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METHOD OF CREATIVITY INCLUDING AN IDEAS EVALUATION TOOL: APPLICATION IN AN INTERNATIONAL WORKSHOP

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1. Introduction

A recent study of 700 Global Chief Human Resource Officers, conducted by IBM's Institute for Business Value, ranks creativity to be the most important leadership quality over the next five years [IBM 2011]. In a time of complexity, slow-growth and uncertain economic conditions world-wide, business leaders now require more creativity than ever. At the other hand, one of the processes that can feed the innovation portfolio of a company is a facilitated idea-generating session. The tools used in such sessions often generate large numbers of concepts and ideas.

As a research laboratory connected to an engineer school, we study tools, methods and personal abilities that can facilitate the development of innovation. In this paper, we propose to focus on creativity session during the early phases of the innovation process.

Our research led us to propose a method of collective creativity based on simultaneous two complementary points of view: psychological and methodological. We apply this method during training and worshop named "48h to generate Ideas". We use these Worshops as experiments and thus analyze, monitor and complete our research.

During the sessions of creativity, a lot of ideas is generated. To avoid losing any information, facilitate distance collaboration and prepare the following phases of the innovation process, we have developed with "Electricité De France" (EDF) R & D, a web application called "IdeoFil®" to store, organize, sort ideas. But, promptly estimating the relevance of the concepts resulting from this idea generation sessions is thus essential to innovative companies. This phase takes place in the early stages of the process, i.e., from the birth of ideas, well before embodiment design. Evaluating ideas in the early stages of design is an important phase in the development of innovating products and services. The evaluation is considered to be one of the most critical stages in the design of new products [Ozer 1999], however managers tend not to apply structured methods to select innovative ideas. The literature does not offer specific tools for the rapid screening process that occurs at this early stage. Therefore, we have done a study of existing practice and in regards of the results, we proposed a method, named "IdéoVal", to assist the ideas evaluation during early phases of the innovation process.

For the 10th anniversary of "48h to generate Ideas", these methods and tools have been replicated during an international collaborative workshop. The aim was to experiment them and to have an overlooks of the impact of international collaboration.

In this paper, we will describe the context of our research. Then, the engineering training will be described, in particular the method and two tools (IdeoFil® and IdeoVal) we developed through studies in our Industrial Engineering Research Laboratory. In a third section, we will present a special workshop developed for our training method : the international edition of "48h to generate Ideas". In

conclusion, we will identify possible future changes in our training, including the integration of the collaborative dimension which we trialled during our international workshop.

2. Context of our research field

2.1 Methodological training and workshop on creativity called "48h to generate Ideas" using a Innovation Platform

The National School in Industrial Engineering (ENSGSI), based in Nancy-France, prepares students for the management of innovative projects, including new products design, new processes implementation and organizational changes. The training is based both on Engineering Sciences and Management, as well as integrating a large part of active teaching and learning through doing.
Research Team on Innovative Processes (ERPI), attached to ENSGSI, is an interdisciplinary laboratory in Industrial Engineering which concentrates on the study of innovative processes. Its goals are to identify and model these collective creation processes, in order to understand them better and to provide tools and methods that assist their management.
These two entities are working together to develop a cross-fertilization between research and teaching. The example we will take is a creativity course, and especially the workshop "48h to generate Ideas" which is carried out by ENSGSI with industrial partners. It makes possible to identify new issues to be studied and is enriched by the results of research studies. The studies are carried out by the ERPI.
This module's tenth anniversary was celebrated in November 2010 by an international collaborative workshop which brought together 900 students in 9 countries, from 14 universities in Europe, the Maghreb and North and South America. The students and their professors had to work on themes provided by six companies (EDF, Orange, Johnson Control…) and to generate ideas for new products.
Since 1999, most of our studies are conducted using Innovation Platforms, builded in ENSGSI and ERPI [Roussel 2009] which are places where research, teaching and industrial issues can be integrated in order to observe how we pass from the idea to the concept and from the *concept* to the product. Indeed, studies and innovation theories show that innovations are usually based on a concept, which is different from an *idea*. An *idea* can be described as an abstract notion which can be partly explained but is not based on knowledge. A *concept* is an idea that has been supported by knowledge although, during the early phases of innovation, this knowledge is not completely defined. It is an evolutive element which is sufficiently concrete to be investigated, especially in a scientific or technical field, in order to assess its feasibility [Le Masson et al. 2010, 2006] [Hatchuel 1996], [Hatchuel and Weil 2002].
To foster innovation and technological transfers, it may be necessary to create places and spaces (real or virtual) where researchers and professionals can get together and collaborate through tools and methods which aid the generation of ideas and help to turn them into concepts. In the industrial, educational and research perspective, we have created a 300m2 Innovation Platform, "Cre@ction, within our school, which has been extended by a physical and virtual network, "I-Cre@", involving 12 partners in 6 countries from Europe and the Maghreb (a network supported by an European Union TEMPUS program). This platform allows us to observe and study the innovation process as well as the learning of this process according to three complementary protocols:

- study of real situations ("in vivo"), where all the parameters are genuine;
- study of realistic situations, where some parameters have been highlighted to be observed;
- study of laboratory situations ("in vitro"), where most of the parameters are framed to make possible the observation of one (or more) of them.

In the following pages, our creativity training method will be briefly described, to focus particularly on study and results of the steps of classifying and selectionning ideas. After, we will describe a case of application during the international edition of "48h to generate Ideas".

2.2 Presentation of our creativity method: A double approach including psychology and methodology

Our creativity approach is that a double facilitation is needed : one psychological, the other methodological. Work on the person is necessary because there are major barriers to the expression of

creativity. However, this work is not enough because it requires that the person experiences the creativity to be able to identify his barrier and resource; identification that requires action and not only a self-reflection. Also, the methodology is a strong support that helps to move forward.
Engineers are used to support their work on methods and it is reassuring for them to know they have tools that will enable them to achieve their goals - in particular, feel more free to diverge from initial problem when they know that the tools will help them both to "think outside the box" and come back in the box to propose relevant solutions. Thus, the figure below shows schematically the facilitation tools and psychological methodology that we have been led to develop and/or used during our research before reinvesting in the educational field.

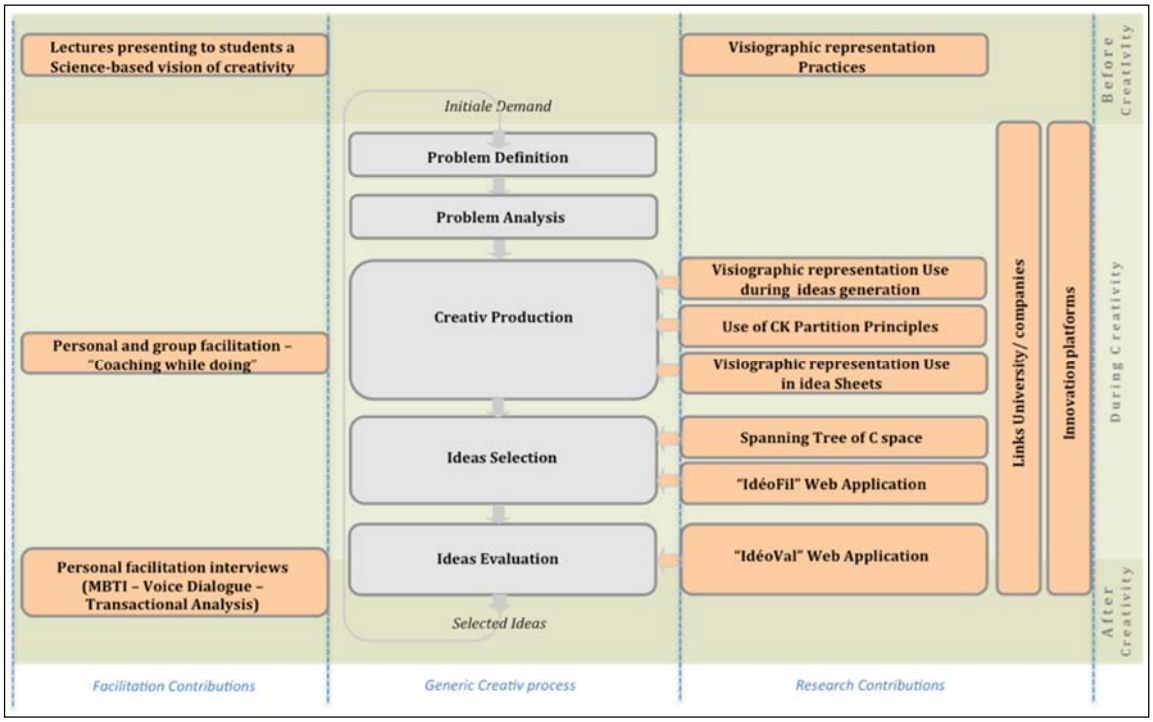

Figure 1. The collective creativity process and the methodological - psychological aspects MBTI = Myers-Briggs type indicator; CK (concept/knowledge) partition

3. Two complementary tools of our creativity method: "IdeoFil®" and "IdeoVal"

3.1 The web application "IdéOfil®"

IdéOfil® is a collaborative information system. Essentially it permits the sharing and capitalization of information (actually, knowledge) that the projects contain, formalizing and to capitalizing on the idea sheets of the projects integrating the process of Createam®, the innovation research team of EDF. IdéOfil claims to be an Information Systems support of upstream innovation. The main actors of this co-development were EDF R&D- Business Innovation, Market and environment Analysis group (ICAME) and our ERPI – INPL laboratory [Maxant 2004, 2006].
IdéOfil® must allow the construction, the finalization, and the collection of the IdéeFix sheets. The objective is to encourage the exchanges between the actors (different groups of creativity working on the same subject as during the international edition of "48h to generate Ideas" or external experts in charge of Idea sheets evaluation). However, these exchanges are not only verbalizations but also reactions that are recorded in IdéOFil®. These exchanges can pass from the synchronous mode (at the same moment and the same place) to the distributed asynchronous mode (at different moments, different places), favouring the integration of experts in the construction and the evaluation of an innovative concept. The movement of the offers is, moreover, made easier, as this tool allows communication (and therefore transfer) of ideas in a way more interactive than that of the documents.

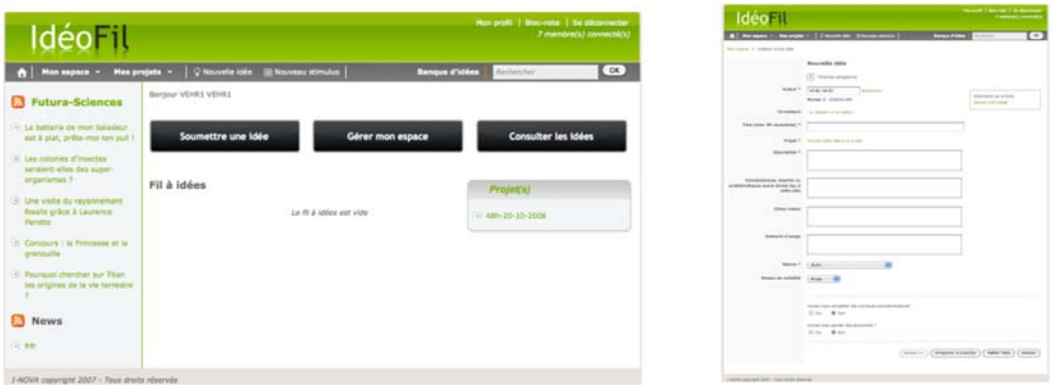

Figure 2. IdeoFil® screenshots

3.2 Results on ideas evaluation and a web application IdeoVal

3.2.1 Current practices in idea evaluation

It is accepted that it is beneficial to eliminate ideas with low potential as soon as possible, because it is less expensive to choose when they are concepts [Ullman 1992] than to suffer a commercial failure later on. In the early stages, the ideas are first generated, then selected, and then are developed in the New Product Design (NPD) process that companies have in place.

Evaluating ideas in the early stages of design is an important phase in the development of innovating products and services [Ozer 1999, 2004]; however managers tend not to apply structured methods to select innovative ideas. Usually, informal meetings are held by managers to select ideas based on their own background. The lack of precise reasoning typically observed in such sessions, results in a somewhat subjective evaluation. The literature does not offer specific tools for the rapid screening process that occurs at this early stage. Therefore, we made a study, the aim of which is better to understand the current practice of rapid evaluation of ideas and then to improve this aspect of the design process [Ferioli et al. 2008, 2010].

This study analyses the activity of creative idea evaluation. The study identified a set of criteria that were used by industrialists to accept or reject ideas. The experiment was conducted in a company and investigated the ideas selection process undertaken by the actual experts who would normally carry out such a process in the company. The ideas screened by the experts were provided to the company from a student assignment; however the experts agreed that they had similar outcomes – both in number and detail – from their own creative sessions. They confirmed that the screening process observed in this study was representative of normal practice. The findings present the mixture of objective and subjective criteria used by the experts and the nature of those criteria (e.g., novelty, feasibility, etc.). A set of criteria was established from the literature and the 'content analysis' method followed to gain more detailed understanding of the idea screening process at the early stages of NPD.

The study has shown that there are two distinct differences between the way that ideas are accepted and rejected. The ideas that are accepted have been analysed in some way by the experts based on some underlying appraisal, or filter, that ensures that the ideas fit with the overall strategy and are technically feasible. Then the decisions can be swung by opinions on novelty, social acceptability and interestingly, just by a basic 'feeling' or instinct in favour of the idea (Figure 3).

Those ideas that are rejected are split predominantly between these two key aspects of novelty and feasibility. But one of the really interesting aspects is the very large number of ideas that are rejected very quickly and with little discussion and comment – an 'instant rejection' category. The research also shows that generally, experts spend more time with ideas that will be accepted than ones that will finally be rejected.

It is plausible to say that in this study two stages exist in the rapid screening of ideas; the first stage is more objective, and if the outcome from this stage is positive, ideas are analysed in a second stage in a more subjective way (Fig 4). If the first stage of the evaluation is not positive enough, Subjective Criteria are not taken into account.

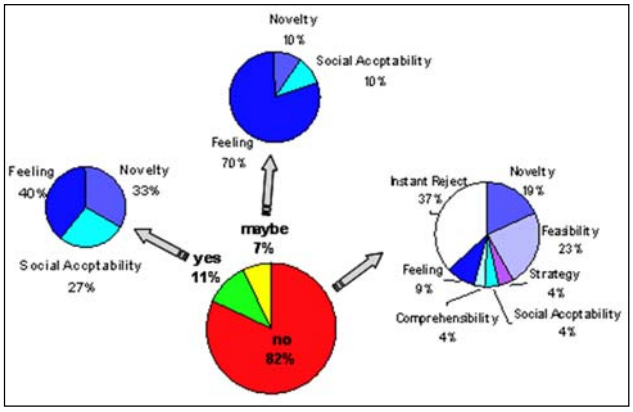

Figure 3. Distribution of final decisions

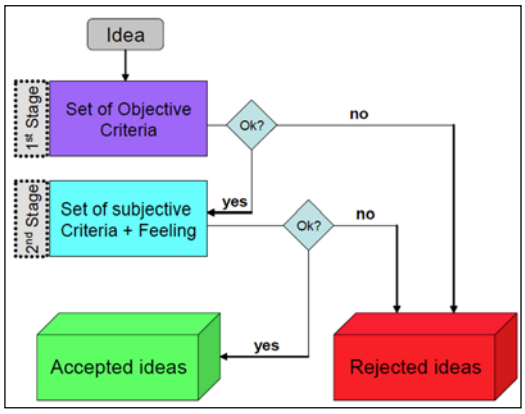

Figure 4. Evaluating model

The research also showed that there was a distinct difference in the mind set of the participants after an hour. This implies that in order to prevent good ideas being lost, intensive idea screening sessions need to be limited in time. This screening might have yielded different results if the team had been brought together for two one-hour sessions instead of the single two-hour long session.

These research findings imply that a fairly quick filtering of ideas, in order to reject the majority, could be performed by experts 'off line'. Such a procedure could be made robust if the team agrees and makes explicit the objective criteria to be used for rejection. The interesting conversations and arguments has to take place in the evaluation process and perhaps this is a critical group activity.

3.2.2 The web application "IdeoVal"

On the base of the study of evaluation practices, we have proposed an process model of evaluation, tested this model [Ferioli 2010] and developed a Web application aimed at facilitating the ideas' evaluation by experts. This tool, called "IdéoVal", offers a good aid to manage the whole evaluation process as it gathers all the necessary information and it provides indicators to assist the decision making. Besides, the Web-based application allows remote consultation by a large number of experts from different domains and different locations. It is important to multiply the experts and their points of view in order to make the evaluation process more effective.

The evaluating process of "IdeoVal" (Figure 5) is:

1. *Evaluation preparation*: during this step, the evaluators have to define their goals and the related criteria (in order to help them to determine these criteria, we propose to them a list based on both our preliminary research and our practical experiments). Once the criteria are defined, they are transformed into a questionnaire which includes an evaluation scale for each of them.
2. *Evaluation step*: the evaluators connect to the "IdéoVal" application to visualise the descriptions (using the "IdéoFix" sheet model) of the different concepts generated during the

creativity sessions. Each description is linked to the questionnaire and the application compiles all the answers.

3. *Evaluation analysis*: once all the answers are compiled, the evaluators can determine the weighting given to each criterion (a weighting that can be changed in order to simulate different configurations and mappings). The application calculates automatically the evaluation results and provides an Acceptability Potential Score (APS). Thus, the creative ideas are presented from more relevant to less relevant according to the criteria and their weighting.
4. *Evaluations compilation*: all the evaluations are collected and compiled in a database. Thus, it is possible to consult all the ideas and their evaluation. At this step, it is still possible to change an evaluation or a weighting if the evaluators consider it appropriate.

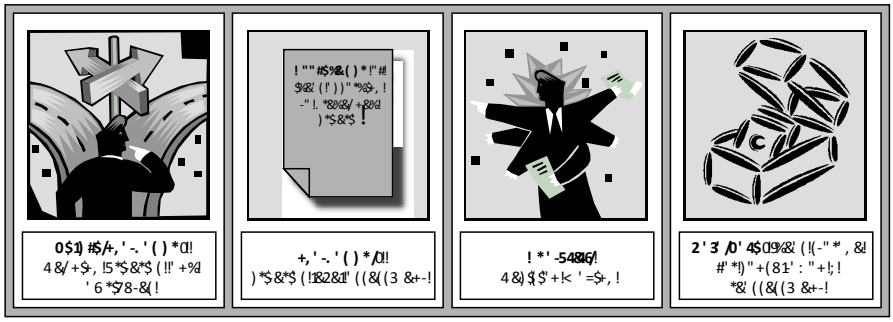

Figure 5. The four steps of evaluation process of IdeoVal

In the following figure (Fig 6), we present an example of three ways of presenting results that application can provide during the thrid step of the process. With the three exemples of presenting results the application can provide:

1. A table of the APS ranking of the ideas and an acceptability threshold (Yes, No, Perhaps).
2. A visual distribution of the APS ranking of the ideas.
3. A visual distribution of ideas according to 5 “Index Criteria” (IC): Innovation IC, Feasibility IC, Strategy IC, Market IC and Need IC. On the charts, the IC determine the size of the areas and their colour is determined by the acceptability threshold

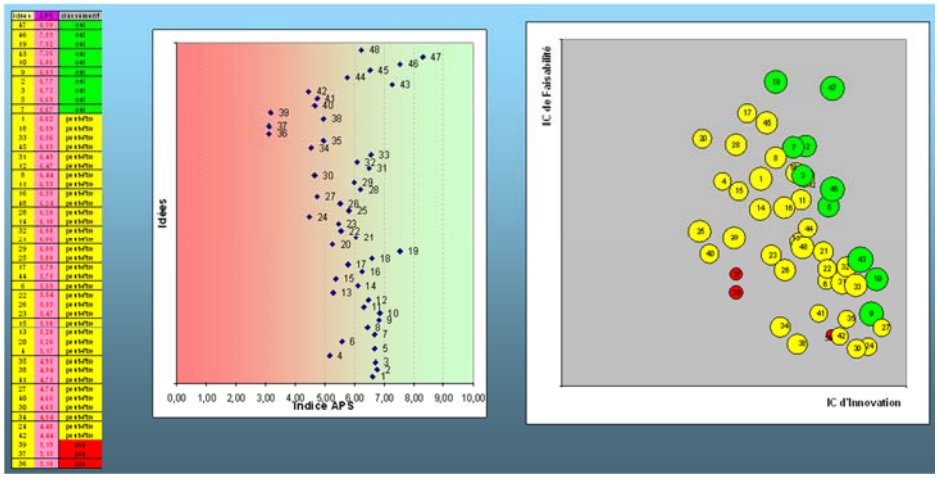

Figure 6. Example of IdéoVal screenshot (1) presenting classification of ideas, (2) APS distribution and (3) circle graph* (*circle size = index criteria market + index criteria need; circle colour: Yes (green), perhaps (yellow), no (red))

The evaluation of ideas at the early stages of innovation processes is an important, long and tiring exercise. This step, considered the most discriminating process, has not attracted the attention it deserves. "Idéoval" was experimented on industrial and academic context. The main objectives of these experimentations were to verify the applicability of the questionnaire proposed by our model, to

validate the proposed collection of information and evaluate analysis results. "IdéoVal" is a tool that aims to facilitate the piloting of the ideas evaluation process by centralizing all information and providing a series of indicators to support decision making. is the formalization of our research approach with interactive software.
These tools and the method of collective creativity using our dual approach (psychology and methodology) were used during a special workshop on creativity. Indeed, in November 2010 for the 10th anniversary, we developed an international edition of the "48h to generate ideas." We Will now present this event.

4. The creativity workshop “48h to generate Ideas” and its “International Edition”

4.1 The main points of creativity module “48h to generate Ideas”

Since 2000, many companies have joined us in the initiative "48h to generate Ideas". This pedagogical workshop has been proposed for different training levels (from License to PHD).
The principle of this workshop is organized on supervised training sessions to generate ideas for innovative products on a topic given by a industrial partner. During two days, with the help of managers and business leaders, participants work in creative groups, write ideas cards, evaluate and selecte ideas, do initial search (base patent, ensures technological, ...), contact experts, realize an object describing the idea (layout, video, etc ..).
For each group, the last step is a presentation of two ideas selected in front of a jury of experts composed of both a banker, an engineer, a designer, a researcher and an industrial partner in the field concerned. The jury assessed ideas having the best potential solution.
The strengths of this module are constraints of time, work in multidisciplinary teams, a strong link with industrial partners allow us to simulate real industrial conditions. Thus, the "48h to generate ideas" are structured chronologically as follows:

- a flash presentation of the subject by the company,
- sessions of ideas production with collective creativity process,
- the "marketplace of ideas" (all ideas cards produced are displayed to the public)
- alternating production / evaluation sessions,
- development of different kid of supports for the final presentation,
- a presentation to the jury in "5 minutes to convince"
- a feedback on three dimensions: industrial / students / teachers.

4.2 The ten years of “48h to generate Ideas”: An International Edition

2500 ideas generated by 900 students representing 90 groups in 14 universities in 9 countries on 3 continents for companies that 6 in 48 hours and finally, 5 minutes to convince.
In November 2010, to celebrate the tenth aniversary of this module, we organized a big event : the international edition of “48h to generate Ideas". For three days (due to the jetlag), 900 students from 14 universities on 3 continents (South and North America, North Africa and Europe) have generated new product ideas on topics proposed by 6 companies (“Electricité De France” (EDF) R&D, OrangeLab, two “passion” brands from Oxylane group (Kalenji, Artengo), Johnson Control and the University of Santa Catarina in Brazil for the Brazilian government with the event of the World Cup 2014) (Figure 7).
Activities were made simultaneously and interactively through collaborative tools web 2.0 (video conferencing, collaborative spaces, wikis ...). Teams working on the same subject at each university have exchanged ideas and had to deal with perceptions and cultures, all in a context of performance obligations:
Provide ideas and concepts relevant to companies. Each team had to draw idea cards, put them in a collective database, evaluate and rank these ideas. At the end of three days, the teams presented their best proposals to a jury in each country and the best were honored at an awards ceremony in ENSGSI-Nancy-France with all the participants (teaching staff, some students, institutions and industrial

partners). In the end, more than 2500 idea cards were produced which 40 were identified as high potential for development by companies.
The success of this event is based on:

- over 10 years experience in organizing the "48h to generate Ideas" in various training courses in France and abroad,
- partners of European and international programs for the development of innovation training at master level in partner institutions (European program TEMPUS "I-Cre@" with partner universities in europe and in Maghreb which driver is the INPL (Morocco, 3 universities / Algeria, 2 universities / Tunisia, 2 universities), framework agreements for scientific cooperation with Latin America (Argentina, Chile, Colombia). For the occasion, we invited to participate, 3 more institutions : University of Santa Catarina in Brazil and Simon Frazer University, Vancouver, British Columbia - Canada and 15 Swedish students from the BEST network (Board of European Students of Technology),
- a 3 articulation of the creativity practice : lessons combining engineering and psychology, strong contact between university and business, a link between teaching and research activities,
- our previous research activities which enabled us to formalize:
    - methods and tools to facilitate the practice of interdisciplinary and collaborative innovation process [Maxant 2006], [Vallette 2005], [Stoeltzlen 2006], [Minel 2003], [Kattan 2009],
    - the collaborative tools "IdeoFil®" and "Idéoval", dedicated to the development and evaluation of ideas and concepts, co-developed with EDF R & D. [Maxant 2004], [Ferioli 2008, 2010], [Gillier 2009, 2010],
    - The innovation platform "Cre@ction" is a platform facilitating the innovation practices where machines, softwares, tools and methods are implanted [Roussel 2009].

Figure 7. An overview of the organization of the International Edition of "48h to generate Ideas"

5. Conclusions and outlook

The diagram below shows that the double facilitation developed over the years covers each step of the creative process, from problem definition to ideas evaluation. Although it should continue to evolve in order better to respond to the problems we will probably be facing, we consider that its main development will be the integration of an international and collaborative dimension.

Indeed, during the International Creativity Workshop organised in November 2010, we noticed two points which it is important to work on to make our training more fitted to industrial needs. Firstly, working in a collaborative way needs to be learned and this learning process could also be helped by using a facilitation process which is both based on Personal Development and Engineering Methods. As regards engineering methods, Visiographic Representation is keen to help people to collaborate. Besides, there also exist tools for real-time data sharing and we may wonder if they are more relevant when used at particular moments of the Design process, and under which specific conditions.
The second point we would like to investigate and integrate within our training is the cross-cultural dimension of creativity group sessions. During the international workshop, students from different countries had to share and select ideas altogether. The way they have confronted their different cultural points of view really brought added value to the creative work. Nonetheless, difficulties due to the different cultural background appeared and aggravated the problems linked to collaborative work and indeed during the phases of evaluation and selection of ideas. This would lead us to complete our engineering training with some knowledge of other Human and Social Sciences, such as Sociology and Anthropology in order to offer an overall, integrated training for the students.

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