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Our industry is constantly evolving. The era of innovation imposes its list of requirements and among them, we will have to conduct our creative activities differently. Our community is wondering about these new ways of generating new ideas upstream of the innovation pipeline. Historically, TRIZ theory remains our common DNA.

However, 20 years later, what remains of the Altshullerian version of TRIZ? The fractal ramifications resulting from the diversity of our research and professional practices have sometimes led us to depart from it, reconfigure it, integrate it with other approaches or even observe it under the prism of a particular discipline.

This 8th edition of TRIZ Future celebrates the automatic practices of invention as a new path for companies turned towards digital era. Our artifacts are becoming more complex, digital technology is omnipresent, and Artificial Intelligence is invading our daily lives. All these factors make it essential to rethink our uses of TRIZ and the role that this emblematic theory can play tomorrow, in the daily life of a company.

This book is intended for all invention professionals interested in the outcome of the innovation pipeline. In other words, almost everyone working in industry, research and teaching. Because even if we are talking about the automation of the inventive phases, it is only legitimate to do so in order to better serve man and society in its quest for a better future.

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Innovation Lab: How to Generate Patents in One Day

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Abstract. Nowadays one of the biggest barrier to the TRIZ dissemination in SMEs concerns the time to develop ideas. For overcoming this problem, we involved companies to participate to a one-day problem solving activity, aimed at developing at least one patentable idea. In the first part of the meeting, the company guided by TRIZ experts reformulate technical problems, market requirements and business model. In the second part identifies alternative solutions and generates ideas for the most promising directions (also taking into account a preliminary patent analysis for identifying white space opportunities). At the end of the day the company gets a technical report with a list of new ideas, including some potentially patentable (even if a secondary deeper patent analysis is needed).

Keywords: TRIZ, teaching methods, consulting, patent analysis.

1 Introduction

One of the most barrier to the innovation in SMEs is the lack in time and resources to spend on it. The same is true also for TRIZ, which needs a long training period in order to become an efficient and effective resource. Because of it, the SMEs find it difficult to take advantage of TRIZ.

In SMEs, the incentive to innovate comes from the customers, who ask for improvement in performance or reduction in cost of the products, or from information given by the suppliers, who propose new technologies or products, or from the market competition, which forces toward cost reduction.

Irrespective of the reason for the request, SMEs rely on the insightful-ness, expertise and knowledge of their staff in order to innovate, who usually has traditional designing tools, but lacks in systematic methods specialized in innovation. They tend to outsource the R&D projects that are burdensome for the internal staff, both in time-consumption and in skills request.

There are companies, like Warrant Innovation Lab, devoted to facilitate and diffuse the systematic innovation in SME, through technology transfer and sharing of

knowledge, ideas, technologies and methodologies, especially cooperating with universities and research centers. They offer services to fill in the lacks in innovation methodologies, establishing cooperation and partnership with suitable research teams.

If the R&D project has no yet defined a development direction toward a specific technology, involving a specialized research team might be untimely. In fact, it may steer the development direction toward a technology it well knows to the detriment of another one it does not usually handle, which might be better.

The risk of developing an ineffective solution, or worse abandonment the R&D project, can be reduced supporting the SME in formulation of technology concept, according to the definition of TRL levels of European Commission (see table 1), before outsourcing the development.

Table 1. Technology Readiness Levels (TRL) in European Commission [1]

TRL	Description
1	Basic principles observed
2	Technology concept formulated
3	Experimental proof of concept
4	Technology validated in lab
5	Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
6	Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
7	System prototype demonstration in operational environment
8	System complete and qualified
9	Actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

Authors introduced a method designed to diffuse TRIZ in SMEs. It provided for a formation course of 40 hours, co-funded by the Chamber of Commerce. The aim was to train employees in the SMEs in order to seed TRIZ in their development department.

In this article, the authors suggest a service to lead the SMEs from the need to the technological concept matching TRL 2 level. There is no requirement to have a prototype or a functional schema. Nonetheless, the method is also useful for those who has yet a product and who want to change it radically.

2 The Innovation Lab Service

The innovation lab is a teamworking session where a team of experts in the field, employees of the customer company, hacks the innovation process through guided by the university TRIZ staff [2].

Given that the TRL 1 or 2 levels are strategic and their effect on the success of a product/process is crucial, the customer team must to include people coming from different business functions: from engineering office and/or R&D department, which have the technical knowledge about the goal of the innovation activity; from marketing

and/or selling office, which have the perception of the customer response and needs; from the management team, to directly involve the decision making people, etc. especially for SMEs, some of those function may come together in the same person.

From the consultant side, a facilitator guides the customer team into the innovation process, while the other members of the staff both participate actively to the innovation activity and support the facilitator searching knowledge (through patent, scientific articles, internet websites, etc.) in real time and tracking the information and ideas which emerge during the meeting.

The venue of the meeting is a suitable room set up in advance the walls of which shows diagrams and images referring to the tools of the innovation course as disclosed in section 3. Most of them are TRIZ-based tools but their usage aims to access to knowledge, generating new concepts in order to query the patent and scientific databases or the internet.

2.1 The Workflow

The innovation lab follows the process shown in Fig. 3. It is organized in two sessions in the same day, in which carry out the TRIZ-based innovation activity, and a third section in a subsequent period, focused on patent application of identified ideas, that may change its duration as function of the features of the emerged solutions [3], technology level of the customer company, the need of experimentation, etc.

1. The first session, in the morning of the first day, the participants work on the problem, pursuing the aims of generalization of the problem itself and enlarging the space of its solutions. This can be get by repeatedly reformulations of the problem using techniques of abstraction of the target product/process (functional modelling), tearing psychological inertia down (visual triggers), suppression of the constraints (modified ENV model [4]), technological alternatives analysis (ENV model integrating the IFR [5] and IR tools specifically developed). Beside the technical analysis, also information coming from the business model and the commercial/marketing requirements can drive the innovation directions (market potential [6, 7]). During such an articulated set of analyses, a member of the staff makes a preliminary patent search related to the abstract solutions emerging from the activity. This session creates a hierarchical tree of solutions characterized by a high abstraction level (see Fig. 1).

Fig. 1. An example of the tools (requirement matrix on the left and visual triggers on the right) used to analyze the problem and explore the space of the solutions.

2. The second session of work, in the afternoon of the same day, concerns the choice of the most interesting solving direction according to the requirement prioritization done and considering the information retrieved by the preliminary patent search. The participants do an in-depth analysis on the best direction found, using the physical contradictions in order to enhance the level of detail. When a physical separation occurs, the elaboration includes also inventive principles, even to enhance the variety of potential solutions. All of them are sketched, named in a way easy to remember and included in the technical report delivered at the end of the day. A template drives the description of a solution. It has been developed in order to summarize the fundamental idea and communicate only the essential aspects that make the it better than other ones. Due to the tiredness and consequent loss of clarity, at the end of the day there are not the conditions to evaluate emerged ideas and solutions, thus the staff waits one or two days for a verbal feedback from the customer (see Fig. 2).

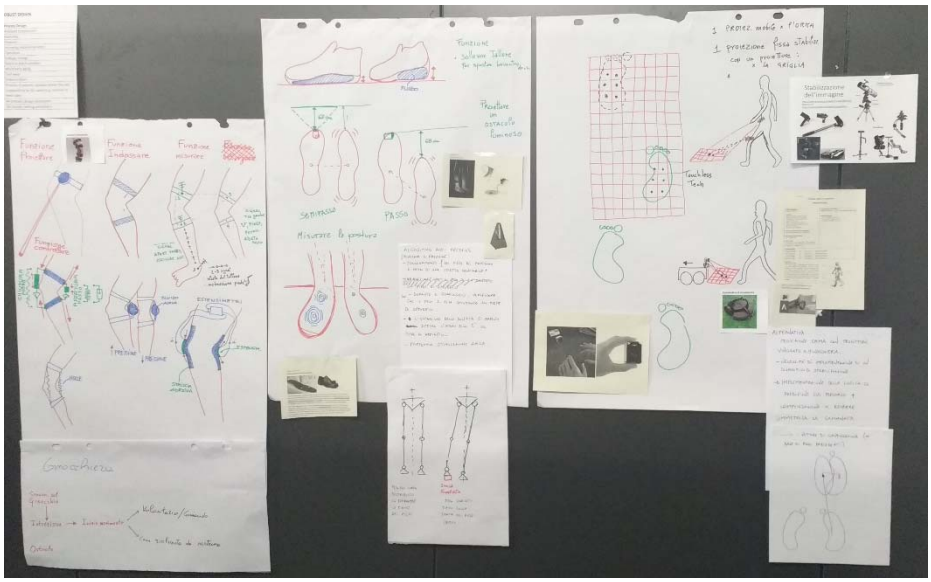

Fig. 2. An example of the outputs resulting from the in-depth analysis

3. The TRIZ staff performs the patent prior-art search, pertaining to the ideas indicated by the customer in the feedback, to assess which are the constraints to the patentability. Simultaneously, the customer continues its evaluation activity, making considerations and tests, involving other colleagues, to better understand which the best direction to follow is. This time lapse allows both the staff and the team to polish and refine the solution, also enrich it with details and versions able to strengthen and expand the breadth of the patent application(s).
4. Filing the patent application, the customer ensures itself the authorship of the ideas. Later, it can start the engineering phase autonomously, sharing information with suppliers, engineering firms and others specialized profiles without the risk of intellectual property plagiarism. A second staff, specialized in technology transfer services, can help the customer in order to looking for technology suppliers, financing grants, industrial partnerships, and other services that could support the development of the patented solution and the start-up itself.

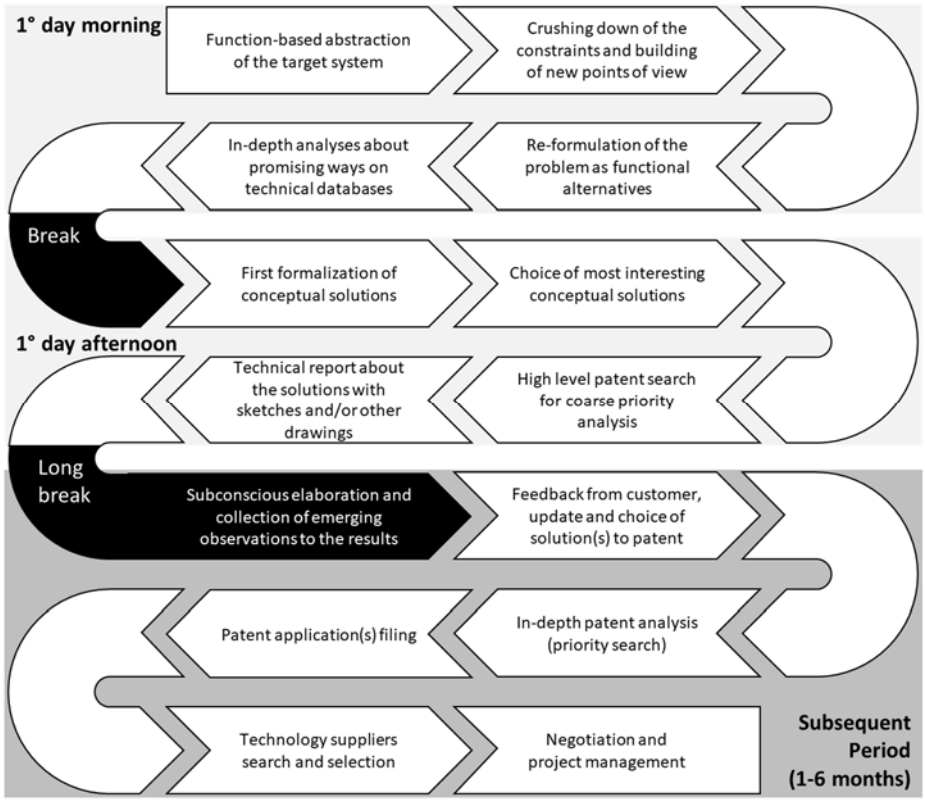

Fig. 3. Summary of the workflow of the innovation lab activities.

3 Conclusions

The role of an intermediary between SMEs and TRIZ trainer is crucial for the success of this service. SMEs start from an important skepticism towards the usefulness and / or feasibility of a systematic innovation process. An independent company, in this specific case Warrant Innovation Lab (WIL), that has been building in time a trust relationship with its customers, becoming a reference partner in those activities that involve an improvement of technology. It has the opportunity to notice if, in customer innovation activity, the R&D projects follows the same path repeatedly without reaching the desired solution.

The leverage on which act to propose the Innovation Lab service is the opportunity, for the SME, to divert its route toward the innovation, tearing down the inertia that limits their space of solutions. Furthermore, the service consists in only one-day activity, which is an acceptable time.

This kind of activity does not aims to substitute the classical TRIZ courses and trainings. It is a complementary way in order to enhance the dissemination of it. In fact, the

Innovation Lab does not teach TRIZ, but employ it in a hided way. Due to the time limits, also the detail level of the solution is limited.

The aim to reach one (or more) patentable technology lets understand the service has been designed in order to create a feasible solution, avoiding stopping only in theoretical analysis. Moreover, the patent ensures independence for the SME in further development phases, even without any other technical consultancy.

All of those considerations are good reasons for the SMEs to be interested in the opportunity to participate to the Innovation lab.

Nevertheless, the solutions got during the Innovation Lab are not the main advantage the customer takes from the activity, although their number is the measure the SMEs use for the advantage got by the Innovation Lab.

The most relevant benefit is the customer awareness about the importance to use (or learn) a structured method for the systematic innovation in order to improve its R&D activities.

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