Building competitive skills in small and medium-sized enterprises through innovation management techniques: overview of an Italian experience

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Received 30 March 2000
Revised 17 July 2000

Abstract.

The paper reports on the work and the results of the IMTIC (Innovation Management Techniques for Industry Clusters) Project supported by the European Commission's Innovation Programme.

The purpose of the project was to make industrial small and medium-sized enterprises aware of the possibilities offered by innovation management techniques (IMTs) in planning and implementing long-term business strategies.

IMTs were presented and outlined to a number of industrial clusters in five Italian regions in the areas of: (i) marketing of innovation, (ii) Technology Watch (TW), (iii) Technology Search (TS), (iv) management of intellectual property rights and (v) quality management.

The Institute for Studies on Research and Scientific Documentation (ISRDS) of the National Research Council (CNR) of Italy was one of the subcontractors for the project. The main task assigned to ISRDS/CNR was to set up the methodological framework for two innovative techniques: TW and TS.

In particular, the methodological process for setting up TW and TS is described. Monitoring by ISRDS of the project phases and the control of the results are also described.

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1. Background

Small and medium-sized enterprises (SMEs) do not always apply innovative techniques that would permit them to be more competitive at national and international levels. As we are now living in a global economy, it is necessary to implement, at all levels, policies that will enable companies to make their activities more international and innovative.

In this context, the European Union (EU) launched the Innovation Programme, which proposes to promote the creation of a favourable environment for innovation and the adoption by companies of new information and communication technologies (ICTs) to improve their competitiveness.

The innovation management technique (IMT) projects [1] were launched within the framework of the Innovation Programme, with the objective of introducing specific techniques for innovation management, seen as tools for helping SMEs to acquire better knowledge of the processes, problems and potential opportunities of the market.

2. The IMTIC project

Among various projects in this Innovation Programme, the EU assigned the IMTIC (Innovation Management

Techniques for Industry Clusters) Project to the Italian Association for Industrial Research (AIRI), as coordinator, to the Institute for Studies on Research and Scientific Documentation (ISRDS) and to the Office for the Transfer of Innovations, Patents and Technical Regulations (UTIBNOT) of the Italian National Research Council (CNR).

This project was concerned exclusively with single industrial clusters in certain Italian regions (Piemonte, Veneto, Lazio, Campania and Abruzzo). It was decided to apply these IMTs to industrial clusters for the following reasons:

(1) they are typical of the Italian economic and territorial structure;
(2) reinforcing the industrial clusters is the best way of reinforcing the industrial system as a whole;
(3) the uniformity of business of the companies belonging to the same cluster made it easier to point out the application problems of a specific IMT in a specific business sector;
(4) subsequent dissemination of results is more effective because it can be focused on groups of companies in the same business sector;
(5) the help of local trade associations made it easier to interest individual companies in the project.

2.1. ISRDS research activity

The ISRDS carries out, on a permanent basis, research and training activities regarding technological innovation and diffusion of knowledge in accordance with the general plans of the Italian National Research Council, of which it is a part, and with the needs of the national research system.

The tasks of the Institute include:

(1) conducting studies on scientific and technological research policy;
(2) carrying out studies and defining methodologies for the application of ICTs.

In particular, the latter task is the natural development of the activities carried out for a decade (beginning of the 1980s) by one section of the Institute, when the Italian Referral Centre for DIANE (Direct Information Network for Europe) was set up within the Institute upon the invitation of the European Commission. The aim of the Centre was to promote the diffusion within Italy of scientific information in innovative forms, especially through the use of specialised electronic information products and services.

On the basis of the expertise acquired in this field, the AIRI assigned to the ISRDS/CNR the task of setting up the methodological framework for two innovative techniques, Technology Watch and Technology Search, and monitoring activities during all stages of the project.

3. The stages of the project

The project is one of the *awareness actions* that aim to show SMEs the development opportunities offered by IMTs. The IMTs deal with general strategy, in that they help the company to formulate strategies within the context of their technological opportunities. Furthermore, IMTs engender a holistic view of innovation and allow companies to take full advantage of new technologies.

The first step of the project was to identify five IMTs of potential interest for the companies, then to set up a methodology to be used by the consultants responsible for their application within the companies and, later, to propose the IMTs to selected single industrial clusters in a series of meetings.

3.1. The innovation management techniques

The five IMTs of interest for the companies are as follows.

3.1.1. Technology Watch [2]

The technology component is rapidly becoming more essential than all the other factors related to competitiveness, not only for the sector of products and production techniques, but also for the sector of management, organisation and training. This component, together with the growing costs of basic and applied research and the impossibility of 'do it yourself', has made 'information about technologies' of vital importance. Companies are forced to implement 'watch techniques', that are voluntary, permanent, sectoral and systematic in their own environment, to control and retrieve information that will enable them to make the appropriate decisions for remaining competitive at national and international levels.

This defensive technique, with which the company keeps under control the environment in which it operates, is commonly known today as Technology Watch (TW). It consists of knowing how to 'listen' to and 'watch' what is happening in this environment in order to learn about all the useful innovations that can support the technological developments indispensable to the company for facing competitors.

The main objective of TW is to identify and point out

quickly to the company 'significant facts' that can be integrated into their strategies and represent opportunities for development both within the company and outside it. Such opportunities are not limited to pure technologies, but can monitor synergies, strategic games, possibilities of new openings in the market etc.

Even as it qualifies primarily as *technological*, this watch must also be considered as *global*, because it must take into account information of various types and from different sectors; in particular, the market and competition sectors. While it is scientific-technical data that the watch must consider in the upstream process, it must necessarily direct attention to technical-economic and market data in the downstream process [3].

To make decisions about strategy orientation, it is also necessary to obtain political, legal, and financial information. Therefore, information about technologies cannot be separated from economic-social information, nor from information on the strategic movements of international groups and on the evolution of behaviours and financial markets.

Rational management of internal and external information that is *valid* and *usable* by the different capabilities present in the company represents the basis for TW technique.

It is a matter of managing different types of formal and informal information sources. The formal sources are generally factual, therefore verifiable. They include printed publications, such as professional literature, books, journals, commercial catalogues, etc; information from other types of media, such as television, radio and cinema; information contained in databases on various types of support and with various ways of access; network information services; patents; service and consulting companies; specialised services of official organisations, etc. The informal sources, whether produced inside the company or coming from the outside (agents, branch offices, competitors, suppliers, conferences, exhibition, trade fairs, research contracts, commercial negotiations, etc), can be inaccurate, as they are often based on hearsay that can be misleading and so must be verified carefully.

An expert and attentive observer must check the formal sources as well as the informal, with the profound conviction that any type of information can be valid and usable.

At this point, it is necessary to specify that the most successful companies will be those that are able to convert information into action, as information in itself is not useful. To become valid and useful, the information must be analysed and the analysis must be complete and accurate. For example, to know that '*that industry is launching a publicity campaign for a new product*' is 'to possess information'. If this information leads to making a decision that leads to the conclusion '*the new product does not pose an immediate threat; it is advisable to continue watching for another six months*', then it becomes valid and usable information.

As mentioned previously, valid and usable information must concern the various sectors that are being watched: the technologies sector (results of basic and applied research, manufacturing processes, products and services, materials), the competition sector (real and potential), the market sector (clients, suppliers, workforce, etc). The information must be a bearer of innovation; it must reveal some sort of breakthrough in the scientific and technological research field that touches the environment in which the company operates [4].

To disregard the breakthrough can be a risk for the company and any information about this risk represents information that must lead to a state of alert.

Consequently, the TW technique implies a series of processes that can be summarised as follows:

(1) to analyse information as a 'bearer of innovation', it is necessary to be familiar with the technical sector in which the innovation appears, in order to be able to 'recognize' it and to understand the environment that it will involve and the value and implications that it will bring, implicitly and explicitly;
(2) the information that has been analysed and considered useful must generate new information that is directly usable for the strategic aims of the company;
(3) analysis and evaluation of the potential implications of the information entails selected dissemination to the persons within the company who are responsible for defining the real interest.

Thus, the players in a 'watch' are potentially all the employees of the company, who must be careful, at all levels and in all circumstances, to 'capture' various types of information, analyse and transmit it to the interested persons. The structure is actually based on a complex model of internal communication, organised around several privileged nodes, one of which is very often the documentation service.

Different scenarios can be envisioned, depending on the size and sector of the company [5]. The following are some examples:

(1) one documentation centre, central and general, that organizes TW;
(2) specific structures that supply the different company functions (research, marketing, production, commercial, financial, personnel management) coordinated by a central documentation service;

(3) use of external consulting structures that offer TW services.

In conclusion, TW is, in a certain sense, an indivisible and global watch technique that requires appropriate methodology and organisation, a particular methodology to make the most effective use of the different information sources and a particular organisation that permits synergy among the different players.

3.1.2. Technology Search

Technology Search (TS) is closely connected and complementary to TW. Once it has been given priority in the company, TS is the search for a specific technology or scientific knowledge and/or know-how that is available, public and useful for improving the company's competitive standing.

TS permits the company to search for, and possibly obtain, a quantity of information on a certain subject, for the purpose of satisfying a specific and contingent need.

Since TS is occasional and not systematic, it is less important to the company from a strategic point of view. It too is global, as it can involve information in different sectors and of various types coming from formal sources (different sorts of printed publications, other mass media, databases, network information services, patents, service and consulting companies, specialised services of official organisations, etc) or from informal sources (competitors, suppliers, conferences, exhibitions, trade fairs, research programmes, commercial negotiations, internal resources such as agent networks, branch offices, etc).

The following three IMTs were assigned to AIRI and UTIBNOT/CNR and therefore they are very briefly presented.

3.1.3. Marketing of innovation

The marketing of innovation (MI) technique involves the following steps:

(1) identification of the market for an innovative product through analysis of the competitive standing, also on a technological basis;
(2) assistance in market research;
(3) formulation of marketing plans for the introduction of an innovative product.

3.1.4. Management of intellectual property rights

For companies that have their own research and development (R&D) capacity, the management of intellectual property rights (MIPR) technique concerns the evaluation of products with respect to current protection or protectability, in Italy or abroad, through cost/benefit analysis and possible sale of rights.

In the case of companies that are innovative but do not have internal R&D capacity, the technique provides help in contracts with the grantor of know-how, etc.

3.1.5. Quality management [6]

Methodologies for quality management (QM) are useful for stimulating the formation within the company of a mentality for continuous innovation.

Three techniques in particular can be used in the company:

(1) *quality function deployment* (QFD): this consists of separating the quality of the product into its components (requirements), thus correlating the physical and service requirements with those requested by the client;
(2) process *failure mode evaluation and analysis* (FMEA) or *hazard analysis and critical control points* (HACCP): the industrial process is divided into stages, in which the risks for product quality and safety are identified and evaluated. For example, it is decided how to check on the stages at greatest risk in case of failure (FMEA) or the stages for controlling food contamination risks (HACCP);
(3) *guided analysis of the European Commission global approach*: applicable Directives and the relative approach modules are identified, providing the support necessary for the definition of the most appropriate modules.

Selected IMTs, industrial clusters

The participating companies in the IMTIC Project selected three of the five IMTs proposed and so the intervention in the companies concerned the following techniques: MI, TS and QM, in particular HACCP and FMEA (see Fig. 1).

TW and MIPR were not selected by the companies.

TW was considered to be an important technique, but the SMEs involved felt it was too costly to create an appropriate internal structure. The prevailing opinion was in favour of a centralised structure for the industrial cluster that would provide service to all the companies in the cluster.

MIPR was not considered to be a technique of immediate interest. The SMEs involved felt that the problem of managing property rights for the innovative products

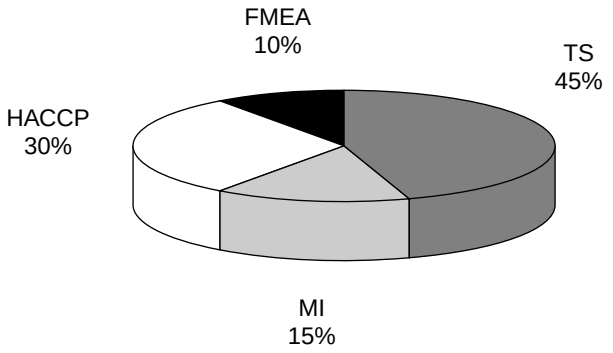

Fig. 1. Take-up of techniques.

or processes created within their companies should be managed case by case, with the assistance of an external expert.

Table 1 shows the selected IMTs by region.

The IMTIC Project involved 40 Italian SMEs (companies with less than 250 employees) located in five regions and belonging to the following industrial clusters: mechanical (8), electronics (2), eyeglass frames (5), shoes (3), food processing (12), electromechanical (6) and metalworking (4).

The areas selected are characterised by very complex manufacturing subsystems, due to the local presence of large leading companies (e.g. Fiat and Olivetti in the Canavese (Piemonte) cluster) that provide work for many small sub-suppliers. See Table 2.

Table 1
IMTs by region

IMTs	Piemonte	Veneto	Lazio	Campania	Abruzzi
TS	•	•			•
MI		•		•	
HACCP			•	•	
FMEA					•

Table 2
Distibution by industrial clusters

Regions	Industrial clusters	No. of companies
Piemonte	Mechanical/Electronics	8+2
Veneto	Eyeglass frames/Shoes	5+3
Lazio	Food processing	6
Campania	Food processing/ Electromechanical	6+6
Abruzzi	Metalworking	4
Total		40

5. ISRDS contribution: TW and TS methodologies [7]

The first stage in the intervention of the ISRDS was the elaboration and illustration in the industrial clusters of the two innovative techniques: TW and TS.

As mentioned earlier, these techniques allow the companies to strengthen their competitive capacity nationally, but above all internationally, at a time characterised by great changes brought on by market globalisation and increased pace of technological development. The competitiveness of the SMEs is determined by a wide range of factors that vary substantially from country to country, from sector to sector and from one company to another.

With regard to competitiveness, there is certainly another fundamental role in addition to the crucial one of the owner/managers. This is the role played by management of intelligence, or the 'intangible investments' that strive to combine and integrate a series of capacities, such as:

(1) conducting R&D activities, at least intermittently;
(2) giving the company an organisation that is appropriate to its characteristics and needs;
(3) ensuring the necessary training of human resources;
(4) investing in systems and equipment that use appropriate technology;
(5) quickly obtaining necessary information through a 'watch', a more or less evident 'state of alert', regarding new technologies, markets and the competition [8].

6. The operational stage of the project: the consultants

To be usable by a small company, an IMT must be simple to explain to the personnel and must quickly produce visible effects. Therefore, the presentation of a technique must be supported by a trained consultant, with experience of working with SMEs and a sound knowledge of the specific technological area.

This type of operation is also an opportunity for testing the tools and systems for acquisition and implementation used by the consultants.

With the help of qualified consultants, the use of the selected technique was introduced into the company. Each consultancy lasted a total of ten days over a seven- to ten-month period, at the end of which, possible new interventions for the promotion of these techniques were considered together with the local authorities.

The project lasted two and a half years, finishing at the end of February 1999.

6.1. The ISRDS databases for technology transfer

The activity in the IMTIC Project was similar to that which the ISRDS had experienced previously in the sector of technology transfer to the SMEs. That activity led to the creation of the Database of Technology Transfer (DBTT) and the Database for Financing Sources (DBFS).

A number of forms were sent to researchers at universities and other research institutes requesting professional affiliation and title of the research project, as well as a brief description of the results achieved, foreseeable future developments, patents taken out, possible industries and sectors to involve, etc. This provided an inventory of the supply of Italian research, which can be consulted on the website of the government printing institute – *Istituto Poligrafico e Zecca dello Stato* (IPZS) [9].

The DBTT was completed with the creation of DBFS, which aimed to help SMEs in locating possible sources of public or EU financing, appropriate for the type of company and objectives proposed, in the sector of research and innovation. The database includes all the pertinent national and EU regulations.

The development of these two products, which involved the entire national scientific community with the aim of promoting cooperation between scientific research and the production sector, was used as a support tool for promoting the TS technique.

6.2. Putting TS into practice

ISRDS prepared a number of training courses to illustrate the contents, size and different access methods of the various types of information sources offered by the market and capable of contributing to the implementation of the two assigned techniques: TW and TS.

Of several demonstrations given, in particular for the application of the TS technique, the one in Veneto is briefly described.

The Veneto cluster is characterised by a high concentration of the eyeglass sector that accounts for approximately 50% of the world market. This sector includes large companies with a strong international impact, a number of medium companies and small sub-supplier entrepreneurs. As the eyeglass sector is in rapid international expansion, and supply from the Far East is becoming increasingly more competitive in price, the Italian companies are forced to innovate their products constantly in order to maintain their market share.

Some companies in the eyeglass sector, belonging to the industrial cluster of Veneto, had the problem of finding the latest international research on the use of new titanium alloys in eyeglass frames. They also needed to know the names of their competitors and to contact companies that produced the alloys. The various electronic and non-electronic sources available on different types of media (in particular, the DBTT database on technology transfer of the CNR, the Internet, online databases for scientific research available on commercial hosts) were used to provide an answer to their problem that was as complete and detailed as possible.

6.3. Monitoring of activities: telephone interviews with selected SMEs

During the stage of monitoring of activities and verification of results, ISRDS conducted a telephone survey on a sample of SMEs participating in the project, to find out how well the companies were satisfied with the consultants' activities in promoting the selected IMT.

A questionnaire containing nine questions was used for this survey. The first five questions asked for opinions on the consultancy, including both interviews with the companies during the consultation and those with companies at the end of the consultancy. The next four questions were only for companies that had finished the consultancy and concerned future aspects of company activity, the IMTIC Project and any comments by the participants about this experience.

The telephone interviews were conducted in three successive stages on a total of 25 companies. In general, those interviewed were satisfied with the experience and wanted to continue using the newly learned innovative techniques. Opinions about the consultants were very positive and many of the companies interviewed wanted to repeat similar experiences in the future. Many participants stated that the total of ten days established for each consultancy was too limited and that a longer stay on the part of the consultant would have been more productive.

7. Conclusion

During the IMTIC Project, the researchers involved participated in a number of meetings and round tables in the selected industrial clusters. Twenty-five questionnaire-based interviews were conducted and a number of online searches on all available electronic media were performed.

During the dissemination activities, a number of seminars were held and experts from ISRDS were available to SME representatives to exchange knowledge and experiences in the use of IMTs.

The expertise of ISRDS in the field of information and documentation is traditionally applied to the public sector. This project provided an opportunity to extend these capabilities to the definition of didactic modules for SMEs.

Following on from this experience, it was decided to create interactive didactic modules for distance learning, within the framework of the ADAPT Bis programme of the EU (innovative pilot training action for continuing education of SME senior staff).

Innovation management is not only about technological change; above all, it is about culture. In this respect, the Italian IMTIC experience demonstrated the willingness of the participating companies to use techniques helpful for introducing innovative processes and to accept persons from outside the company.

Usually, in small Italian companies, there is a certain degree of reluctance to accept external consultants, because the owner personally takes care of all the problems of the company. In the case of the IMTIC Project, all the participating companies willingly accepted the external consultant and were interested in extending this experience beyond the time limits set by the project. While this experience may have contributed to understanding that IMTs are a useful tool for helping SMEs to become more innovative and that these techniques can also be used to encourage the exploitation of R&D, it is evident that the project is only the first step in a long process. Slow and continuous action to increase awareness is necessary to bring about permanent change in the culture of a company.

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