Sustaining the introduction of innovation in digital enterprises

Challenges and demands from Small Medium Enterprises in the Italian Northeast region

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Abstract: Small Medium Enterprises (SMEs) face specific challenges as the pace of technological advancement quickens. In order to keep pace with market demands, these SMEs need, among others, new tools to manage information content and new problem solving skills. They also need personnel capable to analyse the new tools and methodologies, select the most appropriate, deploy the solutions and train their workforce. Larger corporations can relay on the presence of various skills within the company to create successful teams; they can afford external consultants to assist the change management, and broadly based training programs, while SMEs cannot.

In this paper we analyse and discuss specific challenges and demands from Italian North-East SMEs as they have emerged from our experience in research and internship projects. We present some interesting case history data and discuss some general trends emerging from them. In particular we see that the type of problem in SMEs are not very different to the one encountered in large companies: they are of the same class, and the challenge here is to face efficiently these problems with limited resources.

Key words: Technological Innovation, Information Systems to support Innovation, Enterprise Knowledge Management, E-Business models

1. SMES CHALLENGES AND DEMANDS

Globalisation of the markets together with the transition towards a knowledge-base economy is changing drastically small medium enterprises business environments. Both trends rise specific challenges for SMEs. These problems are strictly correlated with the shortage of “intangible” investments like an efficient access to and use of technology, suitable managerial skills, effective training for the work force, high organizational quality and customer relationship management skills as well as new sales skills.

The main difficulties that SMES meet when they try to face the challenges of globalisation are often related to their tendency to remain tied to their “domestic market”. In quantitative terms, some studies [1] indicate that less than 10% of Italian SMEs are currently present in other countries and/or continents and therefore cannot be considered ready to become global market actors.

Data collected in Northern Italy [1] indicate that approximately only 25% of manufacturing SMEs are competitive on an international level. Those that will not adapt to the global market challenges - between 25-50% of the total number of SMEs - will likely disappear. To survive, SMEs need to modify their central business objectives: not exclusively product quality, but also fast product availability, optimal logistics and improved customer services.

The business context for SMEs is in fact radically changed: in the classic model of mass production the enterprise produces a certain constant product, with limited requests for modifications of the production processes for a considerable period of time. Both products and production processes remain relatively constant. In this kind of environment, typical for SMEs, it is not crucial to transfer information between one process to the other in the value added chain. The product itself connects the different manufacturing phases and the warehouse acts as a buffer. In this old scenario, the main goal for the enterprise was the product and the main aim was to produce high quality products.

Now the context is changed from static production processes to a dynamic system of coupled processes. In this new scenario, the main goal is to correlate effectively all production processes. Naturally the product is still the final result, but the reason to choose one specific enterprise relies more in its production processes than in its products. The new aim is to improve the level and the quality of the link between internal production processes and suppliers and customers processes. To maintain a competitive advantage enterprises do not seek only to be selected as suppliers of high-quality/competitive-prices products. They must also become an integral part of the supplier-manufacturer-customer supply chain [2].

1.1 What kind of challenges for SMEs ?

The new business models requires to face the change in three fundamental dimensions of the production activity, both from SMEs and large organization:

- new procedures for the cooperation and the interaction with the suppliers: as enterprises business relations evolve to include all information fluxes between customers and suppliers, new information exchange procedures emerge and need to be implemented. They range from suitable B2B applications to integrate the different production activities to new organizational methods to enrich customer-supplier relationship, like innovative methods to gather more richer information from customers (feed-backs, suggestions, etc.) and involve business customers in both risk and profit investment.
- business processes reengineering for the enterprise to support the transition from the first phase of computerization (not-interconnected information systems) to the second phase of a distributed enterprise information system capable to assist communication and information exchange. The basic skills required here include analysis capabilities and tools, design and management of communication infrastructures, of knowledge sharing tools, and of enterprise procedure optimisation and automation tools. In this respect, the new business paradigm underlines efficient work organization, fast and appropriate introduction of innovation and effective training of the work force as key competencies for the successful enterprise.
- new procedures for the interaction with the customers: the new industrial activities are focused on the creation of profitable and long-lasting relation with its own customers. In order to pursue efficiently this aim, companies must - collect and use customers data - increase the quality of the product, investing in tools, methods of production planning; - increase the offer of value added services to their customers.

1.2 What type of demands from SMEs?

In order to keep pace with these new changes, enterprises need ,among others, new problem solving and knowledge management techniques [3]. They need to analyse the new methodologies and tools, select the most appropriate, deploy the solutions and train their workforce.

By collecting and monitoring proposal for research and internships projects from SMEs in the Italian North-East region, we have been able to identify some classes of demands. The majority of the proposed projects involved the deployment of a particular innovation (technological or

organizational) that the middle management of the enterprises believed to provide a competitive edge. Most of the times the innovation required massive entrepreneurial challenges: radical re-invention of internal or external processes, managing alliances and networking strategies, issues related to organizational memory and knowledge management problems.

In order to identify specific responses to the demands, we have grouped them into the following five categories:

- new management methodologies to examine competitive advantages in networks of alliances: managers demands tools for and training in the decision making process. In particular they seek methodologies and tools to evaluate risks and benefits in alliances, merging and outsourcing activities. This group of demands respond to the challenge for the management of mastering new procedures for the cooperation and the interaction with the other actors of the particular market and is closely related to the following point.
- new form of work organization and supporting tools: here the demands from the management are concentrated on the development of a company culture for teamwork, open to a flexible and modular reconfiguration of roles and activities. In this respect the introduction of effective teamwork methodologies and specific groupware tools need to be considered on a case to case basis in order to assess its usefulness together with related phenomena as innovation drift, care and tolerance [4].
- fast, appropriate and integrated introduction of innovation in the production and management processes. The emphasis here is in a demand of qualified human resources capable to grasp the inherent interdisciplinary approach to an innovative solution. The radical restructuring in enterprises has in fact created a new class of problems requiring more than ever a synthesis of organizational and technological skills [5]. This class of problems is of central importance to all enterprises today and its solution is critical to the success of innovation for SMEs.
- the effective use of the new information channels offered by telecommunication developments. The rapid diffusion of enterprises Intranets and Extranets together with a widespread diffusion of Internet access pave the road to a new series of application and services for SMEs to support business activities. In this setting E-Business is a used term in order to indicate all automated procedures aimed at the management of all aspects business operations. Typical demands are B2B solution for supply chain management and tools for customer relationship management.

- new methodologies and tools for enterprise knowledge management: here the emphasis is in the research on the conditions that promote enterprise learning and on methodologies and tools that assist in organizational memory processes.

2. CASE STUDIES AND ANALYSIS

2.1 General data on internship projects

The Laboratory for Informatics Engineering (LII) at the University of Trento is involved in a multi-year program of research, technology development, technology transfer, and professional training on the use of emerging information and communication technologies for supporting enterprise innovation. The main body of experiences and data we have gather from our work with local enterprises has been focused on the segment of Small and Medium Enterprises (SMEs) in the private sector and with relatively large enterprises both in the private and public public sector.

Our experiences on the problems related to the introduction of innovation have been collected during the years through three main channels:

- applied research projects with local enterprises SMEs,
- internships projects in connection with a three year degree course in Engineering Informatics of the faculty of Engineering, and
- internships projects in connection with higher education training courses both for unemployed people and for life-long training of enterprises personnel.

The different types of training courses we have running have involved so far about 420 students (ca. 240 degree students, 110 post-diploma students and 70 post-degree graduate). In the course of our training activities we have therefore organized and run about 420 internship projects. Approximately half of them involved SMEs. The remaining projects involved larger corporation, like public administration, large research institution and large enterprises. We report in the following data from the SMEs internship projects collected and analysed at different levels.

Table I summarize total internship data, covering a five-year period from 1996 to 2000 for a total of 258 projects, according to the previous proposed categories of SMEs demands.

Table I: Categories of Internship Projects in SMEs

Category	
Alliances / Outsourcing / DSS	13 %
Teamwork / Groupware	26 %
Business Process Re-engineering	37 %
E-Business	14 %
Knowledge Management	10 %

All categories are significantly populated. The main two project classes involve BPR and re-organization of work activities through teamwork methodologies supported by groupware tools. In our activities we have monitor the evolution of the types of project proposed by local SMEs in the past five years. Table II presents this evolution in time.

Table II: Evolution of Categories of Internship Projects

Category	1996	1997	1998	1999	2000
Alliances / Outsourcing / DSS	11%	12%	14%	15%	12%
Teamwork / Groupware	27%	25%	26%	26%	25%
Business Process Re-engineering	48%	44%	44%	34%	16%
E-Business	12%	7%	11%	13%	29%
Knowledge Management	2%	12%	5%	13%	18%
No. of projects	41	52	58	56	51

The growth of demands in the area of E-business and Knowledge Management is important and correspond to a clear trend in the local economy towards an extensive use of the new information channels that are mature for use. This can take place and advantage from the continuous effort of reorganization of the business processes that has started in the past and is continuing in the present year.

2.2 Presentation of case studies

To extract more detailed information from our data, in the following we present three interesting case studies and take the opportunity to discuss some general trends emerging from them and supported also by the overall collected data.

2.2.1 Assessing the deployment of groupware tools in a network of local banking institutes

This project has dealt with the monitoring and assessment of the deployment of groupware tools, based on Lotus Notes, in a network of local

banking institutes of the Federazione delle Cooperative Trentine. The banking network includes 69 independent institutes (Casse Rurali) for a total of 330 front offices. This environment covers very different realities ranging from small offices with only four workers to medium sized offices with more than 100 workers.

The project has involved several skills and operation like:

- integration of the project team (2 students) in an existing monitoring committee
- the preparation and distribution of digital questionnaires
- the preparation of interviews with final users of the systems: top managers, middle managers and operator
- statistical and sociological analysis of the collected data

During the project the management of the consortium of banking institutes has emphasized four area of interest, namely: monitoring the use of the software, analysing its organizational impact and analysing peoples resistance to the new tool. After a first period devoted to get in touch with the company reality, the first phase of the project has been devoted to the preparation, distribution and analysis of a digital questionnaire to all people in the network. The work of analysis here has enable a first clustering of institutes on the basis of their kind of use of the tool. The second phase has concentrated in the preparation of interviews with selected final users of the system. The final outcome of the internship has been a report and a presentation of the findings to the top management of the banking network.

Major findings from the present project include:

- wide differences in the attitude towards the particular innovation are present in the work-force: top management being more prone to adopt innovation, while middle management resist the change;
- the majority of the workers feels the need for special training courses to improve their use of the tools;
- groupware can serve as a set of tools for facilitating closer interaction and better communication between individuals, especially if they are geographically dispersed; however, the use of technology will not bring about improvements per se. It must be combined with the creation of an information-sharing culture and adequate work-processes that support it.

2.2.2 Definition of a model for the knowledge management in a testing laboratory of a manufacturing enterprise

The initial proposed project dealt with the development of a database to assist the management of the material-testing laboratory in Novurania, a manufacturing medium enterprise of plastic fabrics for nautical applications. During the course of the work it became clear that the collection of internal data for the creation of databases involved harvesting of internal non-formalized procedures.

In a second phase, after discussion with the company managers, the objectives of the project were broaden to include:

- an exhaustive analysis of the enterprise testing procedures in the various departments;
- an analysis and selection of enterprise best-practice to be capture in a proposed knowledge database
- the development of a prototype knowledge database
- the use of the knowledge database to propose improvements to enterprise procedures;

Different skills, methodologies and tools were useful in the project. In the first part the work focused in the development of Data Flow Diagram to capture company procedures (see Figure 1). To gather the necessary information a number of interviews with the middle managers involved in the testing procedure were prepared and carried out by the student. The Data Flow Diagrams were used to capture the actual information flow between enterprise departments and to underline criticalities (redundancies, possible coordination problems ..).

The second phase of the project was devoted to the design of the Entity Relation Diagram for the proposed knowledge database. The developed DB tool has been extended to include decision support features, like the automatic proposition of categories of testing to execute to new materials based on stored company procedures. The developed tool is actually deployed in the different departments and our research group monitors its use after the end of the internship project.

Naturally the deployment of the tool has impacted with existing working practice and organization. The success of the introduction of the innovation has been strongly correlated by the human and organizational factors that were discovered and analysed in the design phase.

Figure 1: Example of Data Flow Diagram for overall testing procedure

2.2.3 E-Business Models for a SME: Dr. Schär case-study

Dr. Schär is a SMEs (ca. 100 employees) situated in Burgstall, Italy, a small village about 20 km north-west from Bolzano, the provincial capital of South Tyrol. Dr.Schär has earned an excellent reputation as leader and specialist in the European market for high-quality dietetic products. Starting in 1997, Dr. Schär management decides to explore the opportunities offered by the new telecommunication developments. The company goes on Internet under www.schaer.com and at the same time participates to a local project named Telepraktikum [6] which involve the local Business Innovation Center and some Italian and Austrian Universities.

The Telepraktikum project focuses on the introduction of e-business models in local enterprises with particular attention to the technologies supporting telework.

Within this framework the internship project has dealt with the requirements analysis of Dr. Schär. The proposed technological tools to improve the company e-business profile included:

- Unified Messaging: integrated information system to support e-mail-telefax and phone enterprises messages; the requirement analysis focused on the groupware activities that could be implemented by the use of such a system;
- use of VideoConferencing to support communication with suppliers/resellers located in Europe;
- development of a Call Center (see Figure 2) to manage all Consumer contacts with the enterprise

Through the implementation of these tools, Dr.Schär desires to innovate its enterprise information system and in particular:

- to improve its control on the information fluxes;
- to update its internal and external communication system
- to explore and test new emerging business models and include them in

the company culture.

Figure 2: Information fluxes in Dr.Schär Call Center

3. DISCUSSION OF CASE STUDIES

Some general aspects emerges from these reports, and are supported by other internship data:

- the problems and demands we have found in our local SMEs do not differ from the ones encountered in large enterprises. They belong to the same class of problems, inherently involving organizational as well as technical skills acquisition and practice. Larger corporations can relay on the presence of various skills within the company to create successful teams, can afford external consultants to assist the change management, and broadly based training programs, while SMEs cannot. The typical result from this lack of resources in SMEs is the focusing of their interest on particular one-dimensional problems, connected to a single aspect only (either technological or organizational). But in order to actually solve the problem the overall issues must be successfully addressed;
- a different attitudes is present between top management and middle management in regard to the introduction of innovation. Top management is prepared to face the challenge of an integrated approach to innovation. They are very sensitive and open to the idea of a full-spectrum analysis of particular topics and they seek contacts with possible partners to face the challenges (university, consultant etc.) Middle management are resisting these ideas and are more interested in day by day routine innovation problems, more easily separated in the two macro-area (either technological or organizational);
- a gradual approach in the introduction of the innovation is often desired and expected by the workers and supporting training programmes can assist in the change management aspects of the issue;
- another general aspect is the separation of the projects proposed by enterprises, in regard to innovation, into three main groups: analysis prior to innovation, deployment of innovation, monitoring the process after innovation.
 - ✓ analysis prior to innovation: these projects are more likely to present integrated problems and are the ones at the top of the interest for the top management;
 - ✓ deployment of innovation: essentially operative problems, most often of a technological type that requires operative skills (programming, customisation, scheduling of activities etc.);
 - ✓ monitoring after innovation: again the need for integrated knowledge and culture is high. The collection of data, the identification of critical points, and the final analysis requires

different kind of skills like contextual analysis, data gathering, knowledge of technology solutions.

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5. CURRICULUM VITAE

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