

# Experience Transfer Model, a New Concept for Innovation Power

Ove Bayard, Magnus Areskoug, Mihai Nicolescu  
*KTH Royal Institute of Technology, Department of Production Engineering*  
*oveb@iip.kth.se, amhar@kth.se, mihai@iip.kth.se*

Peter Krajnik, Borut Likar  
*University of Ljubljana, Faculty of Mechanical Engineering*  
*peter.krajnik@fs.uni-lj.si, borut.likar@fm-kp.si*

Maksim Saat  
*Tallinn University of Technology*  
*Maksim.Saat@tseba.ttu.ee*

Donal Nolan  
*Institute of Industrial Engineers*  
*dnolan@iie.ie*

Hans Ahlin  
*Falu Kommun, Local Trade and Industry Dept*  
*hans.ahlin@falun.se*

## Abstract

*In both small and large organizations it is commonly difficult to introduce novel concepts into process- and products development. The reasons vary but they are often irrational and based on optimization of the individual's current situation. This limits the capacity to evaluate the project concepts and to realize them with an opened mind. Generally it is always valuable to have an overall objective assessment and evaluation of concepts and projects. In this paper a new way to facilitate and increase the quality of evaluation and implementation of new ideas is presented. This concept is especially important in the area of Engineering Education and when introducing a new way of thinking for Sustainable Product Development. It is based on an academic approach that involves presenting an idea in order to make it understandable for both experts and non-experts and a systematic problem analysis.*

## 1. Introduction

Generation of new ideas and their implementation into a process or product represent

a key factor for a company's competitiveness in the global market.

The ETM (Experience Transfer Model) concept is focusing on developing a methodology that will speed up the process from knowledge generation to technological innovation. This approach is anticipated both to enhance and to strengthen the innovation power.

The ETM concept is demonstrated in a project, granted by the European Commission, EU Program Leonardo da Vinci, was initiated in 2010. The target group is European engineering professionals working in industry.

The ETM project aims at developing a methodology that combine the use of experience from introduction of technology in industrial enterprises and the systematic approach to problem analysis and problem solving. The partners of ETM project consortium are Institutes, Communities and Universities in Sweden, Slovenia, Estonia and on Ireland.

The paper describes the concept, the different phases and presents an analysis of experiences gained so far in the development process.

One of the most important factors in competitiveness is the ability to introduce new ideas and technologies to the production field. The driving force in this process is always individuals with unique knowledge and motivation. Most organizations have a conservative and reluctant view on new initiatives. Consequently, there is a strong need to improve and facilitate this important process and give different kinds of support to individuals who are pushing for innovation in industrial organizations. In the academia, focus is on the theoretical knowledge building and there is a need to have the industrial implementation view on how the courses are developed and given. The ETM project concept take advantage of experience from industrial cases and transfer them direct from the source, the individual owning the case.

“Innovation power” is a phrase that is important for ETM. Within the project innovation power is defined as the strength achieved to go further with an idea or a proposal. It embraces all kinds of support that a decision maker needs to be able to undertake next step. The power is delivered through experience transfer and knowledge support from other engineering professionals in a selected group with mutual trust and strict confidentiality as their catchwords.

Brainstorming [1] and Problem Based Learning (PBL) [2] [3] are good examples of concepts that can be used for problem solving. The ETM concept is another systematic way of approaching a task, case or problem. In comparison to the given examples ETM focus primarily on the individual’s knowledge and competence and how this can be shared. Unique for the ETM concept is the systematic methodology used, how the analysis process is done and in which phase the experience transfer of knowledge takes place. The ETM concept is developed for groups of engineering professionals and is performed through workshops that are usually lunch to lunch meetings. The concept is applicable on both technological and organizational problems.

**Keywords:** Engineering Education, Innovation, Problem Solving, Vocational Educational Training (VET), Experience Transfer, Industrialization.

## 2. The concept

ETM offers a platform for presenting and discussing all types of technological

problems/ideas in full confidentiality. The concept is a systematic way of presenting and analyzing a problem/idea in a group of qualified persons with different backgrounds and experiences. The environment is carefully organized for trustful communication at high academic level. The ETM concept offers the participants a platform for the workshops and a network of highly qualified people. The present Leonardo da Vinci project has as target to refine the innovation power system generated by ETM and develop it for European scale. The result will be a fully developed concept with all necessary manuals and an administration to handle the network of members (participants from industry) and workshop leaders.

The core of the ETM concept is the workshops with participants from industrial companies with different competence fields. In each workshop an industrial case is presented and analyzed. The ETM concept generates an understanding of the case analyzed to the participants and offers the possibilities to adapt the new knowledge in their own organization. As the workshops can have participants from different countries with other language and cultural situation, these issues will be an important factor in developing problem solving strategies.

By having a European participation the ETM concept will be transferred across the borders. The academic representative participates as the workshop moderator, which means she/he is educated in the ETM concept to develop a deeper understanding for the industrial implementation process.

In Figure 1 the fundamentals of the ETM concept is shown represented by six arrow formed boxes. As illustrated in the figure the workshops are linked to the recruitment and formation of groups. On the participants common platform the workshops create the natural interface between the group members. Through the recruitment and group formation qualified persons meet. The concept provides the participants with a set of workshops that facilitates discussions and sharing of experiences. ETM offers management and support during the workshops. This is basically achieved by following the outlined ETM structure and agenda with its specified steps. The ETM concept initiates the formation of a cross disciplinary network between industrial professionals of different disciplines. This facilitates the participants continues update concerning new technologies, ideas and knowledge.



**Figure 1.** The ETM concept

### 3. Workshop structure and recruitment

The ETM framework is to a great extent based on the workshop structure. It reflects the different steps and their function in the ETM procedures. The structure involves both the workshop agenda and the preparations before the workshop as well as the actions afterwards.

The admission requirements aims for creating a group of persons who have the correct competence level, interest in experience exchange and authority to use information from their own organization. In some cases this can involve formal requirements from the universities if academic merits are to be given.

The formation of workshop groups is a very crucial procedure for the success. This involves check of eventual competitive relations and of previous experiences. This check is inevitably not involving social competence and related circumstances in the primary formation, but will be taken in account after the first workshop has taken place.

The selection of subjects to be presented at the workshops is done after the request by the participants. There are many methods to select subjects and in the case of ETM the request of the problem owner has the first priority. Important factors in the selection are the possibilities to visualize the problem both literally and image wise. It is to remember that the ETM model is not directed to detailed problem solving but more to strategies in handling different problems/ ideas.

The preparation of the ETM workshop involves both the presentation of the subject and the practical details of the workshop as agenda, date and place. It is important to be careful in planning the presentation as it is easy to underestimate the risk for misunderstanding what is brought forward. In the normal case the moderator visit the problem owner and discuss all matters on site.

The choice of place for the workshop has importance both for the possibilities to visualize the subject and to create an inspiring atmosphere for the meeting. In most cases the best solution is to have the meeting at the problem owner's premises in combination with a conference facility. Most people are affected by the surroundings they are visiting quite importantly. A guided tour of the premises often brings the participants to the right level of communication. It is important that the participants have time and space for private work and informal communication.

The detailed workshop agenda is decided in cooperation with the problem owner and the other participants. The preferred agenda layout is to have a lunch to lunch schedule with overnight stay for the participants. Other agendas as one day program are also possible. It is of outmost importance to have adequate time for own contemplation between the different steps of the ETM workshop. The joint meals and coffee breaks are very good social occasions for informal communication and should be planned carefully. The agenda should always include the steps:

- Problem Presentation
- General Problem Analysis
- Individual Analysis
- Individual Problem Solving
- Individual Strategy Presentation
- Summary and recommendations
- Problem owners reflection
- Feed-back

The different steps must always be distinctly separated and finished fully before the next step is started. For the first seminar in a series when the participants do not know each other more time must be spent on the introduction to the ETM concept and how the procedures are.

The management of the seminar is primarily run by the organizing university or educational institution. A moderator leads the meeting and has a secretary for documentation work. The problem owner is performing the problem presentation and the connected visits to premises. The participants take part in the analysis steps and give their presentations of how to handle the presented problem.

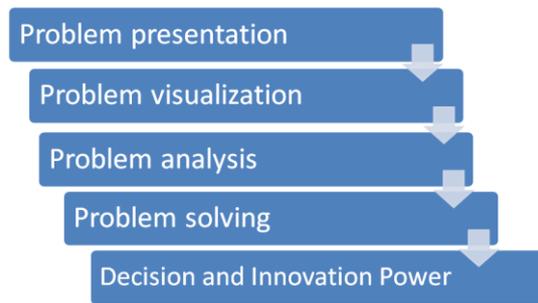
### 4. Problem Presentation and Analysis

The effectiveness of the ETM model depends on a process to use when approaching a problem (problem analysis techniques). With an

appropriate technique problems can be solved or at least decomposed quickly. Without a technique, the ETM workshop may be ineffective, with participants stuck already in the problem identification phase due to various hindrances.

What are the key elements for a well working ETM workshop? The first thing to consider is the group composition. Forming a group of professionals that gives participants with different industrial competence, experiences, cultural background, age and personality a possibility to meet on a mutual platform, the workshop, is the basis for the ETM concept. This creates good conditions for establishing an environment that facilitates a relaxed dialog around a specific task, case or problem. Innovative thinking, efficient exchange and transfer of experience on multidisciplinary bases are in this way promoted. The idea is to have a defined number of seminars for the ETM group. The size of the group is another aspect to consider. Since the number of participants on the workshops may vary, depending on group members' availability, the recommended number of participating, according to our experience, in a workshop is between 8 and 10. In analogy with this the total number in an ETM workshop group should be at least 15 in order to assure that a constructive dialog around and analysis of the task in focus for the workshop can take place. The third thing to consider is how the case or the subject is presented for the ETM participants. The responsibility lies on the problem owner who presents and illustrates the task for the seminar group. In order to achieve maximum output from the ETM workshop it is crucial that all participants fully understand the fundamentals of the case presented. Visualization is a strong tool that can be used to make the problem more transparent and clear from the beginning. The ETM model is mainly developed for problems of more long term and strategic nature.

To achieve maximum output from the workshops the ETM concept follows a well-defined timetable that separate the analysis process into specific steps or phases. In Figure 2 the main steps are shown. In the following sections these will be described in a more detailed way.



**Figure 2.** The main steps in the timetable for the ETM concept.

In order to keep the workshop participants on the right track and to secure that the intention of the ETM concept is followed a person from the academia is moderator for the meeting. This person has a full understanding of the ETM concept and guides the participants through the workshop. Apart from the moderator a second person is appointed as secretary. This person is either recruited among the workshop participants or taken in from academia. The main task for the secretary is to take down notes used for support during the recapitulating sessions that will be mentioned later.

Full attention by the participants is needed, expected and requested through all the steps in the ETM workshop. This is the only way to achieve a good result and maximum output. All external disturbances should be avoided since this makes the participants lose focus and get distracted.

#### **4.1. Problem presentation**

The first step in the ETM concept refers to the problem presentation. It is here the problem owner outlines and defines the task, case or problem that will be discussed during the workshop. Usually the problem presentation takes place on site at the company. This gives the participants a unique possibility to visit the shop floor and look at the surrounding environment. If some of the participants cannot be physically present at the location of the workshop different visualization tools can help them get the information needed for full understanding of the task, case or problem presented. This will be described more in section 5. Visualization.

#### **4.2. Analysis 1 / General Problem Analysis**

The second step involves analysis at the first level. This means that the participants deepen their understanding of the presented task, case and problem by asking clarifying questions. The idea is to straighten out the question marks and gain

deeper understanding of the subject. During this phase the workshop participants are not allowed to present own ideas, strategies or solutions concerning the task, case or problem. The moderator's role is to avoid that this happens. The idea is to keep the independent thinking of all the participants.

#### **4.3. Analysis 2 / Individual Analysis**

The third step is dedicated to supporting questions from the participants and is the preparatory phase before the individual problem solving phase starts. Here the analysis is brought to the second level. The third step is introduced through a recapitulation session where the moderator supported by secretary and her/his notes review what has been said so far. This allows the problem owner to make adjustments if there appear to be some misunderstanding regarding the task or problem in focus. At the same time the summary gives the participants a short review and a possibility to focus their minds on what supporting questions they have to ask to be able to formulate their own individual statement. When there are no more supporting questions to be asked the moderator and the secretary sums up what has been said during the third step

#### **4.4. Individual problem solving**

The fourth step is where the workshop participant sums up her/his ideas and formulates a strategy, handling plan or solution. This step focuses on bringing forth ideas and suggestions with reference to the individual's own knowledge. The idea is to make use of the participants' treasure of specific knowledge and experience and apply it on the case in focus.

The ETM workshop participants own contemplation period is very important to achieve a good result. Especially during the formulation process of the proposal and presentation full attention is needed from the participant and it is strongly recommended that all external distractions as e-mail, SMS, and phone call are avoided.

The workshop participants prepare a digital presentation which shows her/his ideas and sums up the proposal. This is the minimum requirement stipulated by the ETM concept. The participant of course has full freedom to use other ways of visualization tools.

As an alternative to individual presentations the workshop members can be divided into smaller

groups. Each group then prepares a presentation. To enhance Knowledge Management (KM) in a group, Mind Mapping can be used as a tool in the problem solving context. A study by Chun-Sung and Yu-Cheng Lin [4] shows that this has been beneficial for Engineers in Construction.

#### **4.5. Individual strategy presentation**

The fifth step is allocated to the individual or group presentation of ideas, suggestions and solution. The moderator selects in which order the participants make their presentations. Each participant now reveals for the first time what they have had in mind. Some of the ideas and suggestions may come as a surprise for both the problem owner and the other participants. The individual presentations may also show similarities on how a problem should be approached or handled.

This is the overall idea with the ETM concept to gather professionals with different ideas, let them develop their ideas and thinking on individual basis and then conclude it by presenting them to the rest of the group. Innovative thinking can generate a lot of good ideas when employees are not restricted by roles set up by a company culture. John D. Bransford's book *The Ideal Problem Solver* [5] give examples on how to improve creative thinking to achieve this.

#### **4.6. Summary and recommendations**

Being enlightened with new ideas and suggestions the moderator introduces the sixth step to the workshop group. The moderator and secretary sums up what has been said and then the group discuss and try to come to a mutual statement or recommendation.

#### **4.7. Problem owners reflection**

Feed-back is an essential part of the ETM-concept. The workshop ends by giving the word to the problem owner and letting her/him comment on and ask questions about the suggested ideas, strategies or solutions that have been presented.

When the problem owner is satisfied and has got the information and clarifications she/he needs the date for next workshop is decided and the moderator closes the session. Usually next workshop takes place within two or three months.

#### **4.8. Feed-back**

At the following workshop another subject is in focus and the problem owner is another participant

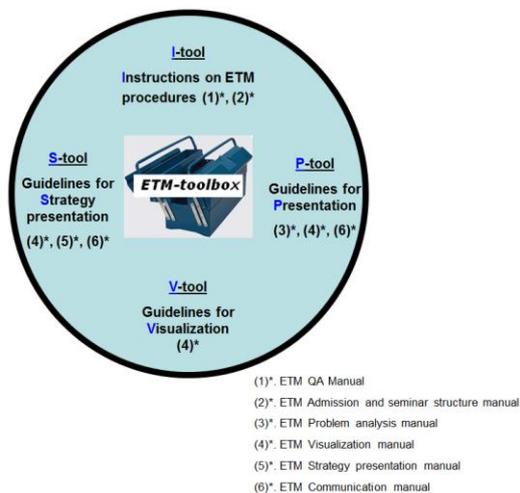
of the group. At the beginning of the next workshop the moderator will ask the former problem owner to brief the rest of the group what has happened since last time. What actions are at the moment being taken? These updates are done at all of the following workshops. This promotes the dynamic process concerning exchange of knowledge according to the ETM concept.

## 5. Visualization

Cognitive learning is an important part of the ETM concept since it involves listening, watching and experiencing [6]. The ideas for application and implementation are summed up in the ETM visualization manual.

There is close link to the ETM toolbox consisting of the I-, S-, P- and V-tool (see Figure 3). The I-tool contains Instructions with reference to the ETM procedures, the S-tool is the Strategy tool that gives guidelines for Strategy presentation, the P-tool refers to Presentation and covers guidelines for presenting the problem and presenting strategies/solutions and the V-tool give guidelines for Visualization.

Visualization has a strong impact on the ETM problem presentation approach as well as the problem solving presentation dimension.



**Figure 3.** The ETM toolbox consisting of the I-, S-, P- and V-tool.

Through the visualization the correct picture of the problem / issue can be drawn / made. It creates both better and deeper understanding of the actual situation and the surrounding environment. The visualization gives the participant to a workshop a possibility to understand, judge, interpret and analyze the actual case with reference to her/his own experience. Since every person filters the

incoming information through their experience, values and beliefs it is important that the visualization highlights what is essential for actual case being examined. Visualization also offers a workshop group member a possibility to take part in the workshop on distance. In this sense visualization promotes mobility with reference to experience transfer. In the ETM concept visualization is a useful resource before, during and after a workshop. Before a workshop visualization can be used for distinguishing and documenting specific problems/cases. This will be useful when selecting/deciding the final problem/case.

During a workshop, visualization offers many opportunities for documentation especially when the participants present their views and ideas. At the introduction workshop, when each participant makes their individual presentation, visualization is a useful instrument. After the workshop, visualization can be used for summing up the main ideas and suggestions. This will make it easier to review what has been done.

## 6. Problem solving and strategy for knowledge management

After the third step (Individual Analysis) in the ETM process a good fundament for the next steps is created. In this part of the ETM process the results of the workshop are concluded. Each partner has at this stage gained full understanding of the presented case and also checked the possibilities for their personal reflections. Now, all partners are given time for personal contemplation over the case and the possible actions needed to handle it. This session should be scheduled in the agenda as free time and can be used by the participant with no restrictions. A good way is to have an evening in between the analysis and the problem solving and strategy handling sessions. This gives ample time for both own thinking and informal discussions with others including other participants. Also there will be time for collecting necessary information for the coming presentation.

Before the individual presentations start all the participants are asked to submit the outlines of their coming presentation. There is a template developed for the presentation which can be used if so wished. This is to facilitate the session planning for the moderator and avoid the feeling that not all participants can give their complete views on the case. The individual presentations are an essential part of the ETM concept and all types of solutions, reflections and views are valuable to the session. The basic idea of the ETM is to generate an improved base for handling the case

presented by the problem owner. This implies that not only pure problem solving is desired but also strategies for handling the case. To have the case considered from different angles and disciplines is very valuable and the comments generated from that.

When all participants have presented their contributions the moderator leads a concluding session where all viewpoints are summarized. If possible a common recommendation is generated by the participants. As final part of this session the problem owner can give his views of what has been presented and discussed

## 7. Experiences from ETM seminars

The ETM concept was developed at KTH, the Royal Institute of Technology in Stockholm based on the need for a strong fundament for argumentation in launching new projects, ideas and concepts, innovation power. The first ETM concept based seminar series started in spring 2007. The participants came from both small and large companies with plants in Sweden. In this first series the lunch to lunch agenda was always used.

A general comment is that it takes time to achieve the trustful and communicative atmosphere needed to obtain the optimum performance of the group. There are several factors that influence this and many of them of social character. A positive trend regarding this could be seen during the whole series of seminars. As this first series was introduced as an academic course at KTH, it was relative easy to create trust in the confidentiality regarding the information given under the meetings. To create the open and freely communication between the participants is maybe more of a question of getting comfortable with each other in the group of participants. Of course the leadership of the meetings is of outmost importance.

Another general observation is that the participants underestimate the importance of time for own contemplation before taking actions. The ETM concept stresses very strongly that between each step there should be breaks from the meeting, eg coffee or meals. Spontaneous reactions could favorably be put at memory notes on paper or computer by the participants rather than communicate them to the others.

The preparation before a seminar is shown to be very important for the outcome of the analysis. One of the fundamental functions of the ETM concept is to offer a common platform of

information that can be used of non-specialist in the subject discussed. In order to reach this target a comprehensively information about the surroundings e.g. company information is essential. Also to make sure that all terms used in the presentation are well defined. According to the ETM groups experience it is very useful for the moderator to visit the problem owner at her/his premises as part of the planning.

The ETM seminars have always a moderator to manage the meeting. The role as moderator is demanding, much because of the tendency from the participants to run ahead in the agenda. It is very obvious that the best results are reach by keeping the planned agenda with all it steps for which the moderator has an essential role.

The analyzing phases are working best if they are interrupted with short breaks with a review of what has been said reported as short summary by a meeting secretary.

The final presentations are based on individual work during the time between the analyzing phase and the scheduled individual presentations. It is favorable to give ample time and good conditions for communication. An evening with a dinner is a good way to create good conditions.

It is very natural that the presentations from each participant vary in form and range. This is also a good thing but the best results come if the participants have different tools for preparation of her/his presentation. That could be to provide internet connections, computers, projectors etc.

The final summary with the problem owner's comments is always very rewarding and appreciated. In many cases new angels on the presented problem comes out of the discussions.

Since 2010 the ETM project works with partners from 4 countries, Slovenia, Estonia, Ireland and Sweden. This has been challenging to introduce a methodology developed within Sweden to other environments. The general observation is that it takes time to introduce the ETM concept but it is much appreciated when experienced in real. A common problem has been to convince potential participants to allocate the time needed for the seminar. A one day agenda has been used for introduction of the ETM concept with a positive but not optimal result. The different national cultures seem not to be a major problem in implementing the ETM concept.

## 8. Conclusions and further work

The purpose of this paper is to present a novel concept for problem solving based on experience transfer model. The overall target for the ETM initiative is to create a trustful and inspiring forum for exchange of experience on high level concerning technology management and development. The model involves different phases such as, Problem Presentation, General Problem Analysis, Individual Analysis, Individual Problem Solving, Individual Strategy Presentation, Summary and recommendations, Problem owners reflection, Feed-back.

The developed ETM model attempts to create a holistic platform through systematic approach. The ETM methodology considers the presentation and analysis of a problem/idea in a group of qualified persons with different backgrounds and experiences. The core component in the methodology is the participation to workshops which represent the ideal environment for knowledge management.

The ETM concept is currently demonstrated in a European project within EU Leonardo da Vinci program. Together with partners from Sweden, Slovenia, Estonia and Ireland several workshops were organized with the participants of the representatives from industry. The project expected results are

- A strong tool for introducing new and innovative projects in industrial organizations.
- A European network of excellence for engineering professionals.
- A European centre for operating ETM workshops

One of the areas to further investigate and develop is the workshop agenda. The lunch to lunch schedule has been successful but there has been a demand for one day workshops. This should be further tested and developed. Another task is to launch the ETM concept as a series of workshop where it is possible to connect functions between the workshops.

The building of a participant network is essential: Starting on national level the goal is to broaden the network and take it to the European level. This will ensure that the ETM concept with its innovation power will be transferred to new industrial professional around Europe and that experience transfer can take place across the borders. The formation of an ETM association that can handle the administration and concept

marketing will contribute to this. The association will also be host of the training program for moderators and workshop secretaries.

## 9. References

- [1] S. Seaker and M. A. Waller, "Brainstorming, The common thread in TQM, empowerment, re-engineering and continuous improvement, *International Journal of Quality & Reliability Management*, Emerald Publishing, Volume 13 (1): 8, 1<sup>st</sup> Feb, 1996, ISSN0265-671X
- [2] H. S. Barrows and R. M. Tamblyn, *Problem-Based Learning, An approach to Medical Education*, Springer, New York, 1980.
- [3] J. R. Savery, "Overview of Problem-based Learning: Definitions and Distinctions", *Interdisciplinary Journal of Problem-based Learning*, Vol. 1, Iss. 1, Article 3, 2006.
- [4] C-S. Chen and Y. C. Lin, "Enhancing Knowledge Management for Engineers using Mind Mapping in Construction, In *New Research on Knowledge Management Technology*", H-T. Hou, InTech, Ch 12, pp. 201-212, 24<sup>th</sup> Feb 2012, ISBN 978-953-51-0074-4
- [5] J.D. Bransford and B.S. Stein, *The ideal problem solver*, (2<sup>nd</sup> ed), W.H. Freeman and Company, 15<sup>th</sup> Feb 1993, ISSN 1042-1629.
- [6] L.P. Rieber, "A Historical Review of Visualization in Human Cognition", *ETR&D*, Vol 43, No. 1, 1995, pp.45-56, ISBN-10: 0716722054.
- [7] M. C. Shaw, "Engineering Problem Solving - A Classical Perspective", Noyes Publications / William Andrew, Inc, Norwich, New York USA, 2001, ISBN: 0-8155-1447-6.