OPEN INNOVATION IN THE FUZZY FRONT END OF THE INNOVATION PROCESS

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Abstract

This chapter stresses the importance of the preinvention phase in the innovation process chain, and explores its connection to the open innovation approach. The chapter focuses especially on problem identification activities (and methodologies) in the preinvention phase as the decisive first step in the chain of innovation activities – this phase and the methodologies available therein are often neglected in the scientific literature on innovation. Following a brief presentation of the list of availble methods for problem identification and idea generation, two selected methodologies (eMIPS and Innovation Cube) are presented in detail that can be used in the preinvention phase in real organizational settings. For each method, its open innovation characteristics are pointed out, as well as some possibilities on how to teach these methods as a part of innovation courses at Bachelor and Master course levels.

This chapter is primarily based on the book 'The Art of Managing Innovation Problems and Opportunities' (Košmrlj, Širok, & Likar, 2015). It was adjusted and some parts were extended to include open innovation topics as the main guiding theme of this Handbook.

Lecture Overview

Prerequisite	Generic knowledge on business processes, creativity and innovation.
Objectives of the lecture	This module aims at: 1. Getting familiar with the preinvention phase in relation to the identification of users' problems/needs and the creation of solutions; 2. Providing insights into how to orchestrate the open innovation approach within the fuzzy front end of the innovation process; 3. Getting familiar with concrete methods on how to identify users' problems and needs.
Workload	4-6h teaching; 4 h self-study.
Learning outcomes	**Knowledge** **LO #87:** To Understand How To Capture Value From Innovation – Appreciate The Challenges And Methods For Designing Innovative Organizations. **Skills** **LO #4:** To Apply Idea Generation Tools To Add Value To The Product / Process / Service / Business Model In An Organization **LO #8:** To Develop Creative Thinking Skills And Methods **LO #9:** To Apply Techniques For Inventive Problem Solving **LO #20:** To Critically Analyze Opportunity Identification, Evaluation And Exploitation For Entrepreneurship **LO #28:** To Develop And Contrast Future Scenarios And Appropriate Corporate Strategies Based Upon The Application Of Corporate Foresight Methodologies. **Competences** **LO #12:** To Plan And Manage An Idea Generation Session. **LO #14:** To Recognize Opportunity (Business). **LO #42:** To Analyze Innovation Needs Of A Company.

Reading List	1. At Kearney. (2014). Great Innovation Starts with the Fundamentals. At Kearney innovation study 2012. 2. Breuer, H., Hewing, M., & Steinhoff, F. (2009). Divergent Innovation: Fostering and Managing the Fuzzy Front End of Innovation. 3. Chesbrough, H.,Vanhaverbeke, W., & West, J. (2008). Open Innovation: Researching a New Paradigm. Oxford: University Press. 4. Deppe, L., Kohn, S., Paoletti, F., & Levermann, A. (2002). The Holistic View of the Front End of Innovation. 5. Hüsig, S., & Kohn, S. (2003). Factors Influencing the Front End of the Innovation Process: A Comprehensive Review of Selected Empirical NPD and Explorative FFE Studies. 6. Koen, P. A., Ajamian, G. M., Boyce, S., Clamen, A., Fisher, E., Fountoulakis, S., & D'Amoe, R. (2002). Fuzzy front end: effective methods, tools, and techniques. 7. Košmrlj, K., Širok, K., & Likar, B. (2015). The Art of Managing Innovation Problems and Opportunities. 8. Likar, B., & Širok, K. (2015). Outsourcing the front end of innovation. 9. Paasi, J, Valkokari, P., Maijala, P., Luoma, T., & Toivonen, S. (2007). Managing Uncertainty in the Front End of Radical Innovation Development. 10. Sperry, R., & Jetter, A. (2009). Theoretical Framework for Managing the Front End of Innovation Under Uncertainty. 11. Verworn, B., Herstatt, C., & Nagahira, A. (2008). The Fuzzy Front End of Japanese New Product Development Projects: Impact on Success and Differences Between Incremental and Radical Projects.
European Qualifications Framework (EQF) Level	6, 7

Lecture Content

Introduction

Open innovation as a very broad and complex concept is related to the innovation process as a whole, i.e. to each phase in the innovation process chain. Therefore, the open innovation model/approach as a specific way of carrying out innovation activities can be adopted at every step of the innovation strategy and is not limited only to some specific activities or steps in the innovation process.

This chapter focuses on the very first phase in the innovation process, the so called "fuzzy front end" or the preinvention phase (sometimes also called unclear or problem phase, pre-development, pre-phase 0 or pre-project activities phase). Just like all other phases, this initial phase can assume an open innovation approach. After discussing the basic features of this preinvention phase and the methods available therein briefly, we present two methods in more detail that can be applied in this preinvention phase with the open innovation approach. We also present potential usage of these two methods in higher education curricula.

Preinvention phase

Contemporary literature (Koen et al., 2002; Deppe, Kohn, Paoletti, & Levermann, 2002) states that this phase is the most important in the innovation process, because it has the greatest optimisation potential and highest impact on the whole innovation process (influencing the design and total cost of innovation), it has the lowest costs of implementing change and the least amount of available information – it is therefore a key step to successful innovation. Yet only few authors or studies have paid considerable attention to this stage, despite its vital role in the innovation process.

Usually, thinking about the preinvention phase starts with the element of idea as a potential source of innovation opportunity (see e.g. Deppe, Kohn, Paoletti, & Levermann, 2002; Hüsig & Kohn, 2003; Verworn, Herstatt, & Nagahira, 2008; Sperry & Jetter, 2009; Breuer, Hewing & Steinhoff, 2009). Only Paasi et al. (2007) talk explicitly about a problem as a potential source of innovation opportunity in the preinvention phase[1]. The element of a problem with regard to the preinvention phase is rarely discussed in the literature.

[1] This means that the starting point in the preinvetion phase (and later on in the subsequent innovation activities) is a problem that customers or users face. An example for this are mobile phones (and also tablets). When they became larger and equipped with a touch screen, the problem of phones falling to the ground emerged, as a large display was significantly more sensitive to impacts. Hence, protective covers emerged on the market en masse, which was a new market opportunity resulting from a clear problem.

In the literature, an opportunity is seen to be related primarily to the pursuit of new technologies, discovering niche markets and potentials, identifying consumer needs, but rarely to a specific problem in relation to an existing product, process, business activity, or as a specific starting point for the creation of an entirely new product. However, by merely focusing on an idea, organizations may miss some key opportunities or may not detect problems that may become unsolvable later. This refers not only to new products, but also to organizational, process, strategy and other "soft" aspects of operations. All of these are sources of problems and eventually innovation opportunities. Ideas as sources of innovation opportunities have their potential and relevance, yet all organizations face problems on a daily basis that may be visible or concealed, known or yet unidentified. An organization that detects and solves its problems and difficulties regularly (at all levels) may potentially innovate and operate more successfully.

Potential challenges and obstacles in the preinvention phase

In managing this crucial phase in the innovation process, there is a danger that organizations (especially smaller ones, like SMEs) will approach this phase in a simplistic/vague manner which can result in a higher failure rate of innovation projects. Another possible danger is that organizations may focus much more on the second major part of the innovation process (new product development), neglecting the crucially important first part (preinvention phase) – efficient management of the preinvention phase is strategically more important than managing the new product development phase (Koen et al., 2002). Additional challenges that organizations face in the preinvention phase are lack of resources and knowledge of innovation, lack of analysis, poor planning, insufficient use of management, and lack of methodical, systematic and structured procedures. All this can have potentially detrimental effects on the subsequent phases of innovation projects.

In the following, we present some challenges (or potential mistakes) that are related specifically to problem identification activities as the cornerstone of the preinvention phase.

Possible mistakes in the problem identification phase

In the problem identification phase (the cornerstone of the whole innovation process), it is crucial to arrive to a correct understanding of a problem/challenge as a potential source of innovation opportunity. Sometimes problems are clearly visible, yet having general knowledge of a problem does not necessarily mean that its causes are really understood. Correct definition of a problem facilitates its proper solution substantially. The reasons for failing to solve a problem adequately are multiple.

Incorrect assessment of circumstances

The assessment of a manager, entrepreneur, executive head or other people arises from previously generated conceptions and experiences that have led to partial or incorrect assessment. This is the basis for further activities, which are consequently incorrect. There are basically two causes for incorrect assessment:

- inadequate understanding of a problem, and
- incorrect specification of a problem.

We talk primarily about perception in connection with subjective assessments based on incorrect assumptions and an old mindset, while we talk about incorrect specification when we have failed to obtain the necessary objective information.

Example: On a long trip the bicycle tyre goes flat. As this tyre has had several punctures in the same season, we make a stop in a store and buy a bicycle puncture repair kit. When the tube is taken out of the tyre type, we discover that there is no hole and that the problem is actually in the leaky tire valve. As we failed to investigate the problem in more detail and relied on previous experience, we lost time and money. The example therefore points to two elements: inappropriate perception and inadequate analysis, and consequently, erroneous specification of the problem.

Insufficient data, information and analyses

Intuition is one of the most common reasons for managers' incorrect decisions. There are a variety of forms in this. The first form is related to insufficient information, which leads to incorrect conclusions, as crucial scenarios are designed without the necessary professional broadness. Another type of problems is a result of incorrectly processed data or improperly considered limitations of individual analytical methods, or even misunderstood results of analyses. The third problem is linked to the "information era", where there is a wealth of information from which we fail to select the most relevant for a particular case.

Example: A publishing organization launches a new magazine into the market. The organization has carried out analysis on the readership for an existing magazine with similar content. Based on this analysis, they have established that they can expect 300,000 readers. However, the organization has failed to consider that each magazine is read by three readers on average, and hence, there are only 100,000 potential customers on the market.

The importance of focusing on the future

A modern innovation strategy must also ensure that the research and development work and

innovation are not always subject to the pressure of today's business needs. Simply said, great innovators usually do not allow today's needs and pressures to nullify their look into the future. Thus, innovative leaders, according to an AT Kearney study (2014) create separate "engines" for the management of today's business processes and those who look into the future and will be able to take advantage of the long-term benefits of growth. For example, IBM created three teams to manage the organization's innovation programme, which focused specifically on innovation strategy, technological trends and operationalisation of innovation. So as to ensure the focus on present and future priorities, IBM has built its business opportunities on three different time frames: short-term fundamental business opportunities, medium-term growth prospects, and long-term upcoming opportunities. IBM has consciously decided to allocate a relatively large part of its funds (10 to 15 percent) for the development of long-term opportunities, and they do not allocate those funds to any immediate priorities or "fighting fires" in the organization (AT Kearney, 2014).

KEY TAKE-AWAYS

- The preinvention phase is the most important one in the innovation process: it has the greatest optimization potential, highest impact on the whole innovation (yet only few authors or studies have given considerable attention to this stage, despite its vital role).
- The element of a problem with regard to the preinvention phase is rarely discussed in the literature.
- By merely focusing on an idea, organizations may miss some key opportunities or may not detect problems that may become unsolvable later (this refers to new products and also to organizational, process, strategy and other "soft" aspects of operations).
- The dangers in the preinvention phase include: simplistic/vague approach, focusing too much on other phases in the innovation process, lack of resources and knowledge of innovation, lack of analysis, poor planning, insufficient use of management, and lack of methodical, systematic and structured procedures.
- In the problem identification phase, it is crucial to understand (define) a problem/challenge correctly as a potential source of innovation opportunity: most common reasons for failing to solve a problem adequately are incorrect assessment of circumstances, insufficient data, information and analyses, and focusing too much on the present business needs.

Available methods for addressing problems. Identifying opportunities and how to choose the most appropriate ones

There are many methods available (see the table below) for potential innovators in the preinvention phase for defining and addressing problems as sources of innovation opportunities. When there are a lot of tools or methods available for a particular task, the selection of the right tool is often more complex than the task itself. In order to facilitate the decision on selecting appropriate methods for potential innovators, each method has been labelled according to the following three aspects that define its features and implementation.

1. Scope: the method is suitable for addressing either a *problem* or an *opportunity*, which is already an intermediate phase on the way to the solution. When talking about the problem, we have in mind an issue or an inappropriate, yet important situation, which needs to be detected first and then defined and analysed clearly. On the other hand, an opportunity indicates either a challenge in the work process, a source of solutions for an already known problem, or detection of the potential for an innovation, but it can also indicate an idea for a solution.

2. Duration of implementation: *swiftly* (may be implemented in no more than a few hours) or *slowly* (lengthy version). Most methods may be implemented in a very short time, swiftly, yet such a manner of implementation cannot provide optimal results. Therefore, the icon "swiftly" is only given to methods which give visible results in a short time. Lengthy, slow implementation is very versatile: it can last several days or even weeks or months. This is specified further in the description of the method.

3. Number of participants: the method may be performed *individually* or may require work in a *group*. Most methods give the best results if they are performed in a group. Group dynamics may contribute to more associations, to divergent thinking and to greater creativity than the ability and practice of identifying and developing new deals. Moreover, the professional background of the participants mostly represents a useful basis for creative work. However, there are methods that may be performed quite effectively independently. These methods are marked in the text with the icon for independent execution, while the remaining methods are marked with the icon for the group. Nonetheless, the individual methods may be very effectively carried out also in a group. It is also useful to include in the group people who are not heavily involved in the searched problems, as they often notice them more easily. Moreover, critical and pervasive individuals, even the "eternal grumblers" should also make part of a group.

A classification of methods according to the above-mentioned features is presented in the Table 1 «List of methods per scope, duration and number of participants». The presented methods have been labelled further according to the profile of the participants, potential and orientation. For detailed description of the methods, see: Košmrlj, K., Širok, K., & Likar, B. (2015), *The Art of Managing Innovation Problems and Opportunities.*

Booklet: The Art of Managing Innovation Problems and Opportunities

The book is intended for those who wish to include elements of innovation in their academic work processes, as well as people who wish to use it in praxis and who would like to structure and improve their existing processes of innovation. It focuses primarily on the management of the pre-invention phase or the so-called fuzzy front end of innovation, i.e. the identification of problems and innovation opportunities. The book brings together a selection of some well- and less known methods, together with a number of newly deliberated techniques and complex web-supported approaches. It should be noted that some of the methods are original. Not only in the Slovenian area, but also in the wider international scientific community, the pre-invention phase has proved to be somewhat neglected. Accordingly, this book should serve as an original approach aimed at systemizing the fuzziness of the front end of innovation. It is a useful accompanying tool in the realization of processes facilitated by curiosity, imagination and the desire to succeed.

Methods for the open innovation approach

As the concept of open innovation includes simultaneous active involvement of several different actors from different institutions in the innovation process, it may be inferred that for the open innovation approach, the most appropriate methods in the table above are those that are designed for group implementation, especially those that require different profiles (backgrounds, expertise) of active participants. In the following, we present two such methods, eMIPS and Innovation Cube,

Table 1. List of methods per scope, duration and number of participants

	ADDRESSING A PROBLEM		ADDRESSING AN OPPORTUNITY	
	Swift Implementation	Slow Implementation	Swift Implementation	Lengthy Implementation
Individual Implementation	Cause-Effect Diagram Ishikawa Diagram Mindmap Problem Mining QaDIM Problem Breakdown SWOT Analysis Forced Connections	Focus on the Goal Gemba Walk TRIZ	Mindmap Attribute Listing QaDIM SWOT Analysis Forced Connections	
Group Implementation	Innovation Cube Ishikawa Diagram Matrix Structure Design Problem Mining Progressive Abstraction QaDIM SWOT Analysis Forced Connections PACIS	Incremental Innovation – "From Sources to a Star" Focus on the Goal DELPHI Wild Cards eMIPS PAPSA PDCA USOMID/SREDIM	Innovation Cube Attribute Listing QaDIM SWOT Analysis Forced Connections PACIS	Incremental Innovation – "From Sources to a Star" Five C's of Opportunity Identification DELPHI PAPSA PDCA USOMID/SREDIM

that can be used in a particular preinvention phase with the open innovation approach. Modern innovation models (e.g. the 6th generation) are built on the principle that innovation processes should be based on users' problems and market needs – eMIPS and Innovation Cube methodologies are both based on the same premise of problems as starting point of innovation projects. For each method, we first present its basic features and implementation procedure, then its open innovation attributes, and finally its potential implementation in a Bachelor or Master level course.

Inspiring case of problem-based open innovation by a 6-year-old girl

An inspiring case comes from a 6-year-old Slovenian girl Pia Alina, who invented an attractive education game. She got the idea from a problem which she intuitively sensed in learning mathematics at school. She was good at maths and the teacher asked her to coach her schoolmates with study problems. As Pia Alina was very sympathetic towards the problems

of others, she started thinking about the issue. For years, her parents had stimulated her to be creative and had often persuaded her that problems are not a reason for sadness, but an opportunity for improvement. Based on these starting points, she came up with a surprising and inspiring solution: a combination of the well-known «Memory» game and a game of basic maths operations - addition and subtraction. Helped by her parents, she designed a very simple prototype. In less than one hour after her idea appeared, children started playing, and the potential of the funny and haunting game was discovered.

Later on, the family, supported by external experts, developed also a game for learning multiplication and learning about countries/capitals of the EU. With the help of her parents and a team of professionals, Pia Alina designed and prepared a formal prototype of the game to test in her school. The responses of her classmates and their parents, the teachers and other experts were very positive, as the game strengthens complex thinking processes as well as the social component of cooperation. In addition, it is a '2 in 1' concept game - a memory game and an innovative pedagogical learning tool. When her efforts were awarded with bronze medals at some international invention exhibitions (SIIF 2015 - Seoul, South Korea, ARCA 2016-Zagreb, Croatia…), her family decided to file a patent and Pia Alina became one of the youngest inventors in the world. The family also decided to market the game. Pia Alina's success in this endeavour is paved by her brilliant inspiration, yet it is important to stress that one of the key moments within the invention-innovation process was a well-defined problem, the open innovation concept and her personal motivation to produce a solution.

KEY TAKE-AWAYS

• There are many methods available to potential innovators in the preinvention phase for defining and addressing problems as sources of innovation opportunities: they differ with regard to scope (addressing a problem or an opportunity), the duration of implementation (swiftly/slowly), the number of participants (individual/group), the profile of the participants (expert/generalist), poten-

tial (incremental/breakthrough), and orientation (present/future).

• Examples of methods include the Innovation Cube, Ishikawa Diagram, Problem Mining, Forced Connections, PACIS, PAPSA, QaDIM, TRIZ, eMIPS etc.

• For the open innovation approach, the most appropriate methods are those that are designed for group implementation, especially those that require different profiles (backgrounds, expertise) of active participants.

eMIPS (e-supported mass identification of problems and solutions)

Description

eMIPS is a methodology developed by Klemen Širok and Borut Likar which enables outsourcing the front end of innovation. The name stands for "e-supported mass identification of problems and solutions". In a way, it represents an extreme form of open innovation. eMIPS is a well-defined set of procedures which can be adapted dynamically to a specific case/challenge in an organization. The eMIPS methodology represents a sort of "umbrella methodology" – a set of procedures where various methods (e.g. for problem identification, decomposition and idea creation) can be applied, depending on the organization's needs. It is based on proactive involvement of the organization's employees, supported by an appropriate methodology and external experts. The goal is to establish/improve the innovation process and to create concrete solutions. eMIPS incorporates the principles of blended learning, offering an appropriate mix and sequence of F2F (face-to-face) and online (eLearning) activities by combining F2F workshops with eMentoring of organizations taking place in eLearning Moodle environment, and the utilization of other ICT communication channels (videoconferences).

Purpose and applicability

The eMIPS methodology is useful for identifying known, hidden and potential problems, and their precise definition and analysis. Through the implementation of eMIPS, awareness of the importance of (simultaneous) detection of problems increases on one hand, and on the other hand, useful knowledge for the identification and analysis of problems is created.

Implementation process

Alongside the ability to adapt to the specifics of the involved organizations, eMIPS provides flexibility and a broad selection of potentially suitable innovation tools and methods. Out of the broad selection of innovation tools and methods that are applied in the first phases of innovation process, eMIPS mentors offer the involved organizations only those few methods and tools which have

been established to be suitable within their line of business and at the same time suits the organization specifics – mainly the size of the organization. In order to address this requirement, a catalogue of more than 40 innovation tools and methods has been compiled, toghether with a corresponding rudimentary decision making system in Excel, enabling an overview of the methods and supporting the method decision process.

The eMIPS implementation encompasses three constitutive elements:

1. Preparatory activities,
2. Core activities: problematisation & ideation phase, and
3. Sustainability providing activities.

Figure 1. eMIPS concept

A. Preparatory activities

These consist of the following sub activities:
1. Identification of the main challenge(s)
2. The organization's team definition
3. Introductory workshop

1. Identification of main challenge(s)

This phase deals with the basic problem, often representing the top of the iceberg. It can be a single serious problem from any field or department of an organization. It can be related to a concrete product, process, organizational issues, marketing challenge, or others. It can also be defined as a

challenge of enhancing incremental innovations among all the employees. However, it is important that the basic problem has been clearly defined. Even though it is not an obvious precondition, it is also useful to check whether the problem is not too narrow (probably dealing with very specific technical details) and whether it offers possibilities for team work.

2. Organization's team definition

A great deal of importance is also given to the selection of the participants, as this can be a crucial factor in the creativity processes. If viable, the eMentor selects participants with various profiles and backgrounds. The organization's team coordinator is also an important part of the group, who should possess personal characteristics like empathy, openness, proactivity, creativity etc. According to the eMIPS concept, external partners (customers, suppliers, other experts and subcontractors) are also offered to participate in the eMIPS process where appropriate.

3. Introductory workshop

eMIPS envisages the organization of two F2F (face-to-face) events. First, an introductory workshop serves the purpose of introducing the eMIPS to the participants and providing the initial motivational impetus. It is a short-format workshop, taking less than 8 hours.

The primary aim of the workshop is to demonstrate the potential of innovation tools and to learn how to use them. The workshop introduction is short, relying on basic information on creativity and innovation, and the advantages of open innovation (Chesbrough et al., 2008). In order to build up the motivation impetus, the presentation focus is tilted towards the presentation of the advantages to the organization. Next, a condensed presentation of three to five problem identification methods takes place. The principle and usefulness of each method is presented in a few sentences, accompanied by visual aids to reinforce the comprehension.

The continuation of the workshop comprises three activity sets. In the first activity set, the participants are tasked to identify as many real problems within their organization as possible. In order to achieve this, the workshop facilitators take each working group through 3-5 problem identification methods, where each of the methods follows a different underlying principle. Different methods are carried out successively, subjecting the participants to different mind-sets (production, marketing, management, organization…) and the different underlying principles conveyed by each method (for instance: Problem focus, Quick and Dirty Innovation Method and Ishikava diagram).

The aim of the first activity set is to demonstrate that under proper guidance, each participant can identify relatively numerous actual problems in a short time period. The modus operandi of this exercise also exploits the potential of group dynamics, since an exchange of alternative views of the participating organizations takes place under proper guidance.

In the second set of practical activities, the participants are tasked with the evaluation of the problems identified earlier. They assess each problem as to whether it is a fundamental problem already suitable for direct solution seeking, a problem requiring further decomposition, or a problem suitable for discarding.

The third activity set aims at demonstrating the potential of idea generation methods (for instance brainstorming, Phillips buzz 66 etc.) as well as the fact that guided implementation of the method can provide significant results in a short time period.

The last part of the workshop is reserved for the presentation of eClassroom, where the emphasis is put on eMentoring, as presented in the next section. The aim of the presentation is to give the organizations a realistic picture of the envisaged activities and required resource inputs, as well as the expected results and benefits. Within the workshop, the participants from the organization get information on eMIPS principles and basic knowledge on the methods used. The (e)Mentors later support and guide the innovation team at the organization level during the implementation of the methods through Moodle-based eClassroom and other ICT channels.

B. Core activities: problematisation & ideation phase

This is the most important part of the whole methodology. The phases of the Core activities are the following:

1. Identification of innovation problems/opportunities

This phase deals with the basic problem often representing the top of the iceberg. If the organization has one serious problem, it might be useful to redefine or decompose the problem into smaller, clearer sub-problems. The result of this phase is a set of the most important problems or the roots of the basic problem. The other option is to focus on "mass" detection of problems/innovation opportunities within a certain department or in the whole organization. The result is a clearly defined basic problem or a set of problems.

2. Evaluation of problems/opportunities

In the case of many (sub)problems being identified, those with high potential should be selected. Regarding the basic problem and the organization's needs, the appropriate method and selection criteria should be defined first. According to them, the selection process is performed. We can simply say that these are the problems, if solved, that will offer significant benefits. The result of this phase is a set of the most relevant and serious (sub)problems.

3. Searching for solutions

Similar to the procedure presented in section "Introductory workshop", for each of the selected problems, ideas for solutions should be found. Even though there are at least a hundred idea creation methods available, it is important to choose the appropriate one. For many simple problems, e.g. Phillips buzz 66 or Brainwritting could be appropriate, for single but important problems Gordon's technique, for technical problems Sinectics or a combination of methods is recommended. The result is most often a huge repository of ideas that should be evaluated.

4. Idea selection

The selection process consists of the appropriate method and criteria selection. It is important to stress that the criteria should be chosen according to the initial innovative challenge, the organization's specificities and some other influencing factors. The result is a set of the best ideas for solutions of the initial problem(s).

5. Implementation plan

The last phase is dealing with the preparation of the implementation plan, taking account of the most important issues of project management, e.g. goal(s) definition, tasks and deadlines, the resources needed, risk planning etc. The result is a clear and realistic plan ready for implementation.

6. eClassroom

eClassroom repeats the method application sequence of the introductory workshop in a real environment, whereby implementation is carried out by the organization's employees themselves under the supervision and support of eMentors. Innovation team members are enrolled in eClassroom as a study group. This gives the eMentor the possibility either to adapt tasking to implementation dynamics or to encourage the innovation team when needed. The group work in eClassroom also separates individual and group communication. This is essential for proper communication management, which in turn provides protection of intellectual property in relation to other organizations in the eClassroom.

All eClassroom activities are focused on building up innovation competencies at the organization level. In the eClassroom the innovation team is provided with tools, corresponding instructions and relevant additional information (cases, articles…). The participants follow the instructions prepared for a specific method/tool and report back to the eMentor on the implementation. Reporting is also structured in the form of guided reflection or structured discussion. The eMentor promptly responds to each posted document by providing feedback or setting additional questions or suggestions stimulating the implementation process and bringing it to a higher level. Simultaneously, the eMentors also gather valuable information useful for fine-tuning the tools and methods, as well as eMIPS modus operandi.

After the conclusion of the first problem identification – problem selection – idea generation – idea selection cycle, the cycle is repeated once more but with a different set of methods. eMIPS concludes with focused action planning. At this point, the mentoring in the eClassroom envisages the integration of (middle) management structures in the feedback loop, first by only informing them of the eMentor's feedback, and if necessary also by consulting them on the viability of the proposed suggestions.

C. Sustaining the innovation processes

The third eMIPS pillar represents the set of activities intended to provide sustainable long-term effects at the organization level. Three sets of activities serve this purpose: collection and dissemination of good practices, proper communication, and innovation process monitoring. Information collected in the eClassroom serves as a rich source of good (and bad) practice examples that can be shared by the participating organizations when and if complementary interests emerge. The communication of the eMentors is focused on boosting the effectiveness of the implementation. Regular and open communication also presents a channel for collecting relevant monitoring data on the extent and quality of innovation activities. It is important to include the top management and PR department and to use all the available communication channels (internal conference, newspapers, intranet and e-news etc.). Obviously, it is important to strive towards systemic implementation of good practice into the strategic and operational plans of the organization or at least to upgrade them.

Participants

eMIPS is carried out in groups of at least 6 employees and is guided by qualified external moderators.

Duration

The introductory workshop lasts for about 8 hours, while work in the eClassroom lasts from a few weeks up to two months. The duration depends on the complexity of the problem, as well as the number and especially the motivation of the participants.

Open innovation attributes of eMIPS

- Collective behavior patterns in knowledge creation, knowledge transfer, and knowledge application of the recipients;
- Collaborative work environment: online collaboration (e.g. virtual teams, mass collaboration, massively distributed collaboration) and online communities of practice (e.g. open source community);
- Distant collaboration, distance-working platform and e-learning (Moodle environment and eMentors),

• The goals of joint endeavours;
• Mass externalisation of the preinvention phase;
• eMentor as an external source of ideas to the organization and the particular problem;
• Openness of the organization's team coordinator;
• Flexibility in the number of participating organizations (provided by the Moodle learning management system);
• Participants with various profiles and backgrounds;
• Potential inclusion of external partners (customers, suppliers, other experts and subcontractors);
• Participation of dislocated external experts (e.g. R&D partners, suppliers, users, buyers, distributors etc.);
• Potential sharing of good (or bad) practices by the participating organizations;
• Possibility of supporting horizontal, interdisciplinary challenges;
• Enabling convergence of scattered, unstructured knowledge, experience and ideas into clear innovation problems and solutions;
• Flexible methodology (various problems can be addressed);
• A wide database of innovation tools;
• Open to variations depending on the specific innovation problems of the organizations;
• Variability required by simultaneous support for the various organizations within the different preinvention phases and
• Creating a culture that values outside competence and know-how.

Potential implementation in a Bachelor or Master level course

eMIPS ia a meta-method (collaborating innovation work in the e-environment, distant mentorship), within which a series of specific creativity/innovation methods could be potentially used (e.g. Ishikawa Diagram, Problem Mining, Innovation Cube ishigawa etc. – see the List of methods above) for application on either realistic or hypothetical innovation challenges. For students to gain practical knowledge and experience with respect to using eMIPS, there are three main possibilities:

1. Students can be involved in real application of eMIPS in organizations. The students collaborate with other participants on a real practical problem in several consequent sessions that connect different stakeholders (a heterogenous group of organizations, eMentors, students of mechanical engineering, psychology, marketing, management etc.). In the course of a specific Innovation module, the students are actively engaged in working, helping, and collaborating in a real innovation process in organizations. This is the most active and rewarding possibility for students. They can search for real eMPIS application projects by themselves or the module teacher(s) could find appropriate projects for them. For practical reasons, it is recommended that a group of 2-5 students join one innovation challenge, instead of participating individually.
2. Students can be involved in real application of eMIPS in (university, techno-park) incubators. A

particular innovation project that is based on eMIPS methodology can engage students from different study fields (faculties) actively, e.g. chemistry, marketing, management etc. A project has a few eMentors, each of which supervises one particular aspect of the innovation project. This approach is based on very intense inter-departmental or inter-faculty student collaboration. As with the first teaching possibility above, here too the students can search for real eMPIS application projects by themselves or the module teacher(s) could find or even organize appropriate projects for them.

3. A teacher can organize an Innovation module in the form of role-play: he/she provides students with some typical cases of real innovation challenges, and then divides the students into different groups, where each group has its own separate role, e.g. organization A, B, C, D, E, municipiality, natural park administration, tourist agency, etc. The students in each group then work jointly to find appropriate solutions to given typical innovation problems (by using different innovation/creativity methods), where they should take the specifics of their assigned roles (interests, behaviors, norms) into consideration (at least to some extent). The goal of this joint group collaboration is to develop and upgrade the proposed initial solution(s) to the level of a potentially applicable service/product for the market. The module teacher has the role of an eMentor who coordinates the whole simulation of a real eMIPS application. Ideally, the teacher should have extensive experience in being an eMentor in a real eMIPS application and should master the first phases of the innovation process completely.

KEY TAKE-AWAYS

- The goal is to establish/improve the innovation process and to create concrete solutions
- Represents an extreme form of open innovation
- Enables outsourcing of the front end of the innovation process
- Can be dynamically adapted to the specific case/challenge in an organization
- Represents an "umbrella methodology" – a set of procedures where various methods (e.g. for problem identification, decomposition and idea creation) can be applied, depending on the organization's needs
- Involves proactive involvement of the organization's employees, supported by appropriate methodology and external experts
- Incorporates the principles of blended learning, offering an appropriate mix and sequence of face-to-face and online (eLearning) activities
- Combines face-to-face workshops with eMentoring of organizations taking place in the eLearning Moodle environment and the utilization of other ICT communication channels (videoconferences)
- Carried out in groups of at least 6 employees and guided by qualified external moderators

• Students can gain practical knowledge and experience by being involved in real application of eMIPS in organizations, in (university, techno-parks) incubators or a teacher can organize the Innovation module in the form of role-play.

Innovation Cube

The Innovation Cube is a simple and concise method for rapid implementation. It can be learned quickly and performed even more swiftly. It does not need a long period of preparation, and the results are immediate. The method has already been used in practice, and it has been finally developed by Borut Likar, Matjaž Marovt and Katarina Košmrlj. It is recommended that the reader studies the example first and then examines the technical aspects of the methodology.

Description. The Innovation Cube directs the participants systematically towards a broader way of considering and addressing problems and needs, opportunities and ideas for novelties, as well as towards finding new markets. This methodology guides our thinking towards incremental and breakthrough ideas, while its application also leads to consideration of future trends and needs.

Purpose and applicability. Primarily used for innovative products and services, this method is directed towards the present and the future through the anticipation of completely new markets and products, as well as for minor innovations to existing ones.

Implementation process. The innovation cube also serves as a tool for creating visions and related objectives. In-depth knowledge across the broader area of the field of expertise, as well as creativity, are essential when using this method. Only a combination of both delivers maximum results.

The method builds on three groups of challenges and/or dimensions of the cube:

1. existing and future needs and requirements of buyers/users,
2. existing and potential users and
3. overt and covert – apparent and latent – problems.

The method may be applied in a simple or in-depth version.

In the implementation of the innovation cube methodology, we talk about a combination of the "bottom-up" approach, where we start from the present and the future – as well as the apparent and latent needs of the users, in conjunction with the "top-down" approach, because innovation is built on new technologies and emerging trends. Indeed, in this part we leave the so-called secure area of innovation, since it does not arise from the clear needs of users, and only time will reveal which potential innovations the market shall actually adopt.

The process is conducted systematically with the following steps:

1. Analysis of the dimensions (needs, users, problems); we try to amass as much information as possible for each of the three dimensions of challenges.

2. "Filling the cubes" or merging dimensions of different fields, which is carried out in such a way that we find compatible information on convergent dimensions (e.g. the future needs of existing users in relation to their latent problems) and then complete the entire cube with this information.

3. Identification of problems and opportunities per cubes (with regard to the common information with which the cubes were filled).

4. Searching for solutions that represent opportunities for innovation in existing products or the development of new ones. For this purpose we use one of the idea creation techniques.

Process analysis of the dimensions in specific areas of challenges is presented in detail below.

Users' needs are analysed in terms of current and future requirements.

• The needs of current users can be ascertained on the basis of surveys, interviews, critical observation of the direct use of the product, and monitoring and analysis of the verbal and non-verbal expressions of dissatisfied customers, with an analysis of comments and suchlike.

• Future needs are those that will arise after a certain time; they can, however, be detected already at present. Such needs are a reflection of the development of technology, materials, new concepts, business models, etc.. If we want to use this part of the cube well, then excellent knowledge of trends across various fields is necessary. Thus, for example, the manufacturers of motor homes need to be broadly familiar with that particular segment of the market, as well as pertaining design and materials. An important element of ideas for novelties is associated with the transfer of good practices from complementary and related sectors, i.e. those whose products do not represent competition, but who are developing similar items (e.g. the transfer of best practices and innovation from the construction sector as well as the information and communication technologies sector can be sought for the application of energy saving solutions in motor homes). Trends can also be monitored in relation to the leading competitors, their current plans and novelties in the preparation phase, as well as their presentations at trade fairs, etc.

Users and/or buyers are analysed in terms of current and potential users.

• Existing users are the key element and most reliable part of our market, as they are the ones who are already using our product, and thus it is essential to keep them. We need to meet their current needs and solve their expressed, overt problems, but we also have to anticipate their future needs as well as their latent, covert needs.

• Potential users are those who do not use our product yet. This segment may be divided into two

subgroups: firstly, those who have decided in favor of the competition, which has convinced them on the basis of their product, brand, price or otherwise; and secondly those potential users who are satisfying the same needs with products from other segments and sectors. In determining new potential users, we need extensive knowledge, creativity and intuition. New potential users are not actually acquired from the "pool" of customers of our direct competition, but rather created from new groups drawn from other sectors. One example is the Cirque du Soleil. The audiences of traditional circuses have long been parents with children. This circus, however, set as its target group all people who are looking for fun and entertainment. So, the protagonists created a business model which combines elements of the classical circus (the erstwhile target audience), with stories and choreography (theatre goers target group), excellent music (music lovers target group), costumes (fashion lovers target group) and vigorous performance (athletic events target group). Based on the innovative concept, the circus has gained a wide range of visitors and experienced a remarkable boom, unlike the traditional circus sector which has been in a long-term decline.

Problems or challenges are addressed as expressed/overt or concealed/covert.

• The expressed/overt problems are the ones that are clearly known to us as a producer or a user. However, we often fail to have a solution.

• For various reasons, we are often not aware of either the problems or the opportunities for improvement. We, or our users, can only be (partially) dissatisfied or say "that is the way it is", or maybe "it can't be any different ", or "this has always been a problem" and suchlike. Such self-evident issues may not be unsolvable –if they can be identified, appropriate solutions may also be sought.

Both in terms of expressed/overt as well as concealed/covert problems, it has proved to be reasonable to break down the area under consideration first into several smaller ones. For example: as regards the applicability of functionality, or simplicity, or materials, or maintenance, or transport, packaging, faults and cancellations, and suchlike, the division must be adapted to the specific product under consideration, but we must not forget to connect the partial solutions into an appropriate comprehensive solution. We can deal only with our product, and likewise only address those challenges that come from the environment. Several additional guidelines for this endeavor may be found in relation to the Problem-mining methodology, which should be applied similarly at this instance.

Application. The method of the Innovation cube can be undertaken simply and rapidly or in depth. In the first instance, a systematically oriented thinking of experts per the abovementioned needs, users and problem fields (per the 3 x 2 innovation cube) is sufficient to achieve positive results without further analysis. If we want to exploit the full potential of the method, however, then in-depth assessment should be carried out. This requires additional preliminary activities that include in-depth analysis of the existing users and competition analysis, together with analysis of the development trends both in the particular and other industries. More participants should be included in the in-depth version.

Example: Spending your leisure time and holidaying with a motor home is a special experience, and the owners and users of motor homes have become almost a subculture. Therefore, innovation is particularly important for the designers and manufacturers in the industry. One manufacturer addressed the development of their motor home models by using the innovation cube, which was implemented across the following areas.

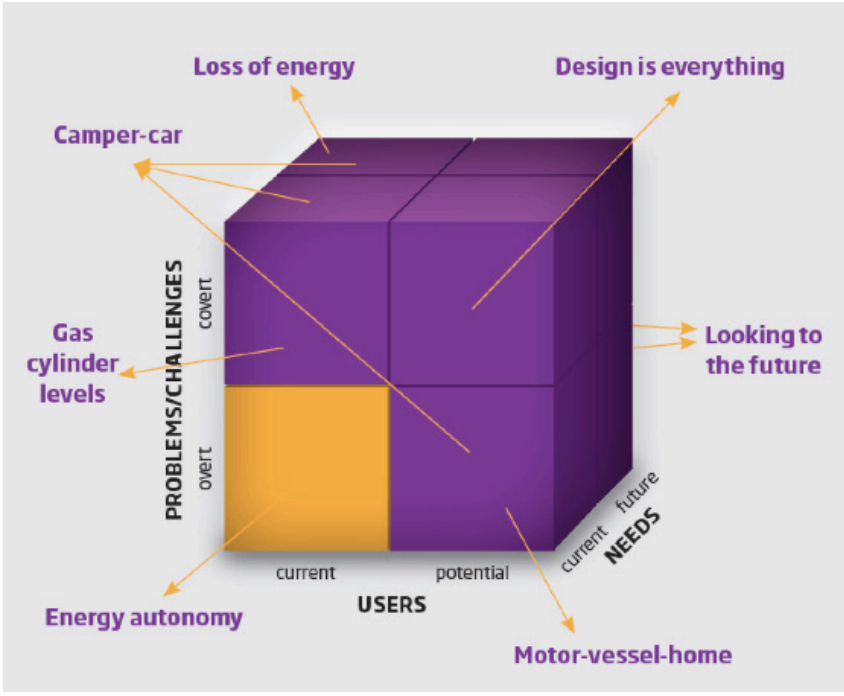

Figure 2. Innovation Cube for Motor Home Models

Energy autonomy. One of the key needs of motor-home users is seven-day autonomy without the need to turn on the engine. This is particularly difficult to achieve in winter conditions. The basic problem is associated with energy, and the provision of massive reserve battery power is problematic. There are various system solutions available on the market, based on, for example, the use of gas, solar power, or fuel cells.

Expression as to the current needs and problems of existing users (lower front-left portion of the cube).

Motor-vessel-home. There is a segment of potential customers who want the freedom provided by a motor home and the freedom enabled by navigation on water. One segment favors the vehicle, the other the vessel. An especially significant part of the content of both is the living area. This opens the opportunity to produce a motor-home-vessel according to the "two in one" principle.

The vessel is an independent unit, its living area can also be used in instances where it is fixedly attached to an overland vehicle.

Current needs expressed on the basis of an overt problem that may attract new potential users or customers are thus presented.

Looking to the future. Today, there is almost no motor home user who would venture out without a smart phone. This device can enable the remote control of lighting, air conditioning, alarm, and suchlike. It can also engender the application of "common sense" and provide an important step in the direction of prediction. Thus, for example, weather forecasts for the week ahead can be obtained via the web to ensure and optimize energy consumption in the provision of 7-day autonomy.

This represents the future needs of existing users – which are already partially expressed overtly; however, for the majority of users this need or desire remains latent.

Camper-car. Many users of motor homes are facing the problem of poor mobility (not permitted to enter inner city areas with motor homes, fixing the motor home for a temporary stay, as well as the static awkwardness of the vehicle consequent to its size). There is actually a solution offered by the motor home itself: a small detachable vehicle which is an integral part of the camper and also contains a power unit or engine. This presents an interesting, clearly expressed challenge to attracting new potential customers whose existing preference is to travel by car and either camp or stay in hotels. At the same time, it is a covert problem of existing users who take the inflexibility of today's motor homes for granted. This example demonstrates the potential future needs and expectations of existing users.

This example presents an expressed need of existing users, and at the same time also the overt problems of potential users.

Gas cylinder levels. Mandatory in the operation of a motor home is the supply of (butane/propane) gas. Despite its extremely widespread use, even in households, the market still does not offer a simple and reliable meter that indicates the remaining amount of gas in the cylinder. As a consequence, we face the need to replace the gas cylinder only when we actually run out of gas completely. This challenge pertains, as a rule, to another sector/industry (production of metering devices), but it could also be encouraged by the designers and manufacturers of motor homes.

The example illustrates a latent problem for existing users and reflects the current needs.

Loss of energy. Motor homes usually have a heater installed for use in cold weather. This heater is often located in an especially poorly insulated space, thus a large part of the heat energy it generates is lost externally. This creates a challenge to produce a better insulated heater, which is a covert challenge for the manufacturers. A balance that will ensure adequate ventilation and the avoidance of overheating has to be found, and the failure to achieve this balance is reflected in an

over-dimensioned heater in a poorly-insulated part of the vehicle. This scenario provides a further opportunity to reduce the power of the heater, which is associated with lower manufacturing costs, lower fuel consumption and fuel costs, as well as a consequent reduction in operational noise. In this context, the concept of innovation needs to be passed to the heater suppliers and manufacturers. There also exist additional possibilities arising from technology transfer associated with energy recuperation, the use of appropriate glazing and insulation materials and seals, etc., from the energy-saving and passive house construction sector, which in themselves engender additional opportunities for innovation.

This is a covert problem of existing users, which, however, largely reflects future needs.

Design is everything. In the design and manufacture of motor homes, utility and functionality are generally at the forefront. Design is otherwise a desirable supplement, but not an essential guiding force in product development. At the same time it must be recognised that there is a segment of potential buyers who see design as the key feature; in this, however, they are unwilling to look at, let alone deploy and fasten the almost mandatory awnings, canopies and similar accessories. For such users, the solution would be a design camper, with utility in terms of both the interior and exterior spaces, i.e. the exterior framework – replacing the traditional awning and canopies – could easily be opened to create a semi-enclosed fore-space.

This example reveals a covert problem of existing users, while at the same time indicates a future need and desire for both existing and potential users.

With the example of motor homes, we have illustrated further development opportunities identified in accordance with the structure of the innovation cube. Some of the innovation concepts could be developed in closer detail by motor home manufacturers and incorporated into their products. Other ideas for innovation, however, are of such a nature and magnitude that they require major changes and may not be taken into consideration until after that change occurs. The examples also revealed that a portion of the innovation proposals formulated on the basis of the "cube" are incremental, while others are breakthrough ideas by nature.

Participants. To implement this methodology, it is necessary to include various experts who have sufficient knowledge and experience in relation to customers, markets, technologies, and products. This way, the solutions thus iterated will be both useful and applicable. Group implementation of this method is the most reasonable and the most effective procedure.

Duration. Without previous preparation, the method may be carried out in a simple, swift version of 1 to 3 hours of duration. In-depth implementation, which requires extensive preparation, may take much longer, depending on the size and complexity of the market, industry and product. Will and ambition are also, of course, essential factors in this process.

Open innovation attributes of the Innovation Cube

• A broader way of considering and addressing the problems and needs, opportunities and ideas for novelties, as well as towards finding new markets;
• Combining knowledge across the broader area of fields of expertise;
• Cooperation of participants with various profiles and backgrounds (not only experts and R&D personnel);
• Potential inclusion of external partners (customers, suppliers, other experts and subcontractors);
• Systemic possibility of addressing horizontal, interdisciplinary challenges;
• Focused on future markets and technological trends/needs (not only present ones);
• Enabling convergence of scattered, unstructured knowledge, experience and ideas into clear innovation problems and solutions;
• Flexible methodology (various problems can be addressed); and
• Open to variations depending on the specific innovation problems of organizations.

Potential implementation in a Bachelor or Master level course

For students to gain practical knowledge and experience with respect to using the Innovation Cube, the most immediate and most easily applicable possibility is for a teacher to organize the Innovation module in the form of role-play: he/she provides students with some typical, standard cases of real problems, and then divides the students into different groups, where each group has its own separate role, e.g. technology developers, craftsmen, designers, market researchers etc. By using the Innovation Cube methodology, the groups of students then jointly work on finding appropriate solutions to given standard problems, whereby they should be taking into consideration (at least to some extent) the specifics of their assigned roles (interests, behaviors, norms). The goal of this joint group collaboration is to follow the guidelines of the Innovation Cube and create various types of ideas. Further on, the students can aso develop and upgrade the proposed initial solution(s) to the level of potentially applicable services/products for the market. This is just the basic outline of implementing the Innovation Cube in a classroom, which means that it can be structured and coordinated in different ways, depending on the specific goals of the Innovation module.

A second possibility is to perform the method on an existing or fictionary product/service or industry as a "project" that is carried out in the following two phases.

1. Field analyses. Students (6 to 9 in total) are divided into groups according to different sides of the cube, namely one group works on users (existing buyers and potential target groups and their specifics in terms of demographics, economic status, lifestyles), a second group analyses the needs (those that are already satisfied with the product/service/industry in consideration and those that are arising or may arise in the future along with alternative possibilites of satisfying these needs).

Finally, a third group works on the problems and challenges in connection with the chosen topic, thoroughly studying the sources of existing problems and trying to detect future challenges along with reasons for their occurence. The students may present their analyses' results in a report or as a public presentation to the class.

2. Innovation opportunites. This step is carried out similarly to the first example of the implementation of the Innovation Cube. The students in the group are given different roles: organization A, B, C, D, E, representing designers, manufacturers, industry, market analytics, policy makers, etc. The roles can be either assigned by the teacher or drawn randomly as in a lottery. An alternative way in the case of several groups in a class is to swap the initial topic between groups, so that each group has to study in depth an analysis report of the previous phase. The group then works on finding innovation opportunities for all or just selected segments of the Innovation Cube. The results can be delivered as developed product/service samples, public presentation or report. The class may even organize an "Innovation fair" to present their work to the public and invite representatives of different industries.

KEY TAKE-AWAYS

- Simple and concise method for rapid implementation
- Can be learned quickly and performed even more swiftly
- Does not need a long period of preparation, the results are immediate
- Directs the participants systematically towards a broader way of considering and addressing problems and needs, opportunities and ideas for novelties, as well as towards finding new markets
- Guides our thinking towards incremental and breakthrough ideas
- Its application also leads to the consideration of future trends and needs
- Requires in-depth knowledge across a broad area of fields of expertise, as well as creativity (only a combination of both delivers maximum results)
- Builds on three groups of challenges and/or dimensions of the cube: 1. existing and future needs and requirements of buyers/users, 2. existing and potential users, 3. overt and covert – apparent and latent – problems
- It is necessary to include various experts with sufficient knowledge and experience in relation to customers, markets, technologies and products
- Students can gain practical knowledge and experience by performing the Innovation Cube on an existing or fictionary product/service or industry as a "project" that is carried out in two phases (field analyses, innovation opportunities), or the teacher can organize the Innovation module in the form of role-play.

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