shows that the process lasts until it converges to an outcome.

The main differences between the Proprietary and the Open business model are referred to:

- Combination vs. Integration
- Delays
- Inertia
- Costs
- Outcomes

6 CONCLUSIONS AND FURTHER DEVELOPMENT

With a specific reference on the main Italian mobile operators, and through the identification of the key variables of the considered alternative models, we defined a statistical analysis of the correlation between model effectiveness, taken as the dependent variables, and complementarities, measured through selected items. In particular, we are currently in the process of data collecting, in order to validate our assumptions, which have been used to build our models.

Our research would then get a progressive stadium when all the data set is available, and significant result can be inferred.

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TRACK: KNOWLEDGE MANAGEMENT

Track Chair

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Participants

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Sari Vesiluoma

INFORMATION SYSTEMS DISCIPLINE: HOW DISTANCE LEARNING CAN IMPROVE TEACHING METHODS?

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Abstract

This article intends to analyze the problem of educational content of the subject "Information Systems" and particularly the resources needed for an innovative and efficient teaching of this subject through Internet. The document draws the benefits and the drawbacks of distance education, and drafts the approaches needed to improve the Information Systems teaching methods.

***Keywords**: Information Systems teaching, e-learning, collaborative learning, virtual team project, technology-mediated education, learner satisfaction.*

1 INTRODUCTION

The Internet and World Wide Web (Web) are changing the very nature of society in ways unparalleled since the industrial revolution. It is affecting local, national and global economies and their infrastructures. Information and learning contents are available at any time at any place to any Internet user. This is creating tremendous opportunities for academic institutions and training organizations to provide on-demand Web-based education and training via virtual learning environments. The same time, same place, only some people instructor-led classroom-based traditional learning environments are giving way to anytime, anyplace and anybody learning/training models that are based on active utilization of the Internet, Web and state-of-the-art software, multimedia, networking, communication, teaching, learning and information technologies (Uskov 2002). E-learning has a proven future and will continue to develop and gain greater and greater significance in the field of higher education and in particular for the methods of teaching Information Systems discipline in the Universities.

2 INFORMATION SYSTEMS DISCIPLINE

Information systems as a field of academic study began in the 1960s, a few years after computers were first used for information processing by organizations. As organizations extended the use of information technology to operational processes, decision support and competitive strategy, the academic field also grew in scope and depth.

In the same way that Universities have degree programs in organization functions of financial resources management, marketing resources management, and human resources management, a degree program emerged for information technology resources management.

“Teaching Information Systems were always affected by the underlying reality of the state of the art of technology” (De Marco, 1998).

And also:

“The study of information systems is a multi-disciplinary subject and addresses the range of strategic, managerial and operational activities involved in the gathering, processing, storing, distributing and use of information, and its associated technologies, in society and organizations” [UKAIS Newsletter, 15th May 1995].

Typically IS courses integrate computing concerns with those of management and business. Though the influences of computing science and management are evident, little agreement is evident on the root disciplines of the field. science,

3 WHY INFORMATION SYSTEMS?

We want to give now a more precise idea about IS course characteristics and contents shared by the academic world To understand why IS is the ideal course for a distance learning.

At the beginning it is fundamental to say that IS, as a field of academic study, uses a number of different names. The variety of labels reflects both the historical development of the field and different ideas about how to characterize it, and the different emphases that were available when programs were begun. In general, the following terms are equivalent and are all incorporated in the term information systems: Information Systems, Computer information systems, Information management, Information technology resources management, Information resources management and Management information systems.

During the history of the information systems studies, we have witnessed different attempts directed at building a curriculum that allowed the reaching of an agreement on a common minimum of contents. It has always been a difficult task, both for the relative innovation of the theme and for the technological evolution (for example: PC pervasivity and Internet) that have often imposed schemes and matters to the field of study.

The official and more known attempts to build a curriculum of studies have primarily been affected by academic associations, reference periodicals, professional associations, at times in a connected way.

Without repeating the various steps and attempts to describe the typical contents of IS teaching, we make reference to the "Final report of the undergraduate information systems model curriculum - IS 2002" above all for the vast number of associations that have approved it.

However, IS 2002 does not represent a universal global IS curriculum. The model curriculum for undergraduate degree programs in information systems is based on the typical degree structure in USA and Canadian universities. The IS model curriculum can serve as a useful reference to curriculum designers and developers outside North America in designing and developing information systems degree programs as its predecessors have done over the past decades.

Gorgone et al (2002) described for each course in IS, the title, prerequisite and catalog description (see Table 1).

Course Number & Title (prerequisite)	Catalog Description
IS 2002.P0–Personal Productivity with IS Technology (basic word processing, spreadsheets, e-mail, and Web browsing)	Students with minimal skills will learn to enhance their personal productivity and problem solving skills by applying information technologies to problem situations and by designing and using small information systems for individuals and groups.
IS 2002.1–Fundamentals of Information Systems (IS 2002.P0)	Systems theory, quality, decision-making and the organizational role of information systems are introduced. Information technology including computing and telecommunications systems are stressed. Concepts of organization and information system growth and re-engineering are introduced.
IS 2002.2–Electronic Business Strategy, Architecture and Design (IS 2002.1)	The course focuses on the linkage between organizational strategy and networked information technologies to implement a rich variety of business models in the national and global contexts connecting individuals, businesses, governments, and other organizations to each other. The course provides an introduction to e-business strategy and the development and architecture of e-business solutions and their components.
IS 2002.3–Information Systems Theory and Practice (IS 2002.1)	Students who have constructed personal information systems will be exposed to the theory of the IS discipline. Application of these theories to the success of organizations and to the roles of management, users and IS professionals are presented.
IS 2002.4–Information Technology Hardware and System Software (IS 2002.1)	Principles and application of computer hardware and software will be presented through lecture, installation, configuration, and operations experiences.
IS 2002.5–Programming, Data, File and Object Structures (IS 2002.1)	This course presents object oriented and procedural software engineering methodologies in data definition and measurement, abstract data type construction and use in developing screen editors, reports and other IS applications using data structures including indexed files.
IS 2002.6–Networks and Telecommunications (IS 2002.4)	Students will gain in-depth experience of networking and telecommunications fundamentals including LANs, MANs, and WANs. Data communication and telecommunication concepts, models, standards, and protocols will be studied. Installation, configuration, systems integration and management of infrastructure technologies will be practiced.
IS 2002.7–Analysis and Logical Design (IS 2002.1)	Students with information technology skills will learn to analyze and design information systems. Students will practice project management during team oriented analysis and design of a departmental level system.
IS 2002.8–Physical Design and Implementation with DBMS (IS 2002.5 and IS 2002.7)	Students who have completed the analysis and logical design course will develop a detailed physical design and implementation based on a logical design utilizing a DBMS. The course integrates intensive project work with relevant concepts.
IS 2002.9–Physical Design and Implementation in Emerging Environments (IS 2002.2 and IS 2002.8)	Students who have completed the analysis and logical design course will extend their knowledge by implementing an information system using a contemporary development environment capable of interacting with a local or a remote DBMS. Teams will use project management principles to implement an information system.
IS 2002.10–Project Management and Practice (IS 2002.7)	Advanced IS majors operating as a high-performance team will engage in and complete the design and implementation of a significant information system. Project management, management of the IS function and systems integration will be components of the project experience.

Table 1 - IS 2002 course number, title and catalog description

It can be easily seen that the largest motivation for the current curriculum update was the advent of the Internet. Moreover, it is evident that IS cannot forget the organizational aspects because Information Technology is pervasive in all organizational functions and it is fundamental in the study of the context of IS (Organization and IT systems).

4 A NEW APPROACH OF TEACHING INFORMATION SYSTEMS WITH THE USE OF THE INTERNET

E-learning technologies could be a good solution to teach Information Systems courses especially because, as you can see in Table 1, the students of these kind of courses already have an adequate level of information technology skills.

The approach is on the one hand to provide media rich resources on the other hand to bring "traditional documents" in the Web. This has several advantages such as flexibility (in time and place), the possibility to give feedback through interactive media and development of structured evaluation processes and it is very cheap to distribute traditional learning material (scanned documents, texts, business cases, ...) electronically. But also disadvantages have been identified such as a lack of peer contact and interaction, high initial costs for preparing multimedia content and for maintaining and updating this content as well as the need for flexible tutorial support (Garvin, 1998). Special requirements to the last "3rd generation learning platforms" come from pedagogical and social research as well as from the technical side. One starting point are virtual learning communities supported by community platforms which enable the learner to communicate on a horizontal level. It has been proved, that collaborative work and learning are very successful in traditional "classroom" learning. The Internet revolutionized the world of computers and communications. This global network became a mechanism not only for worldwide distribution of information, but a means of interaction between people and improvement of methods for distribution of knowledge and education. E-learning has a proven future and will continue to develop and gain greater and greater significance in the field of higher education and in particular for the methods of teaching Information Systems in the Universities (Kruse, 2002).

E-learning use the power of the Internet to enable learning at anytime, anywhere. Its main purpose is to considerably reduce the time people need to learn by providing focused and updated information and notions. A possible e-learning environment for Information Systems should foresee the following components:

- virtual events taking place in virtual classrooms or lecture halls;
- self-paced education delivered over the Internet;
- collaboration in the form of learning groups, chat rooms or discussion groups;
- competency road maps supplying a custom learning plan based on personal goals of the student;
- instructor's tools for online course's planning, design, development, management, modification and revision;
- student's tools for self-assessing, online testing, progress tracking, building of online study skills;
- tools for managers of online courses for automated calendaring and automatic reminding, student activity reports, student class lists.

One key issue in e-learning is communication between participants, for which there are two basic types of technological solutions: asynchronous and synchronous. In the asynchronous approach, the interaction between parties does not require them to be engaged at the same point in time. In synchronous communications, the interaction between participants requires simultaneous engagement of the participants.

Examples of technologies useful for asynchronous communications in Information Systems discipline are: hypertext publications, on demand video-lessons and seminars, interactive cases study, business processes simulators, interactive animations, groupware systems, learner evaluation and satisfaction measurement systems, intelligent library systems (ILS), e-mails, mailing lists, newsgroup/bulletin boards, files/tools repository systems.

For synchronous communications, the more often used technologies are: whiteboards, videoconferences, virtual team projects, business games, virtual laboratories, chat/IRC tools.

5 DELIVERY SYSTEMS FOR DISTANCE EDUCATION

At present there are two main methodologies used in distance learning: scheduled delivery platforms and on-demand delivery platforms. Platforms with scheduled delivery are restricted by time requirements. This category includes appliances such as remote laboratories, videos broadcast over a network and virtual classrooms. These electronic learning methods are based on the simulation approach. The classroom becomes a simulation of a real classroom on the Internet, with interaction between teachers and students. This makes the user feel part of a group, being an online user as opposed to a real life one. This is likely to raise the motivation of students for the course and proposes help when the student has difficulties. On-demand delivery systems enhance these characteristics by providing twenty-four hours educational material for the student, seven days a week, making this way of delivery more flexible than the former. The following table compares the benefits of online learning and traditional classroom methods (see Table 2).

	Traditional education	E-Learning
Relative cost	*High*	*Low*
Access	*Limited*	*Continuous*
Quality	*Variable*	*Constant*
Result assessment	*Difficult*	*Automatic*
Retaining of information	*Variable*	*High*

Table 2 - Comparison of e-*learning to traditional education*

The significant progress towards e-learning is undoubtedly motivated by the numerous benefits it offers. Nevertheless computers will never completely eliminate human educators or other forms of instruction. That is way it is important to understand exactly what are e-learning advantages for Information Systems teaching. Some of the unique features of e-learning are effective training of a globally distributed audience and reduced publishing and distribution expenses. Another benefits of e-learning are individualized instruction, which cannot be provided by print media and courses led by teachers give up ungainly and at high cost. E-learning can answer to specific needs. In addition, synchronous e-learning is self-paced. Advanced students may speed up through or bypass the course material that is redundant while novices could slow their own headway until they fully comprehend the content and then go on. In this way, e-learning is suitable for a maximum number of students with a large span of learning styles and needs.

6 TECHNOLOGY-MEDIATED TEACHING AND LEARNING

One of the major criticisms directed at current Information Systems education is the large amount of knowledge that is imparted to the learner. Another noticeable weakness lies in the neglect of process oriented learning, that is, making the learning and thought process visible in order to develop "the learners' metacognition" (Joyce and Weil, 1986). There is a call for better balance between the imparting of knowledge to the learner and the learner's own construction of it. A suggestion is made that the quantity of material should be sometimes reduced and that the lesson time should instead be devoted to the cultivation of such qualities as problem-solving, decision making and creativity through self-directed and collaborative learning. The complexities of learning and the large number of interacting factors which affect individual and group learning present many challenges. In mediated learning environments the overall learning strategies occur in three main modes:

- *adjunct* in which the technology supplements a course of study offered principally face-to-face;
- *mixed* in which technology partly replaces elements of traditional class interaction;
- *online* in which all the content and processes of interaction are supported by technology.

We look to technology to provide mechanisms and media to support these goals in each of the three modes described. The application of technologies to achieve these processes invites a critical assessment of each medium to deliver the desired functionality. The Internet environment clearly provides a unique medium for the locating and linking of information (Stallings, 2002). However, the enhancement of this into a coherent knowledge base requires a conscious structuring of the medium by the teacher to impose order on that information. This may be attained through annotated links to external sites and the integration of existing web material into a local commentary on content. The web environment should allow teachers to provide access to all their existing course materials as well as use the interactive and representational power of the medium to enhance that knowledge base. Static text-based handouts can become animated, multimedia learning objects with increased information density and pre-structured interactivity. By Internet students can access to quality learning materials on-demand, which are often better to those available or manageable in face-to-face settings.

7 ACTIVE ENGAGEMENT WITH CONTENT AND BEST INTERACTION WITH THE TEACHER

While the provision of access to information is a first step, the challenge of good teaching is to promote activity on the part of the learner to engage both physically and cognitively with the material. This is achieved through the design of learning activities that set tasks for students to complete and that provide opportunities for students to construct descriptions of their developing conceptions of the content. This can be supported through the setting of tasks that may be published to the group or privately to the teacher via email or a website. In such cases, teachers require access to standard templates for student pages and directory structures on servers with ftp access for students. Some course management packages permit the allocation of upload directories for students to publish work. Other active engagement may be achieved through the development of interactive components or simulations that are made accessible through computer labs, face-to-face classrooms or online (Volery, 2001). The essence of the teaching and learning process is the dialogue or conversation between student and teacher. It is through this dialogue that the teacher introduces the discipline content and observes the student engage with it through questions, clarifications and responses. Within a student-centered approach to learning, best classroom practice places the responsibility for managing this interactive process and guiding the students through structured dialogue, with the teacher. Online discussion and dialogue may be held both synchronously through chat sessions or more commonly through asynchronous discussions and bulletin boards. In a fully online course, this is the principal channel of communication within the group, but also in mixed and adjunct modes, it can facilitate interaction over and above that possible within the constraints of a face-to-face class. So, all modes of learning may benefit from the unique dialogue enabled by asynchronous online groups (Alavi and Yoo, 1997). This is supported through the setting of tasks that may be published to the group or privately to the teacher via email or a student website. Other active engagement may be achieved through the development of interactive components or simulations that are made accessible through computer labs, face-to-face classrooms or online. In a fully online course, this is the principal channel of communication within the group, but also in mixed and adjunct modes, it can facilitate interaction over and above that possible within the constraints of a face-to-face class. These processes within the Universities should be enabled through a support for development and an adequate network infrastructure.

8 RECOMMENDED SUPPORT FOR TEACHERS AND STUDENTS

For teachers, the recommended support is in the form of: guidelines regarding minimum standards for Information Systems course development, design and delivery; processes and criteria by which learning materials are to be reviewed; technical assistance in the transition from classroom to online learning processes and in the development of adjunct materials through the modeling of best practice; provision of feedback, in the form of reports from the learning system, on issues arising from student

use of mediated learning material; opportunities to share and discuss practice within the University through the creation of a learning community.

For students, the recommended support is in the form of: specific information about the mediated learning and its use in the Information Systems course; training and information to equitably access courseware and other online resources; access to technical assistance throughout the duration of the course; prompt and accurate response to inquiries, which will be logged and recorded for later analysis; opportunities to evaluate and comment on the teaching and learning process throughout the course.

The Universities need to provide an effective infrastructure for the mediated teaching and learning purposes. This infrastructure includes: a technology plan that includes electronic security measures (i.e., password protection, encryption, back-up) to ensure quality standards and the integrity and validity of information held within the online teaching system; a local intranet, accessible to staff and students to enable high-speed access to email, courseware servers and teaching spaces; high-capacity local servers, to store and structure repositories of media content for courses; high speed connection with the external internet, to enable access to the resources and connectivity of this global resource; modem connections for students to access Information Systems course and course repositories from off campus; access to, and support for the software necessary to enable discipline discourse for both on and off campus groups; technical support for commonly used computer platforms and software, which is reviewed annually in the light of new technologies; templates for commonly used educational strategies, student and course web pages to minimize preparation time. The online discussion groups enable student-to-student interaction that may be informal and initiated by the learners or a formal group task set by the teacher. The technology needs to support both student and teacher initiated dialogue to supplement the central teacher-student dialogue of the learning process. Student-to-student interaction may also be achieved in tutorials or in small group work. Within such learning settings, privacy (from the teacher and others) and anonymity are desirable features of the technology. Such activities might be either part of larger course design or a spontaneous interaction arising in response to a learning process (Marold, 2000). Coincident with the pedagogic processes produced by interaction, important social processes must also occur to create the context of group and to enable individuals to establish and communicate and develop their personalities during study (Beller, 1998). Online learning should incorporate explicit instances for reflection and reporting on cognition (Avgeriou, Papasalouros et al., 2003). The conversational nature of teacher-learner interaction provides the most immediate feedback and opportunity for formative assessment. Additional learning is possible when these interactions are also accessible to other learners, as in the traditional classroom. Online groups should offer an archivable and retrievable record of class interactions as a forum for formative feedback. Individual and confidential feedback may be provided via private threads or email. As mediated learning processes typically lose the immediacy of the classroom, care must be taken to establish explicit opportunities for learning feedback.

9 CONCLUSIONS

We believe that our model for teaching IS using lectures, online simulations and virtual team-projects, by the use of distance education systems, can be very effective. We hope in the next months to define and evaluate the effectiveness and value (as perceived by the students) of the different elements used to teach an Information Systems Course in the Luiss and Cattolica Universities. We would like to enthusiastically invite IS teachers to incorporate similar strategies in their teaching, which we think can be very rewarding and fulfilling to the teacher as well as the students. However, we must add a strong word of caution - the project requires a great deal of planning and effort in order to have a chance to succeed.

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HOW TO INTERPRET A KNOWLEDGE MANAGEMENT PROJECT

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Abstract

This paper wishes to provide a model to systematise knowledge management studies, trying to clarify the different approaches adopted within the literature in order to define a concept on which the scientific community has been debating for a long time. In this paper we propose a taxonomy departing from the hypothesis formulated by Scarbrough, Swan and Sørensen, which include in KM two separated and contrasting streams: cognitive network model and community networking model. Our choice is to integrate the model by introducing two more streams, social cognitivism and the best practice vision. In the last section of the paper, the KM taxonomy that has been put forward is used to interpret the KM application within ENEA, the Italian National Agency for New Technologies, Energy and the Environment.

1 KNOWLEDGE MANAGEMENT – A CONCEPT IN SEARCH OF A DEFINITION

The community of IS and organisational researchers has been focusing its attention in recent years on the role that knowledge plays within the organisation.

This subject, representing in itself a complex and controversial issue, bids for another, equally difficult question, in managerial studies. If knowledge is so important, what are the patterns and the variables to manage it? And what does it mean 'managing' knowledge? In order to answer to these questions it is therefore necessary to dig into the broad and often ambiguous KM literature.

KM is still a rather young field of study, which has not been clearly defined in all its facets. As it often happens in the analysis of organisational (broadly speaking managerial) issues, given the vivid interest they unleash in the academic community, there are different ways to approach the phenomenon.

A great number of definitions have been proposed, with a correspondent variety of interpreting trends and loci of study. These differences are basically determined by two order of motives: the difficulty in defining, "putting boundaries" around the term itself of 'knowledge', and the variety of theoretical approaches and research backgrounds of the scholars interested in the matter.

The 'hunger' of knowledge seems to be one of the few elements on which all agree: the only way to be competitive is being able to manage and create knowledge. According to renown scholars, the only chance to face competition is exploiting knowledge in the most efficient way (Von Krogh, 1998; Drucker, 1998). It becomes of primary importance not only 'owning' knowledge, but above all being able to manage it, influencing therefore the phases of its creation, storing, diffusion and transfer.

If this latter opinion is only partially shared among the KM scholars (Stacey, 2001; Galliers and Newell, 2001), there are several streams of thought on why knowledge is needed, what is its role within an organisation and what are the right tools to create and share it.

KM ideas spread within literature around mid '90's, replacing or overlapping issues such as organizational learning, database management and information management (Scarbrough et al. 1999), and still do not seem to have found a precise and suitable accomodation.

2 TRYING TO ESTABLISH A COHERENT TAXONOMY

Within the literature it is possible to find attempts to rationalise and integrate previous contributions on the issue, but an agreed vision of the problem is still missing. Therefore in this paper we propose a taxonomy departing from the hypothesis formulated by Scarbrough, Swan and Sørensen, which include in KM two separated and contrasting streams (Swan et al, 1999):

·cognitive network model;

·community networking model.

The first approach is the cognitive one, in which knowledge is assimilated to any other resource that management may control; the second approach argues that social relationships are the 'place' where knowledge is found. It is very important to point out the two levels, individual and collective, underlying the approaches. It is the prevailing of one level on the other that characterizes the belonging to one stream or the other.

It is a challenge between two ways of considering not only the management of knowledge, but reality around organisations. Both have grassroots coming from other disciplines: in particular, the individual

approach has as reference the cognitive phsycology that considers mind as a function of brain, which establishes representations of outside world (Stacey, 2001).

The other approach instead relies on different theoretical contributions which have gradually flowed into sociology, in which the social side of human existence is considered as the way in which a person builds and interprets reality.

A fundamental difference between the two is in the definition itself, especially in the evolution from the use of the term 'network' as a substantive (figuring out a static entity, a well defined object within time and space constraints) to the term 'networking', showing an 'in progress' dynamic attitude.

In other words the transition is from conceiving knowledge as a resource to conceiving knowledge as a process.

Relying on this taxonomy our choice is to integrate the model by introducing two more streams, social cognitivism and the best practice vision.

Both these latter approaches contain elements which may belong to a cognitivist or social logic, but as they do not belong in a clear-cut manner to the previous streams we selected to provide them with a full degree of autonomy in the framework.

To clarify some essential features of these four approaches and underline the differences it is possible to draw a synoptical table which make peculiarities emerge:

1.knowledge;

2.level of analysis;

3.KM goal;

4.KM variables.

1. It has often been stated that framing the meaning of the term 'knowledge' is vital to establish a common ground of understanding and a shared lexicon. A possible way to achieve this goal tries to identify how to interpret knowledge (knowledge meant as…) and where knowledge may be found (knowledge lies in….). Moving along towards these directions allows (at least partly) to frame the phenomenon KM.

2. With reference to KM it is necessary to reflect on the level of analysis, i.e. the main unit of observation to harness the phenomenon.

3. Then it is needed to understand the goals of KM, what the organisation wants to reach by putting in place KM policies.

4. At this stage it is possible to focus on the key aspects to consider and possibly on the combined operative tools that should be put in place.

On the basis of these five elements it has proved to be feasible to locate several contributions by key authors within four major streams (table 1):

- ·cognitive;
- ·social cognitivism;
- ·social-construction;
- ·best practice.

The choice regarding how to classify the approaches to KM according to the framework should be seen as an attempt to create a clearer reading tool useful to the ones who have to tackle with KM issues. The existing great confusion on the subject represents on one hand a stimulus to propose synptical models, but on the other hand obviously is an obstacle for the difficulty in including in such a clear-cut way several models. That is why it has to be pointed out that this experiment does not have any ambition in terms of exaustivity of the matter, but still it tries to work as a way forward towards a feasible interpretation of the phenomenon KM.

	cognitive	social cognitivism	social-construction	best practice
Knowledge as….	resource	resource	process	resource
Knowledge in ….	head of individuals	head of individuals	social relationships	organisational practices
Level of analysis	individual	individual	organisational	organisational
Goal of KM	transferring bits of knowledge	transferring knowledge from one individual to another paying attention to the social external environment	creating social environments	chance to locate best practices within the organisation and spreading them within the whole organisation
Key variables	technological	technological and organisational	organisational and mangement of human resources	technological

Table 1. Knowledge management classification

In the light of these observations it is worth reflecting on the fact that in some cases trying to classify in a rigid way every approach is rather risky.

An example comes from social cognitivism and social construction: both point out the importance of some organisational issues pushing towards the need of establishing a background culture in favour of KM, based on the will to cooperate, sharing experiences to foster the creation and sharing of knowledge.

At a first glance it could seem that there are no contrasting elements among the two approaches (both focusing on 'soft' organisational, human resources issues), but a crucial difference may be retained: according to first one, knowledge is a resource lying in the minds of individuals, even if influenced by social context, while in the social construction approach knowledge lies in the relationship, in the process which gets started when an action is carried out.

A straightforward implication is that in the first case the role played by technology is crucial inasmuch as it is feasible to manage knowledge and transfer it among individuals, whilst in the second one what matters is the experience, having the knowledge acting (knowing), and this makes knowledge a unique form of experience.

To get the picture clearer it may be useful to provide also a map to locate the four contributions in discourse (fig.2). Criteria used to position them are twofold: on the horizontal axe there is knowledge; on the vertical axe the level (unit) of analysis. Knowledge may be interpreted in two ways: as a resource (like an input on which exerting an influence, such as land, labour and capitals) or as a process, a dynamic element, continually evolving.

As said, when considering the level of analysis we mean the unit to which it is useful referring to, the reality (individual or organisational) at which is worth looking to find knowledge.

By using the term 'individual' we point out that in order to know the ways in which knowledge is shared and transferred it is beforehand necessary to study and understand behaviours and processes of the individual. 'Organisational' instead refers to the need of studying KM as a phenomenon that is of interest to the organisation in a collective way, referring to all members which belong to it.

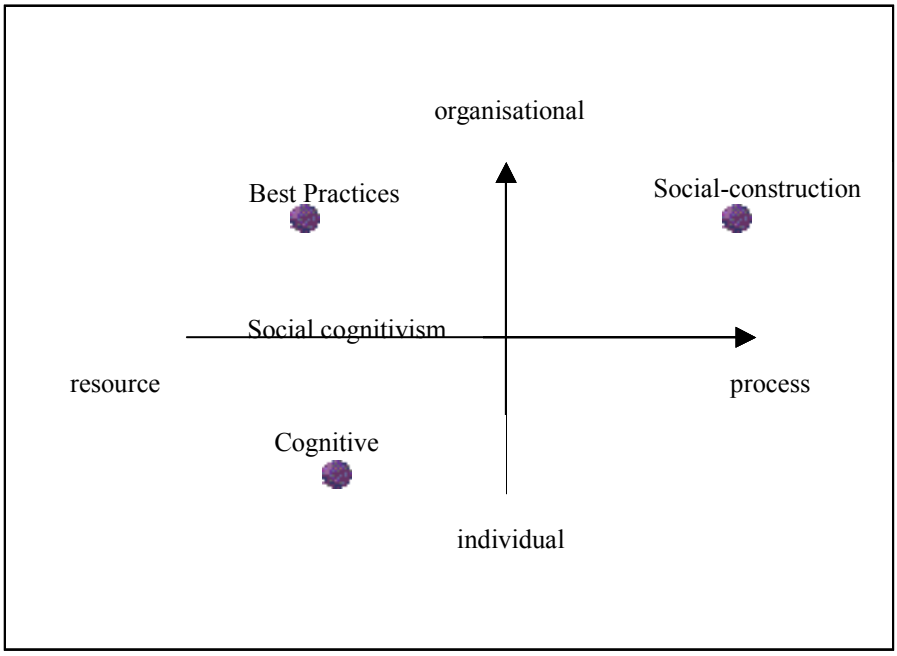

Table 2. A map knowledge/level of analysis

In order to understand the taxonomy we have put forth it is necessary to get closer to the details of each approach.

3 COGNITIVE APPROACH: THE ROLE OF TECHNOLOGY

Cognitive model considers knowledge as an objective resource and treat it like information, as something that may be codified and passed from one individual to another. It is admitted that knowledge is in the head of individuals, but also that it may be taken, stored and passed on to others by means of information systems. Level of analysis is the individual, it is inside himself/herself that knowledge may be retrieved and spread among members of the organisation. KM goal becomes the one of transferring 'bits' of knowledge: the identification between knowledge and information is complete. Technology becomes the means by which knowledge is made available to all in order to guarantee the success of the organisation. The concept of knowledge as an entity that may be codified, cumulated and stored has its roots in a newtonian and mechanistic vision of the world.

As Myers states (1996): "At its core crucial, knowledge must be seen as tied to the personal or human element. Knowledge, as we generally understand it, resides in people' heads"… "The representation of knowledge can be mechanical, digital, visual, and so forth." If knowledge is in the minds of individuals and may be explicitly represented, through digital or mechanical devices, its management brings about the ability to manage it and memorize it.

In the words of Laudon and Laudon (2000): "The process of systematically and actively managing and leveraging the store of knowledge in an organization is called knowledge management".

Role played by technology is crucial, so that information systems used to manage knowledge are defined Knowledge Management System (KMS) (Hendriks and Vriens, 1999) and their use is coupled with a list of advantages that the organisation should receive, such as capturing individuals' knowledge, decision support, training of personnel, improve organisational skills, or promote sharing of knowledge or its storing (Alavi and Leidner, 1999).

Tools deployed to reach these goals are naturally the ones provided by the latest trends in technology, information systems that allow the management, storing and transfer of information.

4 SOCIAL COGNITIVISM

The very naming 'social cognitivism' recalls the rhetorical figure of oxymoron, the effort to couple two trends within the same school of thought: on one hand cognitivism, i.e. the individual processes leading to representation of reality, on the other the social element, i.e. the influence that factors such as culture or environment exert on the cognitive process. It is affirmed that the individual is able to rule the process of elaborating knowledge, but in doing so is undeniably subject to social constraints.

The term 'social cognitivism' derives from an epistemological school of thought defined social cognition (Sparti, 1995), which provides a model of reality based on representations, assigning "priority to the reconstruction of cognitive processes of organisation and representing of knowledge, without getting concerned with clarifying how the actor translates these processes in behavioural choices, i.e. without explaining the action" (Sparti, 1995). The intention is deepening the cognitive schemata used to interpret and build reality within a given social context: the actor remains therefore an active processor of information.

The scholar that more than others epitomises this school of thought is Nonaka, jointly author with Takeuchi of the often quoted *The knowledge-creating company* (1995). In the book the authors propose a model of knowledge creation based on the idea of social cognitivism.

That contribution is still one of the milestones of KM, being considered one of the most interesting and original pieces of work within managerial literature. The study is focused on the concepts of creation and transfer of knowledge. It is of interest pointing out that the object of the analysis is not KM tout court, i.e. is not the evaluation of the phases of storing or capturing of knowledge, but instead consists of a very peculiar aspect, the one which deals with how to ensure the development of innovation within the firm.

Departing from the need to understand how it is possible to create new knowledge that Nonaka and Takeuchi have elaborated a model on the basis of a series of empirical evaluations.

First of all, there is a close relationship between knowledge and information, that "thus represents a mediation factor or a material necessary for producing and constructing knowledge, and influences the latter by restructuring it or by integrating it with new elements" (Nonaka and Takeuchi, 1995). Activating mechanisms to create new knowledge means considering it as a resource, as a good that can be produced and transferred from one individual to another.

Using some terms originally introduced by Polanyi's (Polanyi 1966), the two authors propose again what has now become a classic distinction regarding KM, that is to say that knowledge may be classified into tacit and explicit.

The breakdown of knowledge into the two forms is essential for stating the concept of the influence of context in the elaboration of knowledge itself: it is in the tacit form that it cannot be separated from the environment, in that it is precisely the environment that provides knowledge with meaning.

As Nightingale claims (1998): "this tacit background enables us to see rather than simply see, as we actively interpret our experiences rather passively receive information…this tacit background knowledge gives us the capacity to interpret information and comprehend things, that cannot be codified, such as how to ride a bicycle. Thus, tacit knowledge is both the backgrounds of interwoven experience and the automatic capacity we have to relate experience to it".

The process of the creation and transfer of knowledge depends precisely on the interaction between the two forms described earlier, according to a logic that the two Japanese authors define "knowledge conversion" (Nonaka 1994).

There are two main elements of this process that must be stressed:

- the social dimension;
- the dynamic dimension.

The first is represented by the fact that although the individual is the main character and key actor, he is never isolated from social interaction. The cognitive approach, where the individual is the thinking subject, is tempered with a strong sociological influence as "tacit and explicit knowledge are spread both quantitatively as well as qualitatively, through a social conversion process" (Nonaka and Takeuchi, 1997).

The dynamic dimension is given by the interaction between the two forms of knowledge. The model is based upon the fact that four different forms of interaction are proposed that give birth to the same number of forms of knowledge production. This dynamic element is re-enforced by the fact that the interaction follows an evolutionary path that may be imagined as a continually ongoing spiral, as the interaction continues through time.

The possibility of considering knowledge as an entity divisible into two parts represents one of the strongest forms of criticism that Nonaka and Takeuchi have received in the last few years, from a part of the literature and more especially from Tsoukas (1996, p.14), who states that : "Contrary to what Nonaka and Takeuchi argue, tacit knowledge can indeed be linguistically expressed if we focus our attention on it. And vice versa: explicit knowledge is always grounded in a tacit component. Tacit knowledge is not explicit knowledge 'internalized' as Nonaka and Takeuchi claim…Tacit knowledge is the necessary component of all knowledge…".

Brown and Cook (1999, p. 384), in contrast, admitting the two dimensions, consider that it is not possible to convert them from one form to another as expressed in the model: "Building on Polanyi, we argue that explicit and tacit are two distinct forms of knowledge (i.e. neither is a variant of the other); that each does work the other cannot; and that one form cannot be made out of or changed into the other."

Having singled out the cognitive processes necessary for creating knowledge, the two authors attempt then to analyse the social conditions that favour the creation of knowledge: it is upon such liaison that social cognitivism is founded.

A significant contribution of these authors concerns the organizational conditions that may favour the creation of knowledge both from a practical and a conceptual point of view (Nonaka 1994; Nonaka and Takeuchi 1995; Nonaka and Konno, 1998); by means of appropriate interventions, it is possible to have an effect on a firm's capabilities of innovation and problem-solving.

On the basis of the studies on the creation of knowledge some authors propose some alternative models to Nonaka's, in which they emphasise the crucial role played by tacit knowledge in the process (Leonard and Sensiper, 1998) and the necessity to pay special attention to the cultural factors of the organization, and to the care the top managers must have in managing human resources (Von Krogh, 1998).

5 THE SOCIAL-CONSTRUCTION APPROACH: FROM KNOWLEDGE TO KNOWING

The social-construction approach relies on one aspect: social relationship as a "moment" in which knowledge is created, according to a logic of clear sociological matrix.

It finds its roots in the organizational studies that may be dated back to the late 1980s and that go into the matter of learning (Lave and Wenger, 1991; Brown and Duguid, 1991). The merit of this trend lies in shifting the debate from a technological viewpoint to a more managerial and organizational one that focuses on a role of human resources. As Blackler claims (1999, p. 6): "It would be wrong however, to confuse KM with information management. The true application of KM is a modality through which the organizational practices may be changed to bring it about that collaboration, innovation, learning and research are at the basis of people's work practices".

Knowing becomes practice; it is not essential to know what, but rather to know how. The concept of doing is not only the element that characterizes knowledge, but is the way through which knowledge is manifested, converted and transferred. This concept is often explained by expressions such as "turning knowledge into action" (Pfeffer and Sutton, 2000 and 1999) or more often with the use of the term knowing that replaces the more classical term knowledge.

The terms used by this approach are teamworking, networking, and communities of practice. The concept of knowledge is not longer a pure cognitive activity that resides in the head of the people, but more attention is then paid to the social elements as well as to the dynamic ones. As Gherardi states (2000, p.7) " cognition is seen as a collective activity, socially distributed and organized …". As Gherardi and Nicolini claim (2000, p.330): "…knowledge cannot be conceived as a mental substance residing in members' heads; it can however be viewed as a form of distributed social expertise: that is, knowledge-in-practice situated in the historical context in which it occurs".

One of the most important elements to be stressed in this approach is the return to focusing on the concept of learning. Under the sociological influence the passage from learning to knowledge, that characterized the mid-1990s, is undergoing an inversion in trend. The learning theme is treated is conceived as acquisition of experience, capacity of development of our "practice" and of our ability to interpret the significance of things. As Wenger states (1998, p.96) "we create ways of participating in a practice in the very process of contributing to making that practice what it is."

A fundamental concept in this approach is the community of practice, that unifies two key ideas, the relationship and the dynamic nature of knowledge.

The community is seen as the ideal place for learning, where there exists a series of conditions which facilitate the possibility of learning. As Wenger states (2000c, p.15): "The communities of practice are the bricks that make up a system social of learning since they are the social "containers" of the competencies that make up these systems".

Practice is seen a process of social interaction, it is not considered a resource that can be managed and transferred by one individual to another; therefore the acquisition of knowledge cannot be obtained through the simple presence in an education training course, but requires an effective practice and participation of the individual: only the participation in a community can cause understanding, even if it clearly represents a somewhat complex process. "Practice is a shared history of learning that requires some catching up for joining (Wenger 1998, p.102)."

The complexity of the phenomenon is emphasised also by Brown and Duguid (1991, p.13) who state: "The communities that we discern are, by contrast, often noncanonical and not recognized by the organization. They are more fluid and interpretative than bounded, often crossing the restrictive boundaries of the organization to incorporate people form outside".

From a managerial viewpoint Wenger claims that the task of the manager is that of favouring the growth and development of the communities; it is necessary to pay attention to certain key instruments in order "the project the communities" (Wenger, 2000a; Wenger 2000b). This last phase certainly deserves in-depth analysis in that it is necessary to understand what role the manager can have in this phase: he may intervene through some strategies and techniques, but always in a way as to support the community itself.

Tsoukas underlines the importance of community of practices to acquire competences that are difficult to decode, but which are fundamental for improving their own performances (Tsoukas, 1996; Tsoukas and Vladimirou, 2000).

The complexity of different approaches make difficult to insert these contributions within the same research field: the point is to underline the two concepts of relationship and dynamism as common points of the analysis.

6 BEST PRACTICE

In this classification the best practice contribution represents an autonomous *corpus* routed within mainstream, consulting driven managerial literature.

The concept of best practice recalls the one of organisational routine: moving from an individual level to an organisational one, knowledge is considered as resource that resides in the routine and so it can be managed and transferred. Knowledge is different from information, it is something more complex that implies the participation of the human being, it becomes information in action (O'Dell e Jackson Grayson, 1998, p.5).

KM is an autonomous phenomenon that represents a new managerial fashion as the business process reengineering or the total quality management. KM is not an operational technique, but a cultural issue and in this sense could be associated to the BPR or TQM.

As O'Dell e Jackson Grayson (1998, p.6) state: "KM is not a radical departure or a methodology in and of itself. Rather it is a framework, a management mind-set that includes building on past experiences (libraries, databanks, smart people) and creating new vehicles for exchanging knowledge".

KM is considered as a set of practices, of procedures, of routines to be spread within the organisation to get competitive advantage.

The concept of best practice could be strictly relevant for a single firm: what is suitable for one organisation could not be so satisfying for a different one; anyway the concept itself of best practice is not so well define and is related with good ideas, methodologies, techniques, approaches to solve problems.

Hull introduces the idea of Knowledge Management Practices (KMP) as the way to make the workflow become a routine. KMP concern all the criteria and the steps you need to realize an activity, including all the informal procedures. As Hull states: (p.148) "practice encompasses the variety of ways in which labour is regularised and routinised, whether formally in recognised tasks, techniques and processes …".

"KMPs are thus those practices which are either explicit intended to perform some knowledge management function, or, in the case of some practices which also have other functions such as writing a report for one's line manager, those practices which are believed to additionally have knowledge management dimensions (Hull, p.148)."

To introduce these new practices means to change the way the firm works. That implies changing technological and human factors, hard and soft variables, in order to influence the future of the organization. This complexity does not appear to be coherent with a best practice approach that simplifies the organization as a "box" to be filled up with practices.

7 THE ENEA CASE

In this section of the paper, the KM taxonomy that has been put forward will be used to interpret the KM application within ENEA, the Italian National Agency for New Technologies, Energy and the Environment.

The basic KM applications will be described, constituting a preliminary finding of a more complete empirical research on KM within ENEA that is currently being undertaken.

ENEA, the Italian National Agency for New Technologies, Energy and the Environment is a public undertaking operating in the fields of energy, the environment and new technologies to support competitiveness and sustainable development. ENEA is devoted to:

-promoting and carrying out basic and applied research and innovation technology activities, also through prototypes and product industrialization;

-disseminating and transferring technologies, encouraging their use in productive and social sectors;

-providing high-tech services, studies, tests and evaluations to both public and private bodies and enterprises.

ENEA carries out complex research, development and demonstration projects, mainly technology and engineering — based, sets up and operates major scientific apparatus; assesses the level of advanced technologies development, as well as their economic and social impacts, also on demand by public administrations; promotes collaboration with foreign bodies and institutions, also for defining technical regulations and participation to major research programs and international organizations, providing its (specific) expertise; promotes, fosters and supports innovation technology processes in the national production system, especially in small and medium — sized enterprises; collaborates with regions and local administrations to promote productive development of local resources, through joint actions; promotes technical and professional training and competency of researchers, also through ad-hoc agreements with national and international universities.

In 2003 at the ENEA headquarter in Bologna an experimental KM project was launched, with the aim of having several branches interacting: Portici, Casaccia, Roma and Bologna.

The project goal is developing an application to manage the knowledge assets of the institution, to integrate the traditionally managerial knowledge with the technical-scientific knowledge, with the purpose of spreading and sharing information on the ongoing capabilities, interests, activities, projects, results of the institution.

In the long term the goal is creating a real community able to foster communication among people sharing the same interests that had missed the opportunity to get to know each other and interact.

The Minotauro project applies the KM logic to the information systems within ENEA. This includes not only the structured information, but also the unstructured component of knowledge.

The whole system relies on the Autonomy platform, specialised in KM systems.

As a difference with the old collaboration legacy systems, Autonomy technology allows organisations to have a complete visibility of the available information, of the people that exploit it and of the capabilities of people in the different divisions of the organisation.

The Autonomy Intelligent Data Operating Layer (IDOL) integrates the information coming from different sources by means of the understanding of the actual content. Autonomy is entitled to integrate and operate through different sources such as E-mails, Word documents, media files (unstructured information), XML and metadata (semistructrured information), and information already filed in databases.

The key element in Autonomy is the ability to analyse text and voice regardless of the language, identifying and classifying the main concepts and establishing then categories, links and ways of customising and distributing information.

The ability of Autonomy of creating a contextual knowledge and integrating the information available relies a solution able to:

- classifying: automatic classification of data allows high control, ability to manage and visibility on data;
- retrieval: a full range of search options that may be accessed through queries;
- automatic hyperlinking of linked information: ensures that all users are aware of the whole knowledge assets available within the organisation. The automation of this feature allows to benefit of significant economies of scale.
- summarizing: Autonomy allows to accurately syntethize the content of the pieces of information, enabling as such the users to determine if a given piece of information may be of interest.

- personalization: the Autonomy technology allows a personalisation of users profile. A first profile is developed departing from the basic entry information of the user and then a full profile is developed according to the evolution of each project in which the user is involved. This allows the users working on similar issues to get in touch.

The system is also able to send automatically to each user documents that are supposed to be of interest to her work, relying on the more frequent queries that she posts within the system.

On top of Autonomy, ENEA is also implementing another system called K PATH, realised by Convey software house. What this system allows to achieve is the creation of 'knowledge patterns' on a given topic, adding documents, notes, e-mails, weblinks, media files all relevant and useful to the user called to work on the topic. Unfortunately the implementation of this latter system is currently hampered by the lack of funding.

8 CONCLUSION

The four approaches that have hitherto been outlined represent four different modalities for interpreting the KM phenomenon, for understanding knowledge and the tools deployed to manage it.

The classification has attempted to show certain elements of each trend that characterize them more clearly. As it always happens with taxonomies, our scheme acknowledge a clear limitation in not considering the more subtle differences within each school of thought.

If the theoretical conceptions are different, the managerial tools adopted for implementing KM belong essentially to two categories: on one hand there are those who favour the soft and organizational variables on the other there are those who firmly believe in technology as an effective and management of knowledge. It is clear that one does not exclude the other, as many of the most recent interventions on KM tend in fact to stress how necessary it is to adopt organisational measures along with the deployment of ICT.

Many of the recent contributions on KM deal with the KM technology relationship and, broadly speaking with the necessity of coupling soft interventions with the introduction of ICT applications (Swan et al, 1999; McDermott, 1999).

With reference to ENEA case, it seems possbile to make some final considerations. We will argue that, at the current stage of the empirical findings, the ENEA case could be interpreted as a social-cognitivist approach to KM. First of all, we underline that the Nonaka model, describing the knowledge transformation process, has been consciously used in the development of the Minotauro project Enea is going to implement.

Secondly, considering the ENEA case, we think that the development of suitable DB makes possible to codify knowledge and to transfer the codified data in the Autonomy's system. In this way, the organization is able to organize and use this codified knowledge. In this context, the K-Path product, that should operate in tight relation with Autonomy software, supports employees and managers in the learning process. In other words, this software, that is developed by Convey, realizes the knowledge internalization phase. Thirdly, the implementation of the Minotauro project makes possible to codify knowledge, but furthermore it supports the whole knowledge management process, in each single step.

Finally taking into account the results of our research project, it seems necessary to point out that at the moment the ENEA has realized a surely effective k-architecture, without a similiarily effective organizational structure, that plays, on the contrary, a fundamental role in organizing the knowledge management process.

A possible solution, as stated also by ENEA researchers, could be the implementation of the Minotauro project only in some institutes controlled and managed by ENEA. But also in this case, the problem of setting up a supportive organizational structure still remains.

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THE INSTITUTIONAL ROLE OF LOCAL ASSOCIATIONS IN ADOPTING A TERRITORIAL KNOWLEDGE MANAGEMENT SYSTEM WITHIN LOCAL SYSTEMS.

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Abstract

The competition involves the cost and the quality of knowledge. The challenge is represented by the quality of knowledge available. The district, as a possibility to access specific and outstanding knowledge, constitutes a focal archive of competence and expertise about productive specialisation. It is important to enhance and make explicit the mechanism of creating and sharing knowledge, which is already present at an informal level in the territorial community. The efficiency of the performance of cognitive cycles can be pursued by supporting the relations that the members of a local system hold, using as support Information and Communication Technology.

Telematic networks and ICT enable us to imagine a cooperative electronic space, a "virtual territory" focused not only on sharing concrete space, but also on community planning. The aim of the paper is to discuss about the role of Local Industrial Associations in adopting a new model of sharing knowledge. In this paper we provide a practical framework where a particular system of knowledge management, evolved in the local system, is likely to represent a suitable pathway to stimulate knowledge sharing within local districts.

***Keywords**: Knowledge Management System, Local District, Territorial Community, Virtual Territory*

1 INTRODUCTION

The aim of our paper is to provide a practical framework which continues the research begun by IBM, where a particular system of knowledge management, developed in close co-operation with some entrepreneurs' associations of region Campania, can represent a path to stimulate knowledge sharing and knowledge dissemination in a virtual community.

Management literature emphasises that one of the most important sources of competitive advantage is found in the coordination between different technological and operational skills: it is possible to create new products and to support new businesses by fertilising organisational core competencies (Hamel-Prahalad 1990). Starting from this point, De Leo (1994) asserts that it is difficult to fill the competitive advantage if resources are matchless, because they are seem to be mixed in different ways. The roots of business success are likely to be found in the environment where firms are engaged. Particularly, it is possible to understand the evolution of core competencies from the interaction between organisational and "local" capabilities. The evolutionist theory considers that the relationships among companies are directed to create operational and technological knowledge. This approach highlights how creation of new knowledge is the result of a process of the variation-selection-retention of current knowledge. This morpho-genetic process, which appears as routine, represents a starting point for the evolution and creation of new elements in organisational knowledge by fertilising environmental, technological, scientific, institutional and firm-specific elements (Beccatini and Rullani 1996). Notably, Beccattini & Rullani (1996) discuss "mechanisms of resonance and imitation" through which innovations are "tested" in industrial areas, hence imitation becomes a certification of the success of the original idea in a game of cooperation and competition.

The local productive system works as tool for a constant innovation absolutely effective due to its characteristics (like specialization and cooperation), and it is the result of knowledge sharing process becoming a kind of collective innovation. The innovation will be the effect of a crossbreeding process which will develop itself into the district thanks to the condivision of experiences and as a result of a learning *network specific.*

Moreover the relations between the companies of the district are no longer exclusively tied to a "closed contextual network" where the coordination occurs through social mechanisms.

The virtual dimension assumes importance or better the ability of organization to create relations with others cognitive systems which can provide and produce information on different levels, not a real one. So a greater working division produces considerable replication economies. The organizations, which operate as cognitive systems within a complex correlation tissue, play a decisive role for the transfer of knowledge by codification channels. The ability to create new concepts and new knowledge finds an answer for the complexity and the technology is supporting those processes. The future of the districts is tied to the managing capacity of these change processes supported by a which could place the district into a logic of extended competition. The leader companies and meta-managers impress a strategical push tied to an improvement attempt of their effects and their competitive advantage, by a trend and control development process of new relationships network (thinking and managing development process). Nowadays it is growing up the importance of (Colombo and Dubini 1988):

- a "social architect" (Corno Reinmoeller and Nonaka, 1999) as a promoter of an evolutive product, a typical learning and increasing process of the identity system;
- a "sponsor" which activate projects about change and innovation;
- a "coordinator" who is able to find the needs of innovation out and to match the needs of change, to define the action lines and their set up, to promote the supporting system for the entrepreneurship.

This cooperation space allows access to knowledge at a lower cost but the challenge, however, is represented by a result of a knowledge management process that can increase efficiency and guarantee a growth in efficiency and competitiveness both for single companies and for the entire region.

In this paper we try to answer to the following research question: "Which organisational structures will the Territorial Knowledge Management System have to adopt to realise the integration of knowledge and competencies?"

2 ITALIAN DISTRICTS: THE INSTITUTIONAL CONTEXT

Beccatini (1987, p. 35) defines the district as "a large number of small companies, linked by vertical cooperation relations and horizontal competitive relations specialized in one or more complementary sectors in an area naturally and historically bounded".

The district represents a "socio-economic entity characterised by an active compresence of people community and company population" (Beccattini 1987, p. 39).

Italian Districts show identical attributes as: a) high labour partition and specialisation; b) coexistence of mechanisms of cooperation and competition; c) continuous processes of emulation of colleagues (auto-regulation processes); d) an informal coordination, not hierarchic, sustained by an automatic game with a sanction system held by community (Beccattini 1989); high entrepreneurship with constant innovations from the bottom (Piore and Sabel 1987); a common system of socio-cultural values (Beccattini 1989).

We can consider the district as a real market place, a clan constituted by a network of interpersonal relationship founded on trust and friendship and by behavioural schemes founded on codes and sharing values (Ouchi 1980).

Entrepreneurial instinct and leadership skill have conducted companies to compete on international markets mixing working life and domesticity, where the competitive advantage can be found in the capacity to transfer the knowledge and values through generations. Many researches (Porter 1998 et al.) have pointed out the causal relationship between embedded competencies and advantages on international markets.

The district is the result of a evolutionist process started form the bottom that has consolidated a direct responsibility of employers to build and apply their competencies, a restiveness to hierarchy, a predisposition to fight poverty (Beccattini 2000).

So the district machine is the result of a system of "institutions" in terms of family, organisations, associations, but also of rules and principles. Within this families and associations values and behaviours are shared and corroborated.

In this way companies are conditioned by social life establishing a self-referential system. In fact this system of companies demonstrates a resistance to change providing some effects: the change can not be experimented to the extend that it is a irreversible process because the institutional innovation induces a knock-on effect, where is not possible to foresee the strategic and operational adjustments conditioned by exogenous factors (Varaldo and Ferrucci 2001).

This changes, not pre-determinable ex ante (only objectives are shared), are the product of a constant negotiation that brings to a new institutional asset (Varaldo and Ferrucci 2001).

Even if there are some companies more open to institutional change, broadly speaking the district has a general aversion to institutional change. This aversion depends on internal factors but also on the absence of institutional subject to support the change (Varaldo and Ferrucci 2001).

However, competitive increase and the opening to international markets and new business models, the rising of inter-companies network outside the district, impress a fast change. This brings to some effects:

1. learning processes could be altered radically foiling (loss of knowledge) internal mechanisms of accumulation and transfer of knowledge (Nonaka and Takeuchi 1995);

2. entrepreneurs need to reformulate their strategies on innovative bases of knowledge;

3. emerging strategies need to be supported by efficient and effective processes of hybridisation of knowledge supported by technologies and actors.

I&C Technologies help to recombine and to re-modulate district knowledge maintaining a social entrenchment in the territory, on the other hand insure a knowledge exchange with external actors sustaining the economic dimension without a territorial connivance. Moreover, the decision to delocalise some activities outside the boundaries of the district needs to institutionalise new spaces of aggregation to preserve some characteristics of the original structure.

The challenge is to superimpose a virtual district to the real where they work as link of a cognitive global network exploiting stable relations, sharing personal experiences and activating extensive learning loop (Grandinetti and Rullani 1996).

Districts represent a good laboratory where to experiment the switching modalities from real communities to virtual communities as we can observe some common traits as fast moving of information, cooperation and competition, visibility, sharing of codes, practices, experiences.

3 THE THEORETICAL APPROACH

According to institutional theory man's preferences, interests, behaviours, objectives are the result of a learning process based on social relationships embedded in a social and institutional context, where social behaviours are taken for granted. Institutions, as rules and organisations that represent authority and ties (Jepperson 1991), drive the human action lending meaning, legitimacy and rationality. They normalise behaviours and social expectations giving predictability and certainty, providing experimented and accepted solution to new problems (Hodgson 1988). An institutional asset lives independently form people action because they do not have any interest to mean to question. But breaking with consolidated behavioural models asks again for the same coherent and complete reality, the absence of this element takes back to old institutions. Further new models assimilate old institutions, so old and new live jointly in a layered system that guarantees in time internal interests (revenue, social gratification, status) and external interests (level of integration among organisations, social relations, routines) (Selznick 1949).

Moreover structures are continuously reproduced by actors as routines, where structures influence human interactions and are produced by interactions (Giddens 1984). So structures are at the same time an objective fact and an artefact created by a process of interaction and interpretation, under a process of structuration (Structuration Theory). The same technology depends on actors that use it in a process of learning and sensemaking and they approve a modify it through the design, implementation and use, building interpersonal relations. So technology, reflecting the context, is full of meanings and shared patterns, formalised and taken for granted. Implementation and using determine the institutionalisation of technology (Orlikowski 2001). In this dual process Orlikowski et al. (1995) identify a factor named meta-structuration represented by agents that mediate between users and technology artefacts, helping the organisation to adapt to the context variations and assuring an IT efficacy use. The scope is to guarantee the coherence between technology and context supporting its institutionalisation.

So we propose a framework where an organisation of the district, working in close co-operation with same companies within the district, pursues a legitimation activity in adopting a Territorial Knowledge Management System as a territorial meta-structure modifying working practices.

4 THE TKMS MODEL

This ongoing research project described here is named "E-consulting-1-Definition of knowledge management models and methodologies", and it belongs to a bigger programme of research named Sud.it and managed by IBM Italy (this is a kind of collaboration between MIUR - Ministero dell'Università e della Ricerca - IBM Italy and the Department of Organization at the University of Salerno). The general purpose of the programme is the development of low cost tools and technique, not expensive to manage for small and medium-sized companies. The specific purpose of the project is the development of different functionalities capable of managing a model of Territorial Knowledge Management, and capable of replying the abilities and the profit advantage of knowledge system within a district/territory.

The project aimed at the development of managing model of knowledge for the small and medium-sized companies which could exceed the obstacles tied to the cost concerning the supporting technologies of knowledge management, and the difficulty to identify those necessary figures for the managing system. This purpose must be reached looking at the companies as a whole subject, considering all the territorial and the industrial line-branch viewpoint and the community of professional. This model is a virtual community of companies which are able to reply the abilities and the advantages of a knowledge management system belonged to bigger organizations.

The small and medium-sized companies will be at the same time supplier subject and user subject of knowledge as a whole, making occasions out the exchange of information to increase their knowledge store.

The final purpose is the development of a structured system which will allow the companies capable of exchanging, managing, finding, analysing, elaborating, rebroadcasting information, dates, news, images and all the element of a knowledge tied to defined problems.

The project and the model proposed starts form the Fercomin research (2001) that highlights how industrial association, local government and chamber of commerce, could remove the obstacles to technology diffusion: maintaining company independence, sharing information with competitors, investment costs and training costs (more than 50% gave a positive reply).

The element of innovation characterizing this model is the creation of new co-operational spaces, partially competitive space with that system of social and cultural references limited by frontiers named "territory" at least. Technologically innovative solutions allow an effective connection-joint between specialised complementary contexts. However the real challenge is the presence of the quality about the available knowledge. The district is a fundamental archives about the access to a specific high level knowledge, and it is unbearable source of competences and experts within their productive and specialised sphere. So the creation of virtual communities represents the post of that local managing process of knowledge unbearable to assure the increase of competitiveness for companies and systems through an efficient mechanism of generation and diffusion of knowledge and selection of innovation. The community will assume an active role and it will not limit itself to find knowledge from external sources, becoming itself a possible supplier with other bonds of global knowledge network, where the local system excels, rising until to hold a primary international level. The interaction of all the actors within the local productive system represents an unbearable precondition to promote the creation of fresh knowledge coming from the dialogue interaction of all participants.

Regarding the target of the research we think that Industrial Associations could be the ideal subject with which experiment the approach supposed. Industrial Associations are subjects that institutionally perform service of diffusion and information towards their associates on subjects like labour and tax legislation, financial facilities, events and initiatives planned on the territory, and anything else useful to upgrading and developing processes. Actually Associations are a "broker" of information institutionally acknowledged by enterprises, and use of advanced solutions and methodologies could further strengthen and develop this role. Associations are then candidate to occupy the role of leader in

our model of guided aggregation of enterprises. The role of spreader of information of Industrial Associations is reflected in an organizational structure generally articulated in thematic areas. Common areas are usually four: Economic, Legislative, Industrial accounts, Administrative. Each area is managed by a foreman that coordinates and controls the executives activities in the area itself. Secretary's office and technical services area support all the areas. The foremen refer to a director that addresses and coordinates the resources activity in providing services for enterprises, in outward representation and in associative life. The development of a system of Knowledge Management requires the institution of a proper organizational structure, made by functions, that has the task of valorising and mobilizing the corporate knowledge patrimony. In an Enterprise Association a proper organizational structure could be articulated in the following figures:

Community Leader: is the figure that coordinates the activities of information creators that operate in a certain area (legislative, economic, industrial accounts); he decides the activities and the projects to develop, the arguments to deepen and oversees and validates the produced outputs.

Information Creator: collecting information received from the community leader, he develops and updates topic information of the Associates.

Associates: KM system will have to involve professionals and entrepreneurs of the associated companies, in enriching and updating information, and in sharing knowledge about associative life.

System Administrator: Has the operative responsibility of the good functioning of Association's data processing, telecommunication and multimedia systems.

Decision processes assume a common importance (Beccatini & Rullani, 1996) and necessarily follow social dynamics that allow interaction between many cognitions and individual actions. So whereas we have the creation of conditions that simplify and push individual initiative, on the other hand we have a planning a process of communication and confrontation with experiences advanced by other subjects in even different contexts. The biggest difficulty in the role of meta-manager (structure) attributed to the Association is the ability to reconciliate diverse interests (Callon 1991), to broadly valorise variety with the integration project, without sacrificing autonomy and discretion of the singles, element that constitutes the source of such a variety.

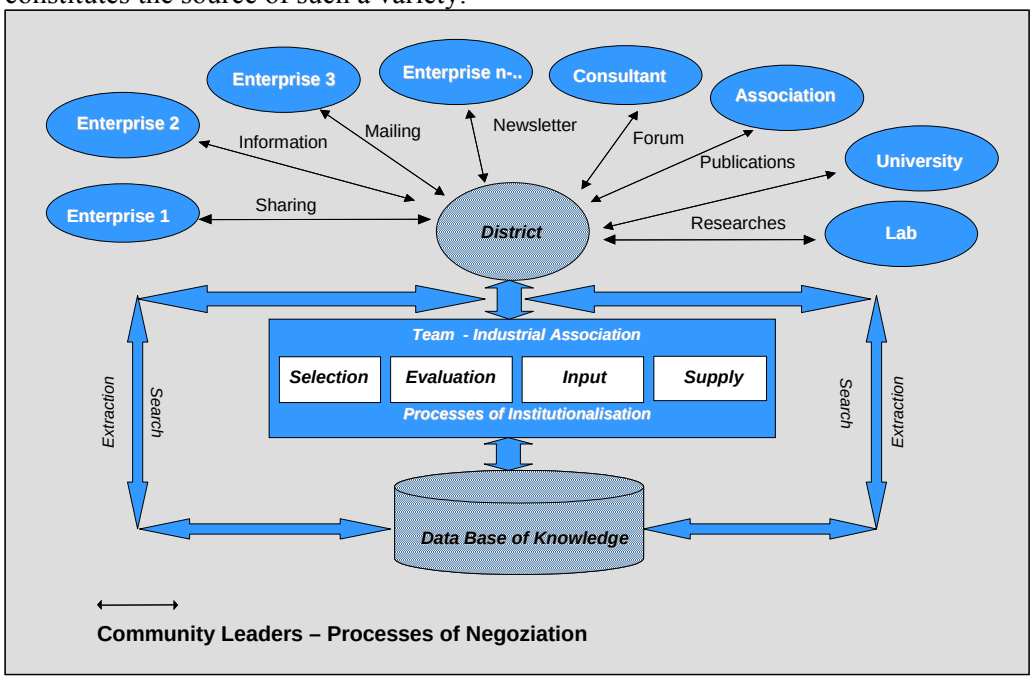

Figure 1. The Territorial Knowledge Management System

The Industrial Associations already are responsible for actions of productive concentration and facilitate new relational mechanisms; they are co-actors of complex processes of work partitioning within the territory and learning; they sustain project of innovation and development motivating the community.

The Industrial Associations activating an institutional environment for the success of institutional project must (Di Maggio 1988):

- mobilize environmental resources and involve subsidiary actors to support the project
- define legitimisation criteria of rules
- build behaviour rules and cognitive maps
- disseminate new ceremonies.

Moreover Community Leaders "also served three other purposes: (1) to understand individuals' norms and their positive or negative views with respect to information and IT; (2) to provide knowledge concerning their information needs that could be useful in seeking legitimation; (3) to provide a reason for later meetings with individuals to probe more deeply into their norms concerning information and IT" (Flynn and Hussain 2004, p. 5). They guarantee "mechanisms of resonance and imitation".

In this "moderate hierarchy" (Boari and Lipparini 1999) meta-management reaches the exploitation of competitive economic advantages for the virtual community analyzing and tracking requirements, allocating satisfiers to requirements, and adjusting the optimality criteria (Mowshowitz 1997). Advanced IT makes more simple a differentiation of the processes of providing services distributed in different places. Functionalities on the portal are very few and are addressed to facilitating the process of creation and sharing of knowledge, such as the application to categorize information and forum. The idea is that the role of technology must be not a predominant element. Users can create and modify the system in according to their needs thanks to an open environment. So it is possible to reinforce the sense of identity through a process of "auto-sizing". Users can open discussions, provide documents to support them, define the criteria of categorization, choose the criteria to manage the structure (in terms of coordinator, chairman, knowledge manager and so on). The "open" source environment enables users to manage and size "their" tools in a system of co-operation.

5 CONCLUSION

At present, the real adoption of KM system is a pioneer project yet. Federcomin research underlines that the local companies show a real tendency to a technological innovation, but they keep a cautious approach. Relating to the use of ICT as support of the relations between the companies belonged to the same district, Federcomin research shows a condition of under-use of such technologies, basically esteemed as a group of tools-means capable of increasing communication abilities of the companies to the outside.

We have faced some resistances tied to a lack of commitment on a top management level of Actors. The managers do not have a vision about the potential benefits of the system, because they have focused their attention on the role of technology rather than the organizational problems and the importance of networking learning processes. They have not sponsored a spontaneous aggregation of firms into system. We are confident in this process of self-aggregation, where enterprises decompress into new operational models, to regain competitiveness, avoiding boundaries and moving in a virtual space (Normann, 2001). Even though within families and associations values and behaviours are shared and corroborated, entrepreneurs needs to reformulate their strategies to the vitality of districts. The model proposed shows how community leaders from one hand can knock down same constraints to the institutionalisation of a new way to interact, on the other hand local associations can reinforce and institutionalise this new rules through communication, training and new ceremonies. Associations moderate in a strategic way the KM portal utilising it as a tool of institutionalisation making goals explicit, maintaining temporary partnerships within virtual communities (Kalil and Wang 2002), organizing companies around information and helping organisations to adapt to the virtual context.

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RESEARCH PROPOSAL FOR PH.D. DISSERTATION: KNOWLEDGE SHARING PATTERNS AND SOFTWARE DEVELOPMENT

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Abstract

Knowledge sharing, or merely the lack of it, is one of the biggest problems in software development work. Individuals working in software development projects have knowledge, but the problem is how the knowledge could reach the other persons needing this knowledge. The main requirement for knowledge sharing comes from the need of division of work.

Software development processes are lacking quite much support for knowledge sharing in the organization. However this does not mean that the existing software development models need to be totally thrown away. We need tools for adding new viewpoints to the processes. Pattern, a vehicle for capturing and conveying expertise (Vlissides, 1999, pp. 8) is here studied as a potential tool for this purpose. As a result is the idea of knowledge sharing patterns and a way for extending quality management systems with more flexible patterns.

1 INTRODUCTION

1.1 Background

In knowledge work effective knowledge sharing is a must making possible the success of the whole organization through sharing the knowledge acquired by the individuals in the organization. The main requirement for the knowledge sharing comes from the need of division of work. Software development is knowledge work with several persons participating in problem solving and needing continuous communication. Still communication and knowledge sharing are one of the biggest problems.

The problems in knowledge sharing result in several ways. The questions in the software development organization are like:

- How to get the project team work together to achieve the goals of the project?
- How to have the needed knowledge / competences available in a project?
- How to share the critical knowledge with those needing it?
- How to get the communication in a project team and between a project team and project's stakeholders work fluently so that everyone knows what he/she is supposed to know?
- How the project manager knows the situation in the project?
- What kind of possibilities there are to "reuse" the created knowledge?

Organizations developing software are using normally formally, in quality management system, defined software development process models in projects. The process model can vary even between projects because of the different needs of the projects. Much process knowledge has been cumulated to the process models used in companies, but still there normally have not been many thoughts about how to get knowledge sharing to work better in the company. Also most of the used process models do not contain systematic way to support knowledge sharing in a company.

For example Waterson et al. (1997) have given implications and recommendations according to their study. One of those is the need to improve software process models: "… processes which involve the transformation and exchange of knowledge and information are largely underplayed in traditional models of the software processes." (Waterson et al. 1997, p. 97).

In this research the objective has been to study the problem of knowledge sharing in software development organization. These organizations quite often nowadays have a quality management system which can be also certified (for example ISO 9001). The problem can then be how to flexible add knowledge sharing properties to software development processes described in the quality management system.

1.2 Approach

To research this wide area, some restrictions and definitions need to be done. The main idea is how to further develop "traditional" software development processes to better support knowledge sharing. The

Figure 6 is describing this and also the key drivers in extending the processes. From the software development side the ideas of agile and software product line based development are studied. These both approaches have their origin in the problems of the traditional approach and these both have their own solutions to the problems. Agile development methods try to find better solutions from the nimbleness and flexibility and the software product lines from the reuse and control.

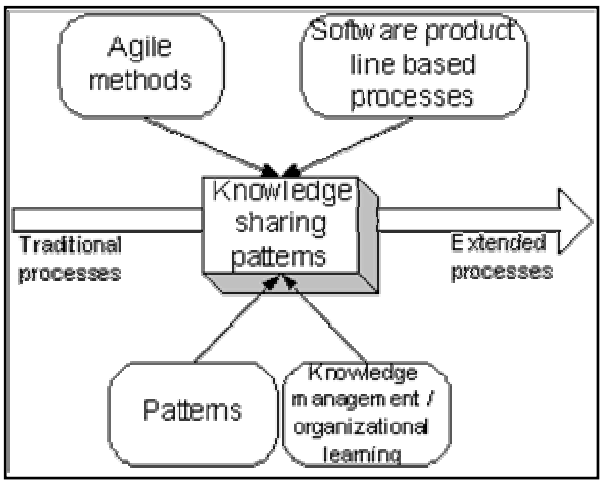

Figure 6: Approach to the topic

In this study the patterns, especially process patterns, are studied as a possible tool and the results show that those are very promising. Patterns are also very concrete giving real possibilities in everyday life and work to solve problems. They can be used for sharing for example the best practices found in different environments. Alexander et al. (1977, pp. x) give a nice description of patterns and their use:

"Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without doing it the same way twice."

Patterns are used as a tool for describing the extensions needed for software development processes and also to other processes in an organization required for supporting knowledge sharing. One part of the approach comes from the organizational perspective and ways of creating organizational memory to support the knowledge sharing. Software development processes concentrate mostly on software development in one project or one product at the time. To overcome this, the needs of the whole organization must be taken into consideration.

When discussing about knowledge sharing or organizational learning, the learning of an individual is also an important part. However it is not possible to cover the whole area of learning in one research, so the learning of individuals, the effects of environment to it and this kind of topics have been defined to be out of the scope here.

1.3 Contribution to knowledge

This research has importance for both the academic discipline and for commercial practice. To the academic discipline, the importance comes from new flexible way of extending processes and from the idea of knowledge sharing patterns. To the practice the importance comes from the competitive edge gained from the better exploitation of knowledge and from rapid sharing of new knowledge to individuals needing it. Also the possibility to easily extend used quality management systems with patterns is important practical matter.

In academic side also the comparisons between agile and product line based software development are valuable to gain more understanding about why these ways of software development are so different from each other and could these learn something from each other.

1.4 Previous research

Process improvement has been a topic for several conferences for years (like ESPI Foundation, www.espi.org) but the objective in these have been from the point of view of quality and measurement based process improvement. The idea of looking the processes from the point of view of knowledge sharing is not much covered.

Thomas Chau and Frank Maurer (Chau et al. 2003, Chau & Maurer 2004) have been studying knowledge sharing in agile processes. In literature, quite often knowledge sharing is studied over company borders (e.g. Appleyard 1996, Fauchart 2003) or the main force is in defining computer supported tools for supporting knowledge sharing (e.g. Heliades & Edmonds, 1999 and Cuena & Molina, 2000). Here the main emphasis is on the human processes and how to further develop software development with better knowledge sharing.

Like the basic idea in this study, Roope Kylmäkoski (2003) has combined the ideas behind agile methods to the more traditional software development and especially to document creation. This is one example that will be used in this research.

One of the main references in discussing knowledge sharing is Nonaka's (1994) article A Dynamic Theory of Organizational Knowledge Creation. Cook and Brown (1999) represent an opposite viewpoint to Nonaka's. Unlike Nonaka, they define that the knowledge can not be transformed from tacit to explicit knowledge or vice versa. Orlikowski (2002) represents the ideas between these two. The ideas from these articles have been widely used in different studies. For example Nissen (2002) has gone further from Nonaka's ideas to knowledge-flow dynamics.

Process patterns like used by Coplien (1995) and Ambler (1998) are similar type of patterns like knowledge sharing patterns meant here. With knowledge sharing patterns however the scope is more detailed and their joining to processes in quality management system is also introduced.

2 OBJECTIVES AND METHODS

2.1 Objectives of the research

The research question in this research is: How to improve software engineering through developing knowledge sharing?

The objective is to find better solutions to support knowledge sharing in software development. Especially the ideas of agile methods and software product line processes are studied and knowledge sharing in these two are compared to learn best practices in knowledge sharing.

One of the objectives is also to pilot these solutions of better knowledge sharing in real life to find out that those really become concrete in the form of better results.

2.2 Hypothesis and research methods

The underlying hypothesis in this research is that knowledge sharing is needed in software development to better exploit the already existing knowledge and to rapidly share the new knowledge. Knowledge sharing is also fundamental in knowledge work, where there is a need for division of work between people.

Agile methods and software product line processes are studied as examples of two very different modes of software development and knowledge sharing. Agile methods seem to support direct communication and knowledge sharing mediated by individuals. Product line processes on the contrary seems to be based on artifacts and knowledge sharing through artifacts.

The research approach used is constructive research (Järvinen 2001, pp. 88-117), especially action research (Järvinen 2001, pp. 114-117). In action research "knowledge is produced and reality modified simultaneously, each occurring due to the other" (Järvinen 2001, p. 115). The researcher is also a managerial actor in the research environment and the ethical questions of insider action research projects (Coghlan 2001) needs to be noticed.

Action research is conducted in an iterative way and in this research the cyclic process of Susman and Evered (1978) is used. The phases are introduced in the Figure 7 below.

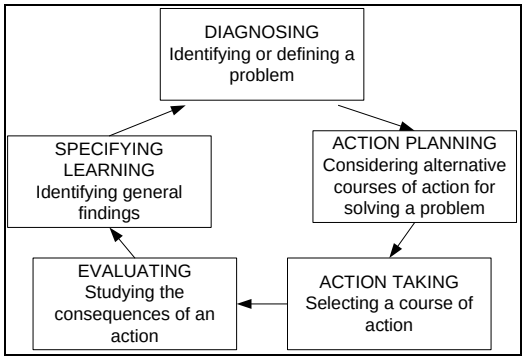

Figure 7: The cyclic process of action research (Susman and Evered 1978)

2.3 Intermediate objectives and schedule

The research will be implemented in two parallel processes, which are described in the figure 8. Theory/model creation goes parallel with the practical iterations (action research cases). Both of these benefit from each other. In between these is the problem definition, which is actually part of these both processes.

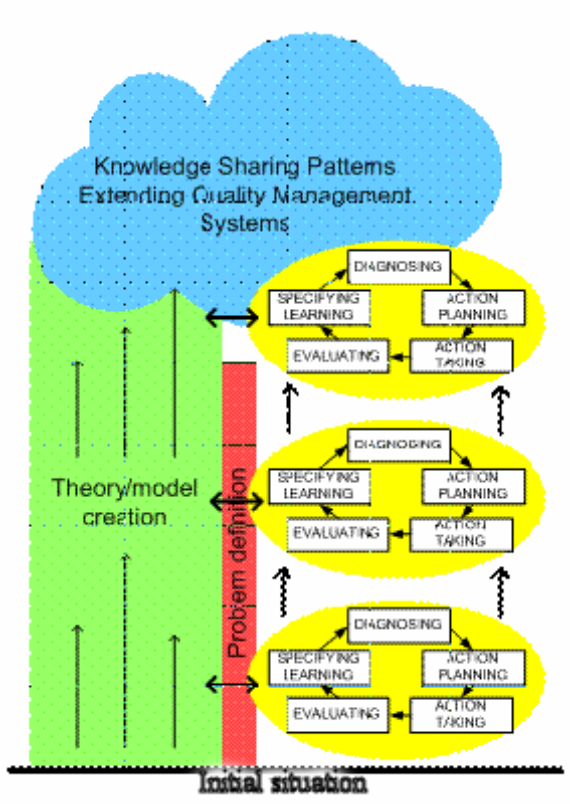

Figure 8: Parallel processes: theory/model creation and practical iterations

The main result is a candidate set of knowledge sharing patterns with which existing quality management systems can be extended. As a by-product or as a main result for the practice are the results of the iterations, which are implementations of the improvements, used in real environment. The intermediate objectives are discussed in the following sub-chapters. The schedule for this research is from 1st of May 2003 to the end of year 2006.

2.3.1 Problem definition

The problem definition has been described as a separate entity or phase, even though it actually is part of the other phases. This has been done to highlight the importance of having concrete results both in the academic side and in the practical side. When doing research in iterative way it is possible that in the middle the actual objectives are lost either because those are not more relevant or because some other objectives seems to be more interesting. The meaning of this phase is then to rethink the problems justifying the research and also to readjust the objectives if necessary.

At least in the beginning and between iterations the problem definition needs to be rethought. In the beginning the objective is to have a better image of the initial situation and the problems related to it.

2.3.2 Theory/model creation

Theory/model creation is implemented parallel to the iterations so that these both benefit from each other. The following issues are included into the theory/model creation. These issues can also be iteratively rethought when new knowledge is gained for example through practical iterations. The issues are:

- Knowledge sharing in general

- Patterns as a tool for knowledge sharing
- Patterns and quality management systems
- Knowledge sharing in agile development
- Knowledge sharing in software product line based development
- Developing candidate knowledge sharing patterns

2.3.3 Iterations

The amount of iterations is three. Actually the iterations consist of several smaller iterations but those are managed here as three bigger iterations. All these iterations include the phases described in Susman and Evered (1978). As an input for the iterations are the results of the theory/model creation and business objectives in developing processes.

First iteration has been the project for reaching the minimum process level and ISO 9001 certificate. The objectives for this iteration were more business driven, but at the same time the basic process structures were established.

Second iteration will be the piloting of some knowledge sharing pattern candidates. In the last iteration the set of created knowledge sharing pattern candidates is piloted and also their connection to quality management system is established.

2.4 Ethical questions

Main ethical concern is that the researcher is also a managerial actor in the target organization. Coghlan (2001) lists several possible problems that can follow from this setting. For example, the following issues (Coghlan 2001) could be thought in this case:

1. While having insights and experience before the research program, the insider actor may assume too much and not probe so deeply as ignorant of the situation might do.
2. Insider actor may find it difficult to obtain relevant data, because of the need to traverse departmental, functional or hierarchical boundaries or because as an insider they may be denied deeper access, which may not be denied an outsider.
3. Role duality: the insider actor at the same time in organizational manager role and in researcher role.
4. Undertaking an action research project in one's own organization is political and might even be considered subversive.

Assuming too much (topic 1 in the previous list) is always problematic with the character of this researcher. To avoid this, golden skill of listening needs to be used as much as possible. Especially in any situation the researcher is not allowed to answers to the questions on behalf of the other persons. Also all results must be accepted by some other actors in the organization.

In a lean organization the departmental, functional and hierarchical boundaries (2) are very scarce and also the company culture has supported the idea, that these boundaries are only needed for managing the entity. Also the researcher's current position as development manager means that she is not a direct supervisor for the personnel.

In this organization, for insider, it is much easier to go deeper than an outsider could do (2), because of quite strict information security limitations towards outsiders.

The role duality (3) is only minor problem in this situation, because as a development manager the researcher has been a sort of internal consultant all the time introducing new development ideas and implementing development projects. This and the created climate of continuous improvement help much in introducing development projects, which these action research projects (4) actually are from the point of view of the organization. All development projects can be even subversive, but this issue

is tried to avoid with communication and other ways of diminishing the resistance to change. This is always one part of development projects.

Another ethical question is that because of quite strict information security limitations, it is difficult to report all results. This is however a minor problem, because in this research there is no need to report technical customer related data.

3 RESOURCES

This research is implemented in the organization where the researcher has her daily work as a development manager. The organization produces research and product development services for the mobile and automation industry. The work is organized as projects and is mostly software development. The company has agreed that the researcher can combine research and work, when possible. The researcher can affect quite much to the objectives set to her work, so she can in some limits have similar kind of objectives in her work and research. The company has also agreed to support researcher's participation to conferences etc. when the researcher has a paper there.

4 RESULTS

As a result from this research is a set of candidate knowledge sharing patterns and ways to connect those to support quality management systems. The research is implemented using action research and the practical results in the organization are achieved during the project in iterative steps. The results in the organization will be evaluated in interviews.

The results achieved in the organization are reported and the resulting processes can be applied also in other organizations.

During the research some articles from these topics will be published. The doctoral dissertation thesis will most probably be a combination of a monograph and articles.

5 BIBLIOGRAPHY

For example the following literature will be used in this research (in addition to those referred earlier).

5.1 Knowledge sharing and knowledge bearers

In defining knowledge sharing Boland and Tenkasi's (1995) work is used. Their definition of perspective taking is quite near the idea of knowledge sharing used in this research. Their term boundary object is also used in describing the ways of sharing the knowledge. Instead of term boundary object a term knowledge bearer will be used in defining it to cover also persons (not only artifacts) as bearers of knowledge. Other basic theories used in this research are Nonaka (1994), Cook & Brown (1999) and Orlikowski (2002).

Theories of organizational learning discuss also much about issues related to knowledge sharing and how the organizational memory creation can be supported. One example is Huber (1991).

5.2 Patterns

A basis for the modern software patterns movement is created in the work of Alexander's (for example Alexander et al. 1977) (Coplien, 1995). Alexander studied patterns in buildings and communities and developed a "pattern language" for generating them (Gamma et al. 1995, pp. 356). In software development the first introduced patterns have been design patterns and also currently those seem to be the main trend. Gamma et al. (1995) is perhaps one of the most famous basic literatures about

design patterns. After that several applications have emerged, for example Noble and Weir (2001) for small memory systems. In addition to these patterns are emerging also for analysis, maintenance, testing, documentation, organizational structure etc. (Vlissides, 1998, pp. 8).

Coplien (1995) has introduced a set of process and organization structure patterns "that can be used to shape a new organization and its development processes". With process patterns he introduces the steps required to implement activities in organization (Coplien, 1995). Ambler (1998, pp. 1) has introduced several process patterns and he describes the term process pattern as "a collection of general techniques, actions, and/or tasks (activities) for developing object-oriented software".

5.3 "Traditional" software development processes

As an example of so called traditional software development processes have been used the Rational Unified Process (RUP) and the book Kroll and Kruchten (2003). Also CMMI (Chrissis et al. 2003) can be referenced if needed.

5.4 Agile methods

Two general descriptions of agile methods have been used in choosing the methods to be discussed. These references are: Abrahamsson et al. (2002) and Cohen et al. (2003). Agile manifesto (Beck et al. 2001) has been used to define the principles behind the agile movement.

Three agile methods have been chosen to be examples. These are extreme programming (Beck 2000), Scrum (Schwaber and Beedle 2002) and Agile modeling (Ambler 2002). Extreme programming has been chosen because it is perhaps one of the most famous agile methods. However it does not very much cover the project management matters, so Scrum has chosen to give more for that side of software development. Agile modeling has been chosen, because it has quite much different viewpoint and it is covering one important part (modeling) that is often partially left out from agile development projects.

5.5 Software product line processes (PLA)

The basic theory of product line processes is based on the book of Weiss & Lai (1999). Another important book is Clements and Northrop (2002). Interesting software product line material is covered also in SPLC[9] conferences.

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