

Lessons Learned in the Introduction of TRIZ at Siemens A&D

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Abstract

Since October 2005 so-called Invention on Demand Workshops are conducted at Siemens Automation and Drives (A&D). These workshops were done for two reasons: On the one hand methods like TRIZ had to be tested for their ability to solve problems deriving from the Automation and Drives product portfolio, and on the other hand it had to be proven that the employees themselves were willing to use those methods in problem solving processes. Both issues could be answered positively. On the basis of that experience a concept for a methodical curriculum for the employees of Siemens A&D was developed.

Keywords

Siemens AG, Introduction of TRIZ, Teaching of TRIZ

1 INTRODUCTION

Siemens has some experience with TRIZ as its Corporate Technology department was and is still dealing with this issue. However, companies like Samsung and Intel showed a different approach to TRIZ methodology which gave them a huge advantage over their competition [1] [2] [3].

Automation and Drives is one of the biggest groups of the Siemens AG. It was searching for opportunities to improve their innovation rate. One of these opportunities could be TRIZ. It had therefore to be proven that TRIZ methods could be used with the A&D products and that the methods are accepted within the company.

Therefore the Invention on Demand Workshop concept was implemented to show whether the presumptions were correct.

After the Invention on Demand Workshops showed a clear success it was decided to teach more people within Siemens A&D in those methods. A concept for the teaching of the TRIZ methodology was developed and is now implemented.

With this article I will go into detail on the Invention on Demand Workshops and give a rough overview of the curriculum for Siemens A&D employees.

2 INITIAL SITUATION

The main goal for Automation and Drives was to have the innovation and technological leadership. Three targets were defined for that goal: to build up a strong patent portfolio, to accelerate the speed of innovation and to ensure a complete coverage of all possibilities in a given technical field. How to achieve all these goals?

We wanted to achieve it by going systematically from the problem to a solution. Normally if we have a problem we would like to have the solution in an instant flash of inspiration. Now for most people this won't work, so they go the trial and error path down to a solution that looks workable to them. By doing that they are finding some solutions that are within the solution space. They try to pick the one solution that is the nearest to the goal they want to achieve. With a methodical approach we try to move step by step from our problem to a solution. We try to systematically develop a wide array of solutions that cover the whole solution space. After we have done this, we would pick the solution that meets our goal (Figure 1).

As we knew clearly, that we wanted to try the methodical path for the Automation and Drives product portfolio, we

were looking for a possibility to bring that methodical approach to the engineers.

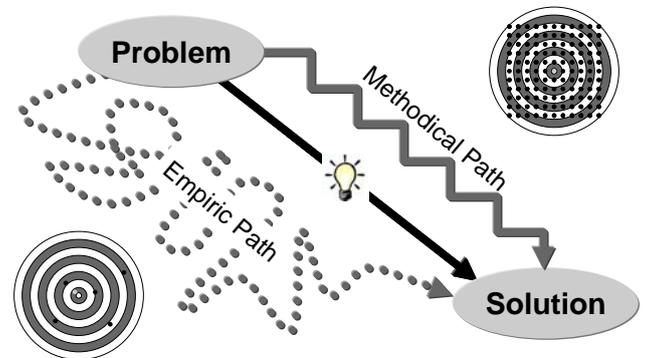


Figure 1: Systematically from problem to solution

3 INTRODUCTION OF TRIZ

The easiest way to do this and simultaneously check the methods for their applicability to Automation and Drives product portfolio was to implement a workshop facilitation that is for free for an internal customer. There were also so called Invention on Demand Workshops in place which were conducted with the help of external and internal facilitators. It was also found, that the goal of those workshops were differently defined by different groups. For the patent strategy managers an invention on demand workshop was a workshop to create invention disclosures. For the innovation manager these workshops were held to invent new product ideas and to the project manager the solving of a complex technical problem within a workshop was inventing on demand. To clear up this field we introduced three categories of Invention on Demand Workshops: The Patent on Demand, the Innovation on Demand and the Solutions on Demand Workshop.

The Solution on Demand Workshop clearly seeks for alternative solutions to a given technical problem. It has to come up with ideas during development or after a customer had requested it. Also these ideas had then to be checked for their novelty. If a new idea arises it has then to be covered with an invention disclosure. But this is not the main target of this kind of workshops. Here the many alternatives are the main issue to be addressed.

The products are the driving force behind the Innovation on Demand Workshops. There innovation of products, services and applications should be developed. Also product concepts with new attractive features are sought for. As with the Solutions on Demand Workshops the

ideas are to be checked for novelty and if possible covered with patents.

A patent application is the product for a patent strategy manager as for him the application is as good as any other product Siemens produces. This issue is met by the Patent on Demand Workshops. The patent portfolio is to be protected and expanded with these workshops. New application patents should be found and "white spaces" should be occupied by own intellectual property.

With this threefold of workshops all requirements for the Invention on Demand Workshops were met and communication was quite clear from then on. Also a demand for facilitation was met and soon there was an Invention on Demand Workshop conducted every other week. On the basis of these workshops running for one fiscal year the statistics in this report are calculated.

Each of those workshops had not only to address different goals. Also with these different goals there are slightly different set-ups of the workshops.

The Solution on Demand workshop for example, needs the technical problem as an input to the workshop. If possible, also the history of trials for solutions and the solutions of the competitor go into the workshop. If this is compared to a Patent on Demand Workshop, you would need none of the former inputs. There the patent portfolio and the issue of the workshop have to be put into the workshop in the beginning.

As the workshop is then conducted, each of the workshops needs a different set of methods that is used within the workshops. The Solution on Demand Workshops is more based on TRIZ tools than the Innovation on Demand Workshops. They use mostly Edward de Bono creativity tools.

For the documentation of the workshop, the three different workshops are nearly the same. They all get a list or spreadsheet with evaluated or weighted alternatives out of the workshop as well as a list of possible invention disclosures. It mainly varies in the amount of entries that are to be found in the lists, as the Solution on Demand Workshop doesn't push the invention disclosure list and more or less just uses it to check their ideas for novelty.

The participants of the workshop use that list of ideas to identify a wide array of ideas, check them for novelty, identify the most promising ideas and improve this most promising idea with features of the other ideas that were created.

4 SUCCESSES OF TRIZ

The above mentioned workshops were conducted since the beginning of October 2005. The department A&D ST 2 acted as a service provider for the whole A&D group. That means that the internal A&D customer (patent strategy manager, innovation manager, project manager) gets the facilitation of the workshop for free to lower the barrier to conduct such workshops. With that facilitation the customer also gets the professional and methodical support for the preparation and execution of the workshop. So the internal customer gets professional support for an innovative workshop for free. With that, many of these workshops were conducted. The following statistics are from the first fiscal year of those workshops. Within this first year there were even some more workshops that don't count into the statistics because they didn't fulfil the innovation requirement for the Invention on Demand workshops. But this was sometimes not clear with the set up of the workshop and could only be judged clearly after the workshop was conducted.

Since October 2005 1238 ideas were created in Invention on Demand Workshops. An idea is a sheet of paper which describes an idea at least with a drawing or a text. Also the name of the idea creator is added to this sheet. These are the minimum requirements for an idea sheet. The idea should be more than just a line of text. A little bit more substance is required, even in this step. If it is less than the above mentioned, it is named "idea splinter" within those workshops to differentiate it from the ideas. As described in the different workshop concepts, one part of the workshop concept is to look for the novelty of the ideas given. With this, out of those 1238 ideas 243 issues for invention disclosures were identified. In the fiscal year 2005/2006 there was a significant increase of the number of invention disclosures written determined. We think that the new Invention on Demand Workshop concept is one of the reasons for that.

All these ideas came from a total of 25 workshops conducted in which 244 employees of Siemens were confronted with different TRIZ tools and creativity methods. There were 10 Solution on Demand, 7 Innovation on Demand and 8 Patents on Demand Workshops facilitated.

As the workshops had different targets it was also interesting to know which methods could be used in which setting and why. If we look upon the raw numbers each method was used, we come up with four different groups of methods. There are those methods that were nearly used in every workshop. These were named the "basic, easy-to-use every-day methods". Those methods are brainstorming (which is more a brain writing), the morphological box, the gallery method and mind mapping. The morphological box and mind mapping is used most of the time for the documentation and structuring of the workshop. The brain writing session is combined with the gallery method in each workshop to get the first ideas from the participants. They have to write down all their ideas to be free for the creativity methods and TRIZ tools to work on really new ideas that they didn't have before.

This brings us to the next group of methods: the "basic, easy-to-learn methods". This is a group of methods that the facilitator of the workshop can explain to the participants easily and that the participants then can use on their own right away. There the first tools associated with TRIZ come up. TRIZ methods in this group are the 40 innovative principles, feature transfer, system operator and effects.

With "Advanced methods" those methods are meant that need more explanation by the facilitator and most of the time also some preliminary exercise to get used to the method. TRIZ methods in this group are the theory of engineering systems evolution, function analysis, SCT-Operator, process analysis and prediction. The SCT-operator looks a little out of place in this group and we would like to move it to the second group of easy-to-learn methods, but this are the actual numbers out of the workshops.

In the last group, the methods were just used once in the conducted workshops. We named that group "Professional methods". There are those methods to be found that are very hard to explain to people who never heard anything of the methods before. Out of the TRIZ toolbox, principles, ARIZ-85B, innovation situation questionnaire and catalogue of effects is to be found. Principles and catalogue of effects would normally count to the number of applications of inventive principles and effects. The distinction was just made to differentiate the use of TechOptimizer 4.0 from the use of printed media.

Looking to the deployment of the methods within the different workshop concepts, it is also clearly visible, that most methods were used in the Solution on Demand workshops. There the issue of the workshop was a given technical problem with its boundaries. The other workshops deal with more open questions. With the given technical problem it was then also easier to identify the right tool for the problem.

Next thing to investigate was the kind of methods that were used within the workshops. Beside classical creativity and facilitation methods the Edward de Bono tools and the TRIZ tools stick out. The TRIZ tools were divided into three categories: Classical TRIZ, modern TRIZ and based on TRIZ. As the classical creativity methods are mostly methods that are very easy to learn and understand a need for expertise in TRIZ tools was identified. Therefore a methodical curriculum was set up in the then established "Innovation Tool Academy" to address this need.

5 INNOVATION TOOL ACADEMY

The Innovation Tool Academy builds up on the experience of the level of the methods used in the workshops. Therefore within the Innovation Tool Academy are three levels of knowledge in the methods: Use of basic, advanced and professional methods. Beneath that a level 0 was installed to address the persons that never heard of the methods. The level 0 should build an awareness of the methods and an understanding how and when the methods are to be used (see Figure 2). The higher the expertise in the knowledge levels, the less is the need for support with those methods.

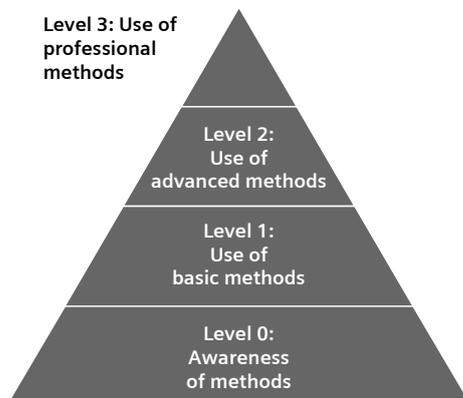


Figure 2: Knowledge levels of methods

To address these different knowledge levels, the different courses were established to teach the employees of Siemens Automation and Drives the TRIZ toolbox. An introduction course should address the level 0 knowledge level. There is a short half day introduction course for the executives and a one and a half day course for engineers. Within those introduction courses just a overview over the different methods that are taught in the other levels is provided. The basic and advanced courses run five days each and the professional course is a two months curriculum with three times five days in a row teaching and the three weeks between each session as a free working period. Within the courses real problems should also be addressed to build more confidence in the methods.

Based on the knowledge about the methods and the experience of the Invention on Demand Workshops the TRIZ tools were sorted into the different courses. In the Basic Course the following tools are taught: Function Analysis and Trimming for Products, Cause-Effect-Chains

Analysis, Feature Transfer, Function Oriented Search, Engineering Contradictions and Inventive Principles and Solving Physical Contradictions. The participants of the Advanced Course will get knowledge of Pragmatic S-curve Analysis, Functional Benchmarking with S-Curve Analysis and Standard Inventive Solutions. The professional course will cover Function Analysis and Trimming for Processes, Nuances of Feature Transfer and Cause-Effect Chain Analysis, Flow Analysis, Algorithm for Inventive Problem Solving (ARIZ), Clone Problem Application, Inverse Function-Oriented Search, Super-Effect Analysis, Failure Anticipation Analysis and Trends of Engineering System Evolution.

To ensure the impact of the knowledge within the courses, after each course (with the exception of the introduction course) a test is carried out. If the test is passed, the tested person has achieved a level of the so called "Creative Analyst" profession and is allowed to subscribe to the next level courses. The name of the profession "Creative Analyst" should enforce the two thinking patterns a person in this curriculum should be able of. First of all a graduate of the Innovation Tool Academy should be a very sharp analysing person: A person that takes a given technical problem apart and can systematically address the different problems on different difficulty levels. After the analysing part, a number of problems should be addressed in a creative way. Many solutions should be found to the chosen problems. After the creative part, the analysing kicks in again to evaluate and select the best possible solutions out of the created idea pool.

6 SUMMARY

This paper describes how the need for a methodical approach to the concept finding phase within a product development process has arisen. It shows how TRIZ was introduced in the Siemens Automation and Drives group by the conducting of free of charge facilitation of workshops. Out of the information gathered within one fiscal year of conducting those so called Invention on Demand Workshops, a need for more information on a broader base was derived. The Innovation Tool Academy was established with a broad TRIZ curriculum.

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