

How to Spread Systematic Innovation Approach in SMEs. Evaluating Italian Experience for Replicating the Model in Indian Context.

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ABSTRACT

This work presents an analysis of a systematic innovation dissemination program dedicated to SMEs, carried out by the University of Bergamo and funded by the Chamber of Commerce of Bergamo and Lombardy Region since 2009. The project is still in progress in Italy, it is going to be replicated in a similar context in India too. Although the main objective was to spread systematic innovation methods in SMEs, it was decided not to focus on the direct teaching of systematic innovation but to provide basic support to SME owners or aspiring entrepreneurs regarding patents. The easiest way to involve SMEs was to use patents as first mean to provide technical and scientific advice on the topic of intellectual property management (e.g., Protection tools, patentability opinions, trademark registration, modes and costs of filing/recording, realization of prior art searches, insights on counterfeiting, etc.) and then introducing systematic innovation tools. Patent issues were used as a "Trojan horse" to overcome the mistrust towards the structured innovation methods. After 8 years of experience, we have collected enough data for providing some considerations on reproducibility and scalability of this model in other contexts. The application in Indian SMEs contexts is explored, evaluated and discussed for the scope of this work.

Keywords

SMEs, Systematic innovation, TRIZ, Dissemination, Patents

INTRODUCTION

In the last 20 years many systematic innovation methods (TRIZ in particular) has gathered a significant worldwide diffusion in academia, industry, and it has been the main topic in several international conferences and symposia. National and international associations dedicated to the method grew dramatically, especially in Asian countries. However, a common trend shows that when a new country is reached, after an enthusiastic initial phase, the diffusion of the method grows slowly and do not soar. There are many barriers that curb this activity specifically in SMEs [1-5], but very few examples for overcoming this problem.

This paper presents a specific course of action to promote TRIZ and SI-Systematic Innovation tools and methods diffusion in a local area that was conceived in 2009.

This program has been realized by means of a synergic collaboration among University and local institutions. It has a long-term perspective and, most important, an indirect strategy to spread SI methods. Actually, SI tools are not directly promoted, but companies are involved leveraging on their interest in intellectual property and patents. The program offer basic services that companies are naturally prone to ask and hence get in touch with the program.

The promising result achieved so far is the reason why we decided to share this model and our experience, hoping that it can be applied in other regions to enjoy the same benefits. Among the most interesting areas



where to expand the program, there are some industrial districts of India that own similarities with the Bergamo area.

INDUSTRIAL SITUATION IN ITALY AND INDIA

SMEs in Italy

To understand the difficulties of spreading SI methods in Italy it is useful to make a premise on the industrial situation in Italy. Italian companies are mainly SMEs that are not properly structured to deal with complex methodologies for innovation.

The landscape is characterized by a large presence of micro enterprises (with less than ten employees), which are about 4.2 million, representing 95% of total production units and employ 47% of workers compared to an average of 29% in Europe.

At the other end, Italy is characterized by a very small fraction of large companies (over 250 employees; 0.1% of enterprises and 19 percent of employees). This fragmentation, only partly mitigated by the presence of groups of companies, determines very low average size (3.9 employees per firm compared with a European average of 6.8 employees), a very simplified company structure (63.3 percent of one-man companies) and a share of independent workers, which is more than twice the European average.

In addition to this, also the distribution of companies towards the industrial sectors is notable (Table 1), as published on Istat report [6].

Manufacturing companies, the ideal target for the application of TRIZ methodology, represents only the 12% of the total.

From these figures, a broad diffusion of SI methods may seem almost impossible, but an important factor must be added to complete the picture.

Table 1. An example of company distribution.

Sectors	% distribution
Business	28%
Agriculture and livestock	18%
Building	15%
Manufacturing activity	12%
Real estate, Renting	11%
Hotels and restaurants	5%
Transportation & Logistics	4%
Community, Social	4%
Financial intermediation	2%
Other	1%

The Italian system, according to the annual report of Istat[6] expenditure on R&D is reduced, but there is a very high share of innovative enterprises. This means that even smaller companies, which have reduced time and human resources available for training on methods like TRIZ, developed a valuable sensitivity to the theme of innovation, with particular attention to intellectual property issues.

Patent matter is a very interesting form of communication to get in touch with key personnel of SMEs. This is not true for larger enterprises. Although there are a few big companies, the worldwide experience taught us that just a few people strongly believing in a methodology might give the right contribution to make it grow dramatically inside the company.

Manufacturing industry in the province of Bergamo consistent of the national average; in 2015 it counted about 12,000 of 95,000 companies. Most of these have few employees and sole owner (Table 2) [6].

Table 2. Legal form of Italian Companies in 2015.

Sectors	% distribution
Corporation	30%
Association or partnership	19%
Sole proprietorships	51%

Therefore, Bergamo is mainly characterized by SMEs, but with very high density in a relatively smaller area.

Table 3 shows the distribution of main assets and an indicator of the state of growth per sector. In particular, it shows that the manufacturing is slightly declining (-0.5% last year). Given these data, the area is rich in terms of excellence and in a 50 km radius there are three university campuses: Bergamo, Brescia and Milan.

Table 3. Italy sector distribution.

Sectors	30/04/2015	30/04/2016	Var%
Agriculture and livestock	5.001	4.986	-0,3
Building	18.793	18.374	-2,2
Commerce	19.896	19.982	+0,4
Hotels and restaurants	5.731	5.773	+0,7
Manufacturing	11.181	11.124	-0,5
Real Estate	6.229	6.201	-0,4
Renting and Travel agency	2.369	2.526	+6,6
Transportation & Logistics	2.257	2.2240	-0,8

SMEs in Indian Scenario

The SMEs are of key importance to the Indian economy. They contributed 17 per cent to the nation’s GDP during FY11 and employ 60 million people, the second largest workforce in the country after the agricultural sector [7].

According to the Indian Ministry annual report 2015 [8], SMEs has shown constant growth rate around 11% every year till 2010-11. The highest growth in recent time was recorded during 2011-12 (18.45%) whereas during year 2012-13 and 2013-14 growth rate was around 14% and 12%, respectively. But it jumped to 17% in 2014-15. However, recent data of 2015 i.e., from April-September, 2015 shown impressive growth of 18.74% (year-on-year growth).

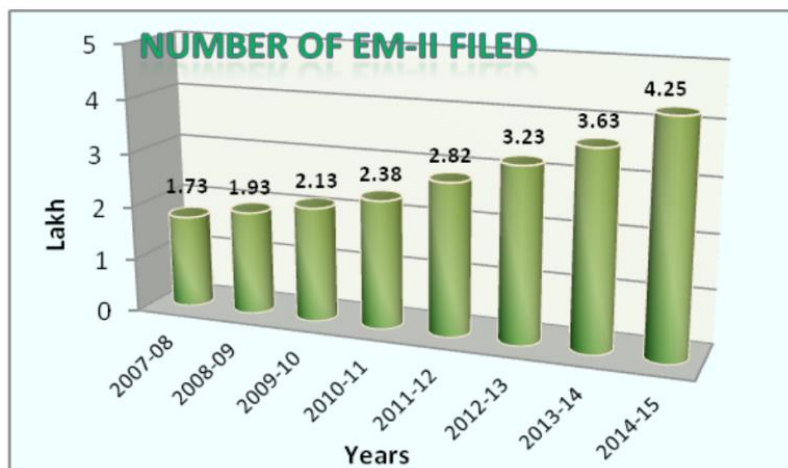


Fig 1: Number of entrepreneur memorandum (part ii) filed by the SMEs during 2007-08 to 2014-15

Indian SMEs units are more concentrated in manufacturing service compared to other service sector (see fig. 2).

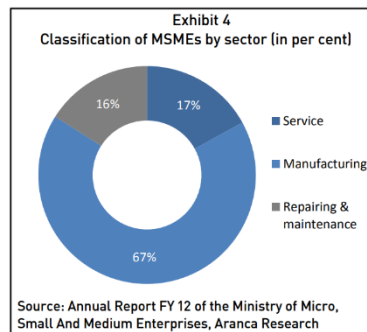


Fig 2: Image

Indian scenario has lot of similarities and situations that resembles the Italian one when it comes to propagation of Systematic Innovation in the SMEs.

However, the good news is this situation is changing with lot of government schemes, Industrial cluster and other developmental policy initiatives (e.g. Startup India, Make in India) in place.

Industry ministry is promoting Innovation and Technological development. Moreover, there is financial support for patent registration etc. With idea to cater to the world market Innovation and IP is becoming a necessity to protect business interests and stay ahead in competition.

In this situation SMEs are in pursuit to look for the cost effective, sustainable, long term support to develop innovation capabilities in-house as IP and innovation services are perceived to be costly affair.

Potential of replicating BERGAMO model

Situation of SMEs in Indian cities of Pune & Aurangabad, and that of Bergamo are somehow comparable. Pune and Aurangabad are known as automotive hubs, hence the SMEs supplying to the giant players (e.g. Tata Motors, Mahindra etc.) have flourished there. The international OEMS are looking at Pune/Aurangabad as their destination for manufacturing, resulting in opportunity to local SMEs to innovate to deliver better services.

These SMEs have organized themselves under automotive clusters, industrial bodies like MCCIA, CMIA etc. These bodies are responsible for capacity building of SMEs, and not been highly successful to impart systematic innovation culture so far. Great deals of SMEs still believe in reverse engineering and replicating the international products.

With the changing business arena, global value chain perspective there is surge to learn about indigenizing solutions and serve local as well as international market. There is cut throat competition with Chinese companies supplying in India. Indian SMEs are therefore looking for points of differentiation and innovation in their offerings. Hence, companies are finding it important earn new knowledge to deliver innovation performance and maintain competitiveness.

There are good universities in Pune and Aurangabad working hand in hand with the industrial requirements and supporting to national mission. There is a potential in integrating all the professional services and imbibing it with the university efforts to render value added innovation services and disseminate systematic innovation approach amongst the SMEs, following Bergamo Model.

BERGAMO MODEL: UNIVERSITY ACTIVITIES

The dissemination program presented in this paper has been held in the industrial context described so far. Two are the promoters: University of Bergamo and the special agency of the Chamber of Commerce of

Bergamo, called Bergamo Sviluppo. Here is how the TRIZ offer has been planned and proposed to the industry.

University – Courses, seminars and masters

Since 2010 the course "Product and process innovation" consisting in 80 hours on TRIZ is part of the curriculum of Engineering students. The course is compulsory in the master program of mechanical engineering, and can be attended by any other master engineer's curricula. It has an average of more than 50 students and has the peculiarity of involving local companies in the final phase of the course.

Every year at the end of the course, one or two companies are invited to present to students a real case study (in less than 3 hours), possibly unsolved, which is then analyzed and addressed by students with no further contacts with the company. The interaction between students and project manager of the companies during the case study presentation is carried out independently, without any teacher's intervention. The evaluation is done according to two criteria: the company evaluates the effectiveness of results while the teacher checks the consistency of method application.

The benefits are valuable because an assessment is made both on acquired skills and on the way such skills adhere to real industrial R&D needs. This is an incentive for students to propose this type of expertise while starting their professional life. From the company side this is a test of the quality of the method, since young and non-expert people propose high-level solutions. On one hand this is a further confirmation for companies already using TRIZ, while on the other hand it creates a great interest in the method for newcomers.

Concerning the basic concepts of TRIZ, it is promoted in a more traditional manner by means of seminars in different university courses, like in the case of "Product lifecycle management".

The goal here is not to train the participants to make them expert TRIZ problem solvers but to convey to future management engineers the message that TRIZ exists, and it can be utilized also for management issues.

Finally, the higher education course "Entrepreneurship and Innovation for SMEs Internationalization, Go.In' – Go International Be Innovative" was born from the joint organization of University of Bergamo and the Chamber of Commerce by means of its special agency Bergamo Sviluppo.

The course has an annual participation of about 40 people chosen among entrepreneurs of small and medium-sized enterprises, young entrepreneurs involved in family businesses and entrepreneurs driving high-potential start-up companies. The course lasts 8 months for a total of 180 hours of which about 20 hours are devoted to TRIZ and patents.

The topic of TRIZ gets the highest attendees' response and satisfaction rate proving also that the word of mouth is an excellent vehicle for the dissemination of the method among SMEs.

University consultancy and professional associations

Italian universities in addition to research and teaching activities, pursues the so-called "third mission", concerning the promotion, the direct application and enhancement of knowledge to contribute to the social, cultural and economic growth of enterprises. Any institutional structure within the University is committed to communicate and disseminate the knowledge through a direct relationship with the local industries and with all its stakeholders.

Within this context, University of Bergamo created strict collaborations on training and consultancy with large companies of the area to promote TRIZ methodology and Intellectual property management and gather sponsors and funding of international level. Some examples of involved companies are ABB, Coesia Group, Imetec, ST Microelectronics and many other smaller enterprises.

The framework of university activities includes, at last, TRIZ education activities dedicated to professional associations (mostly for engineers). Usually, professionals who run their own activity and who are approaching TRIZ moved by curiosity attended the courses. This is done to reach engineers who have graduated before the TRIZ was included in university courses.

However, the courses at the Chamber of Commerce, described in the following section, are of particular interest.

Chamber of commerce activities

Bergamo Sviluppo - Chamber of Commerce developed in collaboration with University of Bergamo a particularly for-profit model, potentially replicable as it is in other geographic and industrial districts. The project concerns the Protection and Promotion of Intellectual Property to support innovation and competitiveness of SMEs [9].

The project is composed by three different activities that start dealing with patents and then converge on TRIZ.

1. Exploitation of Intellectual Property guidance and customized technical support service

It consists of guidance and primary support service, useful to people seeking general information and technical and scientific advice on the subject of intellectual property and patent.

Every month there are two meetings for up to six companies, each of which has access to an individual 45 minutes free consultancy with intellectual property experts. Thanks to this action, experts have a direct opportunity to get to know about the key technical problem, where TRIZ can be used as a tool for effective problem solving. Thus, immediate advices can be proposed on the research and development direction to follow together with a preliminary protection strategy. In most cases, the guidance is not only focused on patent protection but involves a technical evaluation for patent circumvention or to strengthen the innovation actions. To the most promising cases an additional 30 hours consultancy is offered to the company for free so that a more structured customized technical support can be delivered. This activity allows easily identifying those companies that would gain a huge benefit out of TRIZ.

Since 2011, more than 300 participants (SMEs, potential entrepreneurs and artisans) received assistance on both Intellectual Property (IP) issues and innovation actions based on TRIZ.

2. Education and dissemination actions on Intellectual Property and Innovation

The technical assistance is supported by several activities and a variety of training activities, as follows:

- One seminar per year to promote the project
- Two basic courses per year (lasting three days each) dedicated to patent search, explaining techniques and tools to perform patent research independently, (e.g., prior art or freedom to operate searches) and also techniques and tools to exploit patent database to get benefited from design of analogy and technology transfer opportunities.
- Four advanced seminars per year on the topic of: “Patents as a means to innovate and problem solving tools (TRIZ) based on patents”.

Seminars and courses attendees increase every year coming from different industrial sectors and with different roles inside the companies.

3. TRIZ course and tutoring

The TRIZ course lasts 40 hours and is aimed at entrepreneurs and workers of companies that wish to acquire specialist skills to address development and innovation projects with a systematic approach.

The training course is organized in two sections: the first is an introductory module to the fundamentals of TRIZ methodology (24 hours) and the second is an advanced form of the methodology applied to real industrial cases (16 hours). At the end of the course for selected attendees it is planned to perform a methodological coaching on a case conducted independently by the company, and shared with the teacher over the following months.

Professors affiliated to the University of Bergamo, Department of Management, Information and Production Engineering carry out teaching. The teaching is designed following innovative criteria and taking into account the longtime experience of researchers acquired both in business courses and in academia. The result of such



long experimentation [10-12] is SPARK, the TRIZ based method to solve problems. The strengths on which we worked are those of motivation and the global workflow that is the sequence of TRIZ tools to be used along the problem solving way.

SPARK was born in order to arrange the tools according to a linear sequence of five steps, within which a series of TRIZ tools are located and can be used in sequence or in alternative to each other. The ultimate goal is to generate a very accurate output between one step and another regardless of the number of instruments used.

On one hand, this approach made TRIZ application more systematic, forcing the use of tools in an orderly way, while on the other hand it guides the user in the choice of few alternative suggested tools. In fact, newcomers were hardly able to make a selection of most useful tools to reformulate the problem since the beginning of training.

SPARK merges traditional TRIZ Tools with requirement management strategies, and with tools for knowledge management (especially patents and pointers to physical effects). Some tools, such as standards and multiscreen solutions, have been completely redesigned.

All instruments are managed by a user friendly IT platform that contains teaching material and examples.

ACHIEVED RESULTS

Events held by the Chamber of Commerce have more chances to be advertised and promoted in local newspapers and professional associations, compared to university initiatives. In recent years there were many articles dedicated to TRIZ in local newspapers among which there were some valuable interviews of the companies reporting their experience in training and using TRIZ in their everyday activities.

From our perspective, the successful story of real cases, even in micro and small enterprises, is the most effective communication channel. Definitely, they give credibility and authority to the method and to trainers, much more than any other communication means.

Another significant achievement consists in the number of patents filed by companies. Although this parameter should be evaluated on a medium term perspective, the signals of the increase in the number of patent filed by companies of the territory are already well visible, even if not necessarily attributable to the project (Table 4).

Table 4 Patent filing at Bergamo Patent Office from 2005 to 2014.

	Trademark	Patent	Utility model	Industrial design
2005	427	53	17	4
2006	449	68	35	8
2007	463	61	22	4
2008	422	66	40	9
2009	501	69	30	6
2010	589	67	40	15
2011	593	54	48	2
2012	550	54	44	16
2013	553	37	47	16
2014	522	59	42	16

The measure of this return is certified from the fact that the technical assistance on Intellectual Property is carried out in collaboration with the experts of the Trademarks and Patents Office that participate to the meetings. The same experts are those involved in the patent filing activity and, thus, they meet once again the inventors and have the chance to directly measure the impact of the project on local patents.



Another indicator is the growth of the number of companies and inventors participating to the Exploitation of Intellectual Property guidance service. The number increased from 4 to 12 people per month, on a relatively small territory.

The quality of the ideas and the way they are presented is evolving and who has an idea often has already conducted an accurate research about it. This is an important signal of the fact that in a few years the innovation culture has globally grown in all its aspects. Actually, the skill of performing basic information search and to use patent search portals (e.g., Espacenet) has reached a broad diffusion even in micro enterprises and artisans.

An additional fact is the increased interest of enterprises to have students who attended the TRIZ course at the University. Only few years ago, advanced TRIZ competences were taught only at PhD level while now companies are looking for these skills in master students. On the other hand master degree students with a TRIZ course are more likely to be hired in R&D positions.

CONCLUSIONS

If systematic innovation approach is adopted and sponsored by large companies, it is the best way for its diffusion, as already seen for General Electric and Six Sigma. In a region dominated by SMEs we may also need alternative strategies. This paper presents a specific project to disseminate systematic innovation in industrial area where SMEs are prevalent. It is a long-term project bringing systematic innovation tools into the company through the issue of patents. It involves university and local authorities and consists of a number of initiatives that work around SI with gradual path that culminates in a SI (focused on TRIZ) course of 40 hours and tutoring by experts. The teaching method is based on an ad hoc teaching platform integrating classical SI tools with marketing requirement management and tools for knowledge retrieval (especially patent). This platform is called SPARK.

Measurable indicators tell us that the results until now are good and that this model could be replicated in other contexts like Pune or Aurangabad in India, owning the same characteristics like Bergamo: namely a university with strong expertise in systematic innovation and a local organization that believes in the project with a time horizon of at least five years

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