

Infrastructure for Systematic Innovation Enterprise

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This article discusses why automation still fails to increase innovative capabilities of organizations and proposes a systematic innovation infrastructure to improve innovation management and increase innovative productivity.

Automation of Invention

Efficiency of innovation depends on the ability to produce successful ideas that can be realized in form of viable products and technologies. Thus we deal with the issue of productivity: once an enterprise is willing to stay competitive, it must be able to constantly raise productivity of innovation. Today, any enterprise involved to the development of new products and technologies increases its productivity by a growing degree of automation. CAD/CAM/CAE, Rapid Prototyping, CRM, ERP and other types of IT systems lead to changes in the infrastructure of the organization. But despite the growing influence of Information Technology (IT), we still have little IT support for innovative activities. Much effort has been invested recently to develop software that would help (like products from Invention Machine Corporation), but we do not have “automatic inventors”, or Computer-Aided Invention systems that would allow us to create new products and technologies similarly Lego™ design set, or CAD systems. Today the problem seems to be a lot more complex that it appeared 10 years ago.

In the recent past, while being busy with Systematic Innovation, I was as well involved to a quite extent to the activities devoted to Artificial Intelligence and later, Knowledge Management. Significant parts of both disciplines were targeted at developing IT systems that would be capable of gathering, extracting, representing and coding knowledge to enable automated reasoning in order to solve problems and generate innovative solutions. A basic assumption was that once we can describe and program a logical system which could reason with a large number of facts and rules (knowledge base), we would be able to build a kind of “artificial intelligence”, or something that can really simulate human brain and can solve creative problems. This concept failed [1].

Perhaps, the most important cause of the failure was an assumption that logic can solve every problem. Most of modern IT systems incorporate heavy logical mechanisms or include numerous intelligent agents that can search among huge massive of data, filter it out, transform, and display in a convenient form. No doubt, these systems help a great deal with ordinary, well-defined problems and raise productivity. But they are not capable of innovation. They can only solve “typical” problems, that is, problems that already were solved in the past and we understand the exact mechanism of a problem solving method and this method is based on a certain formal approach. Innovation still requires creativity, and this is where we hit the barrier. What is quite clear today is that logic can not substitute creativity, but it can trigger it nevertheless.

A major reason is that we still do not know what mechanism helps us to solve non-typical, inventive problems. There are a number of theories and hypotheses that attempt to explain the phenomenon of creative thinking, but still making these theories formal does not seem to be possible. Thus, the higher degree of formalization of the underlying theory is, the higher degree of automation is achieved (Fig. 1). Take, for instance, the concept of metaphor: it is a very strong method for producing new ideas, but we only have a vague understanding of how it works. Metaphorical way of thinking is capable of establishing high-order analogy between seemingly unrelated events or objects. And not only it is limited to establishing the analogy, it also makes interpretation of how we can use this analogy to obtain some positive effect.

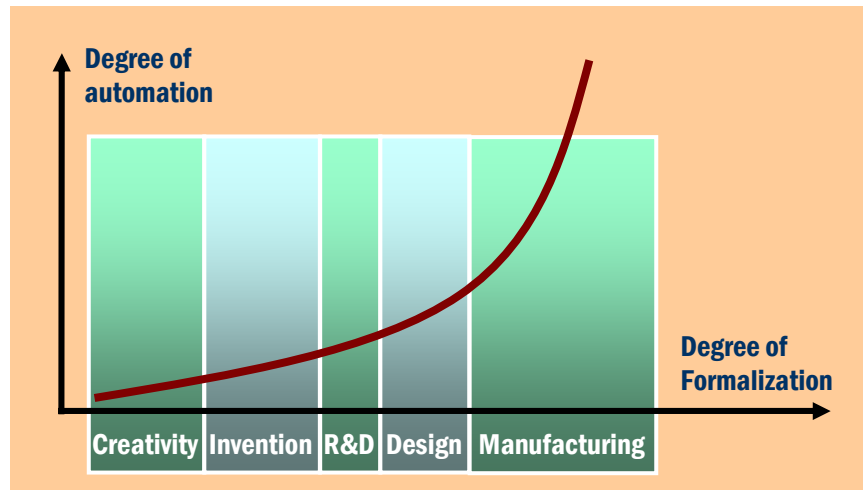


Figure 1. Formalization vs. automation during product development

A role of personal creativity

TRIZ works in a similar way [2]. It introduces logic behind the inventive process and provides us with a number of high-order patterns of past solutions, which can be used to generate new ideas. Logical thinking is a kind of abstract thinking and TRIZ-based Systematic Innovation¹ does not provide exact solutions, since these solutions simply do not exist yet. But Systematic Innovation acts as a thinking method and as a trigger which helps to choose a right solution strategy. Numerous TRIZ software packages available from different vendors do not automate invention: instead, they provide fast and convenient access to TRIZ or customized organization-specific knowledge bases, and can as well be used for learning TRIZ. Today, Systematic Innovation is the most powerful technology for solving innovative problems and producing new ideas, but mastering Systematic Innovation requires considerable time and effort. This might be considered as an obstacle in a short run, but nevertheless is a winning strategy in the long run.

As a conclusion, the role of creating new ideas and concepts still remains and will remain for the time being to the great extent at the responsibility of human problem solvers. But since the rates of new product development accelerate rapidly, to stay competitive we need to transform innovation to well-planned and predictable activity; and currently it becomes clear that systematic approach to innovation is the best platform to achieve this transformation.

Some companies resist introducing systematic methods for innovation support, thought. They believe that breakthrough innovations result from unstructured thinking only. This is partly correct, but unstructured thinking is not a replacement for the systematic approach. Instead, the best results are produced by a synergy between systematic methods and creativity: TRIZ-educated people know that bi-systems (those systems which result from combination of two similar or different systems) have a higher degree of efficiency than mono-systems. But what is interesting, TRIZ has never rejected creativity. The course of Creative Imagination Development is still regarded as a very important component of increasing inventive capabilities [3].

Where is management?

However innovation is not just about creativity. We can think of great ideas, but they will never see the world without implementation. Often, new, seemingly great and bright ideas are rejected

¹ It is important to note that TRIZ is only a part of what we call “Systematic Innovation” since Systematic Innovation includes a number of other tools and defines a process of creative innovation, while original TRIZ is a set of specific problem solving techniques.

since they might not be implemented at all: e.g. they violate physical laws, or too expensive, or market research shows that customers would not be willing to invest to these new products or technologies. If an idea is accepted, there will still be a long way to transform it to a sellable product which will involve many different resources. Thus, the degree of quality of generated ideas becomes one of the key factors that determine future competitiveness of every business. Wrong investments lead to wrong results – and this is why systematic methods for innovation must not be neglected since they increase the probability of producing high-quality ideas and concepts as compared to traditional trials and errors methods.

We tend to believe that successful innovation involves three major ingredients: creativity, knowledge and proper process management.

- **Creativity** is needed to break the psychological inertia, to invent a new solution, or to recognize a new application area for the existing technology. Without thinking out of the box, we would be still tied up with old technologies. Systematic and logical methods which enable re-using previous creative experience represented at abstract level helps boosting creative capabilities of inventors and problems solvers.
- **Specific scientific and technological knowledge** is required to find new ideas, especially in hi-tech areas. A great deal of technological solutions results from knowledge of technology itself, knowledge of physics, and knowledge of technology in general.
- **Responsible Management** is one of the most crucial ingredients of successful innovation. Although we used to think that management has little to do with creativity (which turns to be a wrong statement, modern world demands creative managers), management is a key element that makes innovation happen. I observed several times how good ideas were “lost” due to the poor management of the innovation process or problem solving sessions were organized in a chaotic manner without even registering ideas that were born during the sessions.

On one occasion, I noticed that the company released a new product, idea of which was developed with my involvement several years ago. When I contacted personnel of that company who were involved to the project, I was surprised to know they even were not aware of this new product... But luckily, in this case the product was brought to the market. In some other cases, ideas were simply forgotten and lost. But sometimes, old ideas are a good source for new innovations, since they were rejected for certain reasons in the past which do not exist any more... But ideas are lost.

Why does this happen? One of the reasons is that, as known, once we solve a “big” problem dozens of “small” problems arise: a new solution has to be verified and in most cases, modified and adapted; a prototype has to be built, costs have to be optimized, a final product has to be developed... And not all of these small problems are easy to solve. Sometimes we need innovative thinking again and again to implement the same idea. On top of that, here we face a risk management issue: it is unclear at the beginning of the project if the product will be successful on the market.

Creating innovation infrastructure

It becomes clear, that companies need a person responsible for the whole cycle of innovation: from recognizing problems and needs to producing a final product. Today, this role usually belongs to other types of managers who have other responsibilities as well, like CTOs, CIOs, business development managers, technology managers, or knowledge managers. But innovation itself is a big area, involving a number of projects, and especially, cross-disciplinary knowledge and communications. As noted in [4], innovation management involves 5 categories:

- *Idea management*: development of organization-specific methods for managing idea generation processes.
- *Innovation life-cycle management*: coordinating the entire innovation life cycle from the envisioning stage through to the rewarding of individual innovators or innovation workgroups.
- *Product development management*: realization of ideas in form of commercial products and technologies.
- *Environmental innovation management*: constant monitoring and “scanning” of the environment in which an organization operates in order to predict future innovations.
- *"Outside-the-box" innovation management*: creation of organizational culture that stimulates creative thinking.

Summarizing, we can outline four major ingredients of a modern innovation infrastructure (Fig. 2):

1. **Human expertise with methods, techniques and tools of systematic innovation and creativity.** Here we mean a methodology of systematic innovation, methods for boosting creativity, thinking methods. A core innovation team which would be literate with these methods and possessing multi-disciplinary background, equipped with IT tools would be responsible for generating intellectual property and solving most difficult problems. The same team can be responsible for basic education of staff in new thinking methods. An important issue is that no matter how these methods are related or not, an organization should establish a process of idea generating which will provide the highest efficiency of work. It is important that formal methods and informal ways of thinking should be well balanced: as known, too much formality kills creativity.
2. **Seamless access to scientific and technological expertise,** both internal and external. External expertise plays a significant role for innovation since many breakthrough ideas are based on combination or utilization of technologies that reside outside of the problem solver’ expertise. All possible expertise can not be kept within a single enterprise, therefore there is the need to establish and maintain connections with third-party scientific, technological and consulting organizations.
3. **Innovation Manager:** A person, who is a strategic thinker, knows innovation process, familiar with methods used along the complete innovation cycle and who is responsible for innovation, and possesses enough power to implement innovative products and technologies.
4. **Information Technology support for innovation process management:** all information flows from idea to product should be supported, including the abilities of documenting decision making processes, establishing communication means to connect all parties involved to the innovation process, as well as tracking and measuring results. Specifically, communication channels should be established with customers and suppliers who often produce very valuable ideas on how to improve core products and technologies.

As follow from my experience, presence of these four components is necessary to turn a traditional company to an innovative company. They form an innovation system of an enterprise. Neglecting any of these components might affect negatively any company survival in the long run.

Another important aspect is formation of innovation culture at an enterprise. In the old economy, innovation at large companies usually was triggered in a bottom-up way, by engineers, employees, etc. One of the pioneers in the field of corporate innovation, 3M allows its employees spending 15% of their working time for their own experiments [5]. This greatly stimulates innovation at the company. But today the roles are expanding: top management should not only stimulate innovation, but be totally involved to the innovation process.

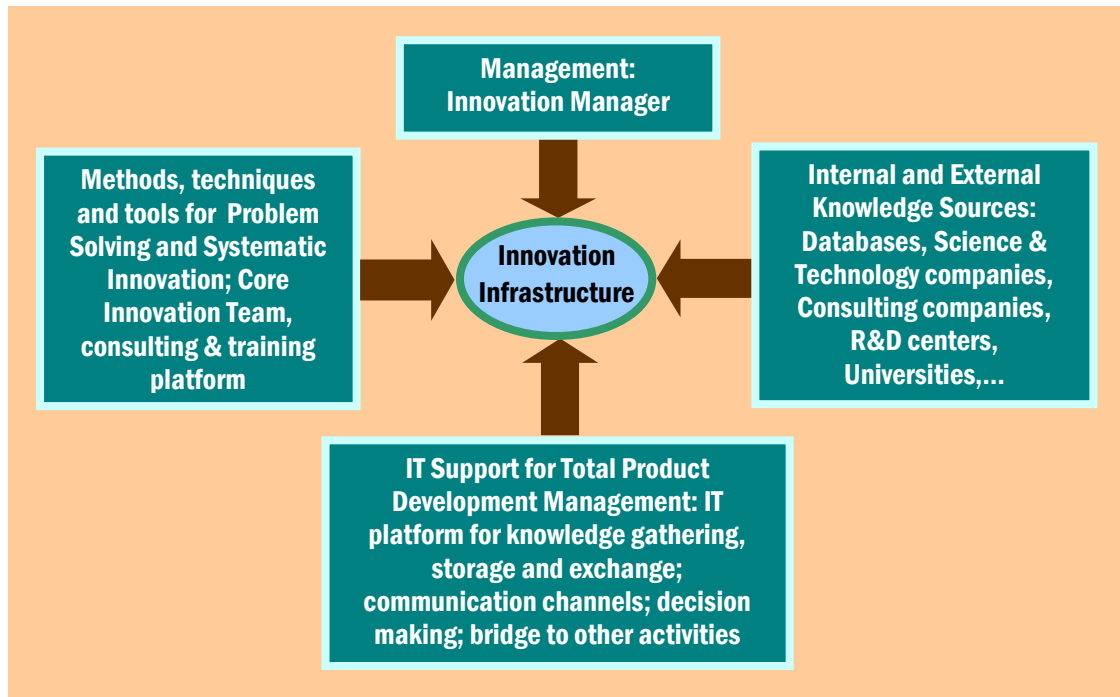


Figure 2. Necessary components of innovation infrastructure

There is a common opinion that innovation is mostly used at the early phases of design process. This is not a case any more. Innovation belongs to almost every department which is related to the product: from R&D unit to sales and maintenance departments. It becomes a task of a company's innovation management to make every unit or department innovative.

Every day Europe moves closer to the knowledge economy, since production and manufacturing becomes rather costly, comparing, for instance, to Eastern companies. This is not a secret that most of manufacturing relocates to the East. As predicted by Gartner Group, "By 2005, *innovation focused knowledge workers will represent 30-to-35 percent of the employed workforce in developed nations.*" We are close to 2005 now and we see that this becomes a reality. If knowledge becomes widespread goods an economy can rely on, there will be a permanent need to generate new knowledge to stay competitive. And in most cases, new knowledge is a basis for innovation. Thus the role of innovative thinkers equipped with relevant IT tools supporting innovation will become critical for survival in knowledge economy.

References

1. Dreyfus, H., 1998, *Why Symbolic AI Failed: The Commonsense Knowledge Problem*, available at: www.hfac.uh.edu/phil/garson/DreyfusLecture1.htm
2. Altshuller, Genrikh. "The Innovative Algorithm. TRIZ, Systematic Innovation and Technical Creativity". Technical Innovation Center, INC. Worcester, MA. 1999.
3. Salamatov Y. "TRIZ: The Right Solution at the Right Time". Insytex, 1999.
4. Rozwell, C., K. Harris, and F. Caldwell, "Survey of Innovation Management Technology," Gartner Research, January 2002, Markets, M-15-1388.
5. <http://www.3m.com/about3M/century/experiments.jhtml>

About the author

Valeri Souchkov is independent consultant and trainer in Systematic Innovation with over 15 years of experience of performing projects for different organizations worldwide. He initiated promotion of Systematic Innovation methods in Western Europe, was a co-founder of Invention Machine Lab in 1989, and the European TRIZ Association in 2000. He can be reached at valeri@xtriz.com