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Unlearning/Relearning in Processes of Business Information Systems Innovation

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Abstract

Unlearning is defined as throwing away concepts learnt in the past to give space for possible new learning. The learning process that supports deep change should be composed by different unlearning-learning phases, both at the individual level and at a more general organizational level. Must unlearning and relearning concepts be explicitly considered in business process reengineering based on the reorganization of information systems? This paper tries to answer this question, by describing the impact of change in information systems on the knowledge model of an organization. The analysis of a recent case study of information systems innovation, permit us to highlight common deficiencies in the design of information systems reengineering processes, particularly in SME. The paper ends with the suggestion of "good practices" that could permit the success of innovation processes by reducing the risk of failure due to excessive resistance to change.
Keywords: Information Systems Innovation, Unlearning, Resistance to change

1. Introduction

Unlearning is defined as throwing away concepts learnt in the past to give space for possible new learning. The need of an explicit consideration of this step in innovation processes emerges from different contexts, especially from business companies, which are pushed by the market into frequent innovation cycles to survive to competitors.

Is there the need of an explicit step of unlearning in business innovation processes? And, above all, what does it consist of?

The success of innovation processes always provokes more or less deep effects on the existing knowledge system and therefore imposes unlearning at some level. We consider the applicability of unlearning and relearning in a particular case of innovation, information system reengineering. We focused our attention on SMEs (Small and Medium Enterprises), which constitute a large portion of the Italian economical environment.

In this paper we initially define unlearning and its prerequisites by making a presentation of the existing bibliography and state of art. Then we analyze the effects that modifications of information system can rise on individual and collective knowledge, following our hypothesis. We observe a real case of innovation in a SME by interpreting some of the difficulties of the change process as indicators of a "crisis of knowledge", potentially requiring a step of unlearning. At last we identify the characteristics of SME innovation processes that could prevent or delay unlearning process, and therefore make the embedding of the new knowledge more difficult. As a final point, we propose practices that could support the success of technological innovation by highlighting the "places" of unlearning.

2. Unlearning

The concept of unlearning was introduced as a consequence of the recognition of the influence of personal conceptual maps on learning processes. Cognitive science and neurolinguistic science on one side, the ecological approach theorized by Bateson [5] Maturana and Varela [23] on the other side, suggest that a large part of our ability of learning is based on the recognition and interpretation of stimuli through a comparison with the cognitive models that compose the structure of our knowledge. Cognitive models are mainly implicit and vary continuously, usually through micro-adjustments that consolidate some pattern at the expenses of other ones. The intuitions of early '80 were confirmed by the observations of neuroscientist engaged in the study of the relationship existing among brain, consciousness and knowledge: such studies revealed a physical evidence of the activation of new neural connection paths in correspondence to new knowledge acquisition; they reveal also that the old, strong knowledge and cognitive maps embody in processes of selection of preferential neuronal paths, whose activation is faster than the activation of other potential ones [17].

In adult time we spend a great learning effort trying to put new elements inside the global frame built-up by our cognitive maps. This is evidently a necessary process and a fundamentally economic one, as it makes immediate and shared the interpretation of stimuli in relatively stable contexts. However, in turbulent environments, or in front of innovation, the strength of maps and cultural patterns becomes a slowing down element, as it drive to mould new information to old models. New stimuli often require a rather radical change of the structure of our knowledge, a cultural change: the ability to unlearn patterns used till now is a prerequisite to give room to new shapes, not compatible with the existing models [6]. Unlearning, therefore, should not be reduced to the recognition and smoothing of explicit personal knowledge, but should involve also – and above all – the portions of knowledge that usually remain hidden or that are not so visible, such as implicit personal knowledge and organizational cultures. So, the learning process that supports change should be composed by different unlearning-learning phases, both at the individual level and at a more general organizational level [3], [4], [24].

3. Related works

3.1. State of art on unlearning

As richly documented in [7], the concept of unlearning, introduced in early '80 [20], is widely accepted by the academic community, even if it is used with some difference. Klein [22] for instance, proposes an unlearning model where knowledge is not thrown away, but it is temporarily put aside, parenthesized, and remains anyway part of individual and organizational patrimony. Schein [27] describes a process of "unfreezing – cognitive change – re-freezing": unfreezing prepares an environment suitable to receive new knowledge that deeply modifies cognitive structures, while re-freezing embodies the new information in a new knowledge schema. Bettis and Prahalad [11] propose the concept of "dominant logic" as an element that influences the shape of an organization's learning curve by weighting on its unlearning curve; they hypothesize that an organization can evolve only through unlearning processes whose intensity is a function of the strength of the dominant logic.

Becker [7] formalizes an unlearning analysis model that puts in evidence individual knowledge elements (explicit knowledge, tacit or implicit knowledge and conceptual reference frames) and organizational knowledge elements (inherit knowledge, organizational memory and organizational culture).

As regarding real life experiences, a number of papers analyze single unlearning cases (for instance, [28]), but studies on the factors influencing unlearning processes based on a large number of experiences are still rare and recent. Akgun and others [1],[2] analyze the result of a survey on more than 300 executives of different companies engaged in the project and development of new products, and individuate a number of factors that apparently make

unlearning process easier. One of the key factors is the turbulence of the organization's reference environment: rapid changes, short life-cycles, dynamic markets, rapid obsolescence of know-how, are all conditions that pushes in the direction of a continuous change. When the turbulence generates a 'knowledge crisis', or just a state of anxiety (the guess of something that cannot be framed in conceptual schemes, and the resulting disorientation), the ground is ready for the activation of the unlearning process, through an implicit or explicit discussion of the existing knowledge models. Unlearning drives towards a stable change, a co-evolution of the group and the project, only if the new knowledge is effectively used in the development of the project. This last phase is very similar to the knowledge re-freezing phase proposed by Schein [27].

The connection between environment turbulence and ease of unlearning is underlined by several researches. Cegarra Navarro and Rodrigo Moya [15] shift the attention to the rather different concept of success. They state that success tends to preserve the existing order of organizations: often resources are used to maintain positions instead of supporting unlearning/learning processes.

Different researches [8],[9],[10] put focus on the structural characteristics that facilitate unlearning processes in organizations. The authors made an inquiry involving employees of public and private companies of north-east Australia finding that large companies or companies employing a stable work force have a better predisposition in treating unlearning phase in training processes.

3.2. What facilitates unlearning

Can unlearning be an explicit phase in innovation processes? And is it possible to communicate to the learners the necessity of unlearning? Apparently it is not possible to communicate this necessity, as who is required to unlearn can comprehend new knowledge, and therefore can recognize the step he made, only after the unlearning step. But the symptoms of the presence of a slowing down element can be easily perceived and should be proactively searched [29]. In literature they are often described as disorientation, anxiety, negative states [13]; practically they are different forms of "resistance to change". If symptoms are strong enough, or if the source of discomfort lasts for a sufficiently long period, the person can learn the new information that overtakes old knowledge [10]. Actually, the necessity of unlearning is evidenced by a time interval, lasting more or less, where new knowledge could be available, but it has not been embodied, nor consciously, through comprehension and aware application, nor unconsciously, through habitudes generated by practice. In the design of innovation, unlearning could instead be explicitly considered through the formulation of hypotheses on the possible influence of the innovation on knowledge, and through the allocation of "spaces for disorientation" to dispose at the appearing of early symptoms of resistance, spaces to be used to launch actions for speeding up unlearning. Which interventions could be more useful is still a matter of discussion; a typical approach is based on individual and organizational counseling [27] whose purpose is to help people to see the sense of their own work and of their role inside the organization [19], [21],[25] and to help them to develop imagination, the ability to represent their object of work in other conceivable contexts.

4. A formal framework of actions in business information systems reengineering

In the previous paragraphs we talked on the unlearning concept. Now we would like to verify that unlearning is a necessary step for the success of business process' innovations that requires the introduction or the modification of an information systems in a company.

Unlearning is an obliged step when new information is in conflict with the existing knowledge structure. We must therefore ask ourselves if and how much information system reengineering processes can stress the knowledge system of organizations and of the people

involved. For this purpose we formalize the different typologies of intervention on informative systems ([30], [31]), on the basis of the need of new individual or social learning and on the probability of "disorientation" or resistance, signals of unlearning necessity:

1. *Technological change*. This class contains the substitution or the re-design of hardware infrastructure to enhance performances (for instance, the adoption of a different network topology; the partitioning of computational load among different servers); software updates for corrective or improvement purposes; operative systems updates. Despite their cost and their innovation, these interventions usually don't alter the conceptual model of the system nor the interaction system, and they are therefore "transparent" to the final users, who will notice just better responses of the system or little variations of the user interface.
2. *Computerized process substitution*. Substitution of computerized procedures with others having a similar conceptual and interaction model; for instance, the substitution of an e-mail client with a less expensive one. Basic mail treatment does not change, but something can vary. Such kind of interventions usually require training on the specific usage of the software on well known objects (e-mail messages, in this case), in well known processes (sending, receiving reading mail, and so on); they do not alter the relations among who uses the new system and the organization. In this case the new knowledge perfectly fits the existing knowledge patterns and the "disorientation" – strictly individual, if any – lasts the time to learn the new operative sequences.
3. *Interaction change.* Modification of the interaction paradigm on computerized processes, such the evolution from character based systems to GUI (Graphic User Interfaces) systems. The implications on the knowledge system could be very heavy. For instance, in the procedural model sustained by character based systems the tasks are to be executed in a give strict sequence; in the "event" model typical of the graphical systems the sequence of tasks is not predefined, the interaction is based on stimuli/reaction, and a same work can be completed following different interaction paths. Obviously such a transformation can be very destabilizing, and the temptation of passive resistance through the reproduction of a working model typical of the previous interaction system cannot be but highly damaging, augmenting consequently distrust in the new model.
4. *Informational growth.* Modification of basic concepts of computerized processes. The impact of change on knowledge system is deep: usually informative level grows up, there are new data to be treated, and they must find a representation into the knowledge system of the operator. Procedures could be conceptually very different from the previous ones, and they usually trace more complex functionalities. Interaction with other processes may change, and therefore the relation system of the organization can vary. The disorientation, in these cases, is mainly felt at the individual level, but it can concern more or less widely the organization itself.
5. *New computerized processes*. The influence of change on knowledge system is very deep and has different levels of impact. At a technological level, people should learn to interact with computerized systems. Moreover, if computerized processes change an existing working habit, the temptation of following the old task steps with the new system will be high. But computerized processes have necessarily operative mechanism far different from the same processes conducted without the aid of computers. For instance, to find a name on a telephone list without the use of a computer one makes as first step a dichotomist search on the list, and then, when the result is close enough, he searches sequentially the list. If he uses a computer he must specify the string to be searched and activate a pattern matching function; lastly he searches sequentially the small list of elements returned by the matching function. The implications on knowledge of new computerized processes are not limited neither to the competences of usage of the electronic tools, nor to the comprehension and application of new processes. New computerized processes may raise heavy modifications on the relational sphere of people using the new systems and a chain effect on all the people entering in relation with them. For example, a new computerized process in the production department of company

strongly influences the internal organization of the department, but it also influence the flexibility of the structure in responding to unexpected requirements from the sales department. As a consequence, new computerized processes influences sectors apparently distant from the one directly involved in innovation.

The deep reorganization of a process provokes the disorientation not only of the personnel directly involved in that process, but also of who interfaces the process. After the reorganization of a sales process even the old customer can feel disoriented and should activate his own unlearning step. Finally, disorientation can touch the very personal sphere of working identity: especially in stable contexts, identity is based on the role and on the relation systems of the organization. Variations to the relation system and changes of role may be perceived like disavowal or like unnecessary changes of a system that "works", a system in which "I feel good"; therefore they may provoke deep states of discomfort and strong resistance – active or passive, acted explicitly or unconsciously – to the occurring change [32].

Reassuming, different interventions on informative systems can generate different necessities of unlearning. We remark two aspects anyhow. With the only exception of maintenance actions, every modification of the informative system requires unlearning that may touch the surface (change in operative tasks) or deeper levels. When reengineering is effectively innovation, unlearning phase is usually necessary, as the change implies the redefinition of the relationship among the self, the object of work and the environment, and stresses both individual and organizational cultures. A similar conclusion is reported also in [14], where the author underlines the role of technologies in reshaping social structures.

A representation of the relationship among modification of informative systems and the necessity of learning/unlearning is shown in Figure 1.

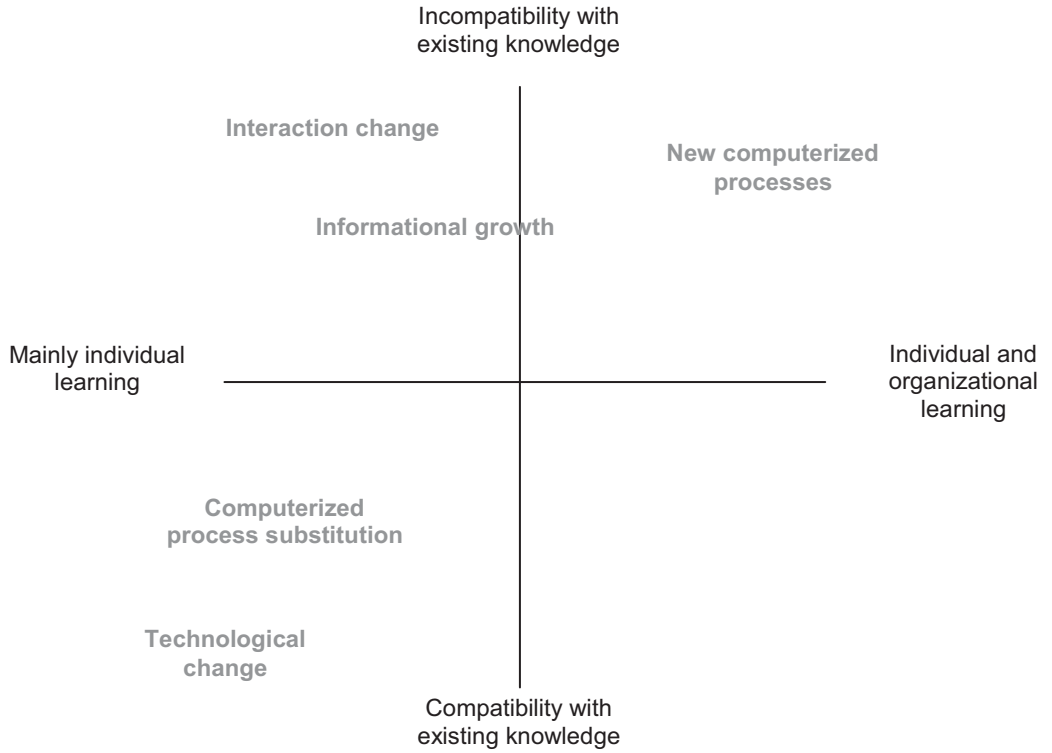

Figure 1: Relationship among business information system change, existing knowledge, request of individual and organizational learning

5. Information systems innovation in SMEs and unlearning: a case study

In 2007 an Italian medium company (about 50 Millions euro of annual income) of the food market started a challenging substitution of the information system. It is an old company, gradually grown in the last years. Its market is the North Italy with direct sales and Europe and USA with distributors. The total investment in the new information system was about 400.000 euro. The selected software house was a local one with a software specialized in the particular market of the Company. It exploited the occasion to give way to a more wide reengineering of its business processes and of the company's organizational structure as well.

The project involved

- People from the company, both Area Managers and operative staff
- People from the software house, five software engineers, one of whom with a previous experience in a multinational environment
- People from a team of external consultant with strong commitment in business process reengineering and in information system start-up.

The phases of the process were

- An initial analysis of the running situation (as-is) and the desired future business processes (to-be). This phase involved area managers, the software house team leader and the external consultant.
- After the development of the customized software procedures, the start up of the system through incremental steps. Each step involved the area manager and the operative staff with learning sessions on the processes and operative sessions on the use of the new system.

All the described typologies of intervention on information systems occurred in this case study. The change requirements provoked noticeable difficulties in knowledge acquisition and in the convergence of the reorganization process, based on an innovative and intensive usage of information system. Some of the most involved sectors had great difficulty in abandoning old working schema and in acquiring the knowledge required to develop the new operational methodologies.

5.1. Outline of the case

The company had to substitute the existing information system and it used the innovation lever to rebuild internal organization; in particular through the reorganization of critical areas that were no more adequate to the new business model and that were slowing down the evolution of the entire company.

Innovation process was started by the company's high management and involved, in the different phases of design, training and start up, the experts of the provider of technology. As company side experts, a pool of independent consultants of scientific/technical extraction followed the entire process by:

- suggesting innovative organizational strategies suitable for the company to compete in its reference market
- verifying the technical feasibility of the proposed solutions
- designing, together with the company's key-users and the supplier's experts, the details of the applicative solutions.

Interventions on informative systems touched the different typologies formalized in the proposed framework (Par.4)

1. *Technological change*, made mainly by the substitution of legacy systems with new open systems; as a side effect, new computerized tools, such as tools for the multidimensional analysis of data, became available.

2. *Computerized process substitution.* Not expressly present in our case-study.
3. *Interaction change.* Change of interaction paradigm of the ERP (Enterprise Resource Planning) procedures. The previous system connected clients to the server through a terminal emulator, with a procedural character based interaction. The new ERP, instead, executes client "event driven" processes that permit graphical interaction.
4. *Informational growth.* Reengineering of several computerized processes, by the adoption of new and more complex processes, with higher levels of automation and integration.
5. *New computerized processes*. Introduction of new computerized processes based on ERP in company's areas where processes previously were not supported by computers, or were supported by individual productivity tools.

In parallel the company started a review of the internal organization, whose more evident effects are the constitution of a new Customer Support department and the growth of importance of Logistics, underlined by its new autonomy (previously it was a function of Production).

Technology change did not have per se any evident recoil on users. The only department heavily engaged was EDP (Electronic Data Processing) people, who vocationally follows technological innovation.

Interaction change from "character based" to "GUI" event-driven systems led to a different informative representation and imposed to the users a new way to interact with ERP procedures; but such a novelty was not an absolute one, as users worked already daily with graphical Office Automation tools.

As regarding the change of existing computerized processes, in several cases the impact on organization and on knowledge system was very strong. An example is the introduction of new tools for data analysis based on a data warehouse. In the old system analysis were performed starting from reports generated by ERP: data were then manually put into electronic spreadsheets and the information was often molded to the desired results. The use of a centralized data warehouse led to a very deep change in the usage of business data, which are no more property of a single department, but are commonly shared, both as source and as interpretation. This led to heavy problems of comprehension of the meaning of data structure and of the need of right and well-timed updating of the entire informative system.

Process reengineering led also to a radical reorganization of departments. The most meaningful event is the birth of Customer Support, a new department detached from Sales Department, who previously followed this subject. Here the informative system changed completely its functions:

- The quantity and the typology of treated data are fairly wider than in the past: now all the data related to post-sales events and their economical quantification are computerized.
- All the machines and tools given to the customers are bar code labeled to better trace them.
- Processes are strictly integrated to those of other company's departments, such as Sales, Purchases and Logistics.

The introduction of new computerized process was by far the more complex element. The change, very radical, touched mainly Production, a department that was used to work completely manually. People just used Office Automation tools to calculate efficiency indicators, but the processes were completely unmanaged and manual. The new system covers by computerized procedures all the classical production phases (planning, monitoring progresses and production accounting), and work processes have therefore radically changed:

- Initially production planning was made in a pure MTO (Made to Order) way: production plans were based just on effective customer's orders and on the stocked supply. The new organization works with a mixed MTO e MTS (Make to Stock) politic, where production plans are based on sales estimation as well and, in a very complex way, on other elements

such as stocked products, supply orders, supply times for raw materials. Planning is performed by a computerized procedure, the MRP (Material Requirement Planning) system; MRP periodically analyses several indicators and composes automatically lists for the purchase and production. In this case a reproduction of the old planning methodology could not absolutely be proposed, as the conceptual model of MRP is completely different: it is based on the complete regeneration of the planning at each run, and therefore shows a new scenario at each step. The adoption of this new modality of production management led to the introduction of a more effective material management process and therefore enhanced the customer's service level. The old planning methodology, which worked with very narrow times determined by customer orders, was completely abandoned.

- Production Progress Monitoring. The manual process was substituted by a mixed monitoring of the progress, where accounting is performed partially manually, partially automatically by using electronic scales and inline items counter.
- Production Cost analysis. The old process was very approximate, based mainly on estimated data. The new processes permit actual data collection and a new efficient control mechanism.

5.2. Fitting the case-study into the framework

Several hypothetical difficulties were identified during the planning of innovation; they influenced both the design of training and activity scheduling:

- *Technological change*: during the initial analysis no meaningful influence of the change of the servers on the users was supposed. Therefore only informative training was held, to illustrate the characteristics of the new systems and the recoil of their usage on the overall company system.
- *Interaction change*: the initial hypothesis was that the new interaction modality would not affect users so much: in fact, all the employees used to work with character based ERP were also acquainted to GUI, for they used Office Automation tools on windows based systems. The planned support actions were purely based on training the correct usage of the new interface, its applicative limits and operative modalities.
- *Informational growth*: the initial hypothesis was that process review could have a great impact on users: therefore almost all the workforce was involved in the definition of the new organizational models and of the interactions among new and old structures.
- *New computerized processes:* the great difficulty of this passage was evident, so a great effort was made to involve personnel in every single step of the design. As examples we cite some detail of the new processes that people from Production had to face:

    1. *Production planning*. Production should unlearn completely the old process and re-learn a totally new one. Therefore the staff was initially brought in a path of conceptual abstraction to isolate some basic principles of the technology of the particular product and the machineries that operate transformations. These condensations of the experience, previously lost in the manual process, became constrains to be respected by the new planning system. The abstraction step was followed by an explicit training on the basics of the new production planning model; finally, processes implementation was held together with operative training and support.
    2. *Production monitoring*. The existing process was observed, and the essential information treated by the company was individuated. In this case abstraction step importance was less than Planning, as the old monitoring process was very simple; the new technology, which moved part of the computation on client systems, permitted also to start new processes absolutely unthinkable in the previous model, new processes that have no analogy with old practices (in cases like this, innovation

is led with "pull" methodology, and is suggested by the availability of new technologies).

3. *Production costs analysis*. This function was not previously performed by production; therefore an explicit training session on costs management was organized. After training, an employee from Management Control Department was temporary allocated to Production to support staff in cost management and to smoothly transfer knowledge between the two departments.

6. Assessment of the case-study

6.1. The emerged difficulties

During change process unforeseen difficulties emerged. A first obstacle was caused by the change of interaction mechanism of the ERP, whose usage, information presentation, even the colors provoked a great disorientation. The delicacy of this passage was considered in the design of training, but a so negative impact and, above all, an impact so variable from person to person was really a surprise. To face the emerged difficulties, an amount of time and resources greater than the one planned had to be spent in the start up phase; the more disoriented staff received attention and additional training, and some of the most inapplicable requests were rejected.

We wonder why this change was so badly accepted: the change shifted towards a well known and more homogeneous modality. In other contexts it is easier to accept variations. For instance, when driving a car, no one is bothered by the modification of important elements, such as the position of acoustic and optic indicators or the presence of an automatic gear system. Therefore, why changes in computer interactions are so destabilizing? We formulate the following two hypotheses:

- It is easier to accept changes on tools we know well, on tools we historically manage, than on newer tools (like computers) we are not so acquainted to use: if it changes I am scared because I think I am no more able to drive it.
- The immutability of some objects, like cars, is widely accepted; computerized procedures, instead, are expected to be totally customizable, a probable heritage of the myth of software flexibility. Actually interaction mechanisms of software procedures are usually "embedded" in the development platforms and their modification would require an enormous cost, probably similar to the one required to move directional indicators from left to right in a car. There is also a conceptual limit, as interaction tools maps defined logical models; thus the change required is not only operative.

Reengineering of old processes presented some difficulties as well. Great difficulties in the adoption of new processes and a strong inertia have been noticed mainly in Sales Department, where employees tend to work following old habits. Particularly external operators (i.e. commercial agents) still interact with Sales for problems related to customer support. In the new organization Customer Support is a new separated office, with its own competences and objectives, and the behavior of commercial agents provokes an overload of the Sales, which acts as a mediator between Customer Support and external staff. This lack of respect of the new operative procedures leads to inefficiency and overburden of the information system, which is managed by two different subjects, with a partial overlap of activities and data treatment. To solve this situation the company decided not to coerce, to avoid an enhancement of structure's disorientation: they decided instead to make additional training and to monitor constantly the activities to gradually bring the two departments to run activity regularly.

Lastly, the main problem of new computerized processes was the necessity of the staff to abandon at every level (from management to low workforce) strengthened functional models. A first resistance was actually due to the complexity of the new processes and to the tentative of breaking them up in intermediate steps to have a better control over them: an impossible

task, for the new process is absolutely incomparable to the old one. As already stated, a step of abstraction and re-learning had to be made: this step was not simple, mainly for the scarce educational level, and often for the age and the seniority level of the involved workforce ("I've been working this way for thirty years"). At last, a strong cultural change occurred: it was relatively simple for some people who already had other working experiences, but far more complex for older employees, who had to be followed by consultants in abstracting the conceptual model out of all the old processes, and in matching the extracted models with the new processes. A couple of employees, with high seniority level and a medium/high responsibility level, couldn't endorse the new model and therefore remained underutilized, left to the margin of the new processes. The problem of the high complexity of the new processes was crucial as well: more data, more parameters, more procedures. Clearly the problem was still related to the cultural level and to the adaptability of personnel involved in change. Usually young persons with a higher education level easily adopted new procedures, quickly assimilated the growing functional complexity, better accepted the pervasive presence of the new system.

6.2. General discussion

When this innovation process was launched, the impact of some elements on knowledge was taken in consideration, planning actions of training and support. The impact of other elements was instead underestimated, particularly individual differences in the willingness or in the ability of learning and the resistance caused by the strength of old relationships [33]. We formulate some general findings on the factors leading to underrate these aspects in a technological innovation project that was, otherwise, very robust.

In technological innovations in SMEs, training and flanking actions are usually designed and held by technology suppliers [18], who might consider these phases secondary. Attention is given mainly to the technological object rather than to environment and people; usually training is planned without a real preliminary analysis of organizational cultures and of the profile of the people involved. The implicit assumption is that information will flow naturally from the consultant to the learner, it should anyhow be learnt and naturally nest on the declared knowledge basis, without a notable difference among persons. But knowledge implies mainly human and social dimensions.

To be effective knowledge should be assumed by the singles and by organizational cultures [12], [16]. It seems that also the curator of the innovation process is required a "unlearning effort" to consider human and social factors critical elements for success.

The lack of a role for human resources management is a second element that can contribute, in SME, to the underestimation of the importance of human and social factors.

The difficulty of design an action on the social and individual plane is surely a preventing elements, as well as the impossibility of taking immediate measures of the impact of an action on these fleeting subjects. The temptation, often put into practice, is to remove individual and social factors as they are uncontrollable, and to get rid of resistance to change as a manifestation of a bad character that should be treated with coercion.

Lastly, narrow times and limited investing capabilities push towards a compression of the time allotted to the innovation process; this condition is incompatible with the need of time for disorientation to ripen in a controlled way, a step necessary for unlearning.

6.3. A "Best Practices" proposal

In business information system reengineering, the application of new functional and organizational models requires a not trivial conceptual effort, whose basis lay onto the ability of workers and organization to unlearn their working habits to learn new ones. From the case study analysis and from other experiences of the same kind, we derived a set of indications that could permit the completion of innovation processes by reducing risk failure caused by excessive resistances to change:

- Human and social factors should explicitly be part of the design of the new system. Today, in SME's information system reengineering, analysis phase usually covers just technological and process elements; in our opinion this elements should be joined by a deep analysis of the organization, the observation of relational dynamics and of cultural and personal characteristics of the workforce that will be touched by the change. This would permit a better foresight of the difficulties of the innovation process. In the case study, for instance, high seniority and a scarce cultural level could emerge as individual critical factors; the presence of strength relationship among Sales and commercial agents could emerge as a social critical factor, while the tendency to consider data used for company's analysis as a property of the single department could be seen as a critical factor due to the organizational culture. The knowledge of such conditions could permit a more accurate design of actions to support innovation process.
- Resistance to change should be considered as a inescapable factor of the process; its possible manifestation should be discussed with the customer, so that its presence does not constitute an unpleasant surprise, but a foreseen event, to be managed with appropriate actions.
- A fundamental step is to help user to abstract the essential concepts from the operative process, independently from their final fulfillment. It is therefore necessary to define at the single process level what in technical terminology are called "the requirements of the process" (what the process is required to do), regardless of the operative specification (how the process should be developed). The problem is not a trivial one, as usually for the operator it is easier to define how he acts than why he acts that way (which are the motivation or the objectives that led to a certain kind of activity). The abstraction phase is necessary as it gives an overall sense to the steps of the process. Abstraction condenses the essential out of the process: it bases on experience and highlights the habits layered in time that are still valid. The need of abstraction reaches the maximum level when innovation is carried on in a “push” way (push by the informative need), as the case of production planning described in the case-study. In these cases a process, already set in the practice of the organization, computerized or not, should be redesigned with the support of information systems to augment business performance. Abstraction step highlights the informative exigency that pushes to process reengineering, and illustrate it to the people that mainly see practical aspects, often endorsed by habit. When innovation is carried on in a “pull” way, the availability of new technology suggests a new opportunity and therefore gives rise to totally new processes; an example of "pull" innovation is e-commerce; where an emerging technology (the Web) permitted the naissance of a totally new sales model, in terms of interaction, market and functionality. The need for abstracting basic concepts from previous experiences is limited, as often there is no available experience and the modeling is mainly original. But it is necessary to give a sense also to these new pull processes, to permit people to comprehend and learn them easily. Its evident that the two methodologies (push and pull) are not alternatives, but represent a continuum, and the need of abstraction is always present, at different intensity level.
- Abstraction step should be followed by the disposal of the new knowledge through appropriate support actions: classical training, co-design of the operational details of the new processes, flanking in daily activity, … At this stage of the process, resistance to change may occur, which signal the rising conflict among old culture and new knowledge.
- Unlearning. To give place to new knowledge and new practices, the user should unlearn, abandon the process followed until now. Unless he unlearns, he will act resistances such as explicit boycotts, inapt requests, passiveness, or attempt to control what is hard to comprehend by breaking up the new processes in step that mach analogous steps of known processes. Most of times this last approach is highly misleading and results in the augment of frustration and disorientation of the user. Duty of people responsible for innovation is to early recognize the presence of resistances to change, both expected and

unforeseen, and give the start to corrective actions: for example additional training, flanking, listening to problems and giving advices, enforcing; these actions should support the user and help him at least to make new habits stronger; in the same time they could safeguard innovation process. Underestimate the existence of resistance to change and its strength imply the concrete risk of innovation process' failure.

- Learning/Relearning, embracing the new processes. This is the final point of innovation processes, the result to which abstraction efforts, training and flanking tend towards. But it is an arrival point built at the same time with process implementation, like a river digs a new path by eroding ground in small stages, until the new path becomes the main stream and the old one turns into a secondary oxbow.

7. Conclusions

Through the analysis of a business case study, in this paper we evaluated how innovation in business information systems can influence the knowledge system of a organization and the relationship among personnel of the organization itself. Technological business innovation is an occasion for a deep cultural evolution where some of the old habits and knowledge loose their validity and should be abandoned to give place to new processes. Innovation comes with learning and re-learning processes whose principal step is unlearning, the ability of smoothing the strength of old knowledge and habits to give space to new learning.

Our plans for the future are

- to observe the applicability of the framework and the best practices we proposed, which are in contrast with several diffused habits in SMEs, by analyzing information system reengineering in different social and cultural contexts;
- to define a set of indicators and metrics, in order to measure the effects of the application of the best practices, by analyzing the time spent in each phase of the innovation process and using specific questionnaires on the reached results;
- to measure the effects of the application of the model we outlined on new cases of innovation in business information systems.

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