How the ALIENNOR Platform Supports the Identification of Eco-Ideation Stimulation Mechanisms During an Eco-Ideation Phase

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Abstract. Creativity stage or ideation phase is one of the most important step of innovation process where ideas with high potential of environmental and social impact reduction are generated. Therefore, many eco-ideation tools (stimuli, mechanisms, etc.) have been proposed. These tools are mainly at micro level (providing technical solutions) or at macro-level (providing a systemic view). The research project ALIENNOR[1] aims at providing a set of Eco-Ideation Stimulation Mechanisms (ESMs) at meso-level compromising both systemic vision and technical solutions. This paper presents how ALIENNOR platform (a part of ALIENNOR project) supports the identification of appropriate ESMs used in eco-ideation phase.

1 Introduction

By integrating both of environmental and social factors, eco-innovation could be defined as *"inventions, designs and new solutions for fulfilling human's and nature's needs in ecologically effective ways"* [1]. Eco-ideation is an important phase that takes place upstream the eco-innovation process [2] since in which, ideas with great potential for reducing environmental impact are proposed [3]. Problem finding - the starting point of any eco-ideation process plays a crucial role and often requires some techniques or supported tools to foster the generations of useful ideas such as ideation stimuli (heuristics), mechanisms, wheels or diagrams. Proposed methods are mainly technical solutions (at micro levels) or systemic approaches (at macro levels). They can be simple tools (simple to implement and to use) that don't require specific knowledge such as Eco-design Strategy wheel [4], BEC synergy diagram [5] or complex approaches such as TRIZ-based tools [6–9].

[1] http://www.agence-nationale-recherche.fr/Project-ANR-15-CE10-0001

adfa, p. 1, 2011.

The ALIENNOR project aims to develop a method supporting companies in their innovation process at three levels: a) the idea generation; b) eco-innovation evaluation; and c) idea generation and concept evaluation coordination.

In the idea generation phase, a set of seven stimulation mechanisms (Eco-ideation Stimulation Mechanisms – ESMs) has been proposed to support eco-ideation sessions (see Table 1). However, only two or three (at most) ESMs should be used during the eco-ideation phase of a particular eco-innovation case. With seven pre-defined mechanisms and a base of pre-selected eco-innovation cases, three methods can be used to identify the most appropriate ESMs:

(a) Identification of relevant ESMs through an analysis of the environmental problems from the design brief;
(b) Identification of relevant ESMs through a systematic reformulation of the design brief according to each ESM and
(c) Identification of the ESMs through inspiring case studies.

Each method requires a group of participants coming from various disciplines (scientists in eco-innovation, designers or students). This paper presents "*how ALIENNOR platform is used to support participants to identify the most relevant ESMs used in eco-ideation phase?"* according to each method listed above. The rest of the article is structured as follows: In section 2, we review some existing eco-ideation ICT (Information and Communication Technology) based tools, in section 3 we present main functions of the ALIENNOR platform and three usage scenarios corresponding to three methods, we describe in detail in section 4 how the platform is used in the third method with a real example of eco-innovation cases. The paper ends at section 5 with some conclusions and perspectives.

2 Related work of ideation-tools and ideation-mechanisms identification approaches

In this section, we review some existing ideation-tools and eco-innovation platforms that have been used to promote the eco-innovation design/ process. We present also three approaches used in the ALIENNOR project to identify appropriate ideation-mechanisms.

2.1 Existing ideation-tools and eco-innovation platforms

Many ideation-tools have been proposed such as Eco-design Strategy wheel [4], BEC synergy diagram [5] or TRIZ-based tools [9,10]. These tools are mainly stimulus, mechanisms, a diagram or a wheel that help to foster the generations of useful ideas for the eco-innovation process. However, for a particular eco-innovation case, only a few stimuli, mechanisms are used and we have found a lack of interest from the community in developing ICT (Information and Communication Technologies) solutions such as web-based platform, desktop software, etc. that facilitate the identification of the appropriate ESMs to be used. Only a few works that has been proposed. Two among them

are *Information/ inspiration* [11] and *IDEATRIZ Innovation software* [12] but they aims to facilitate the whole eco-innovation process instead of eco-ideation phase.

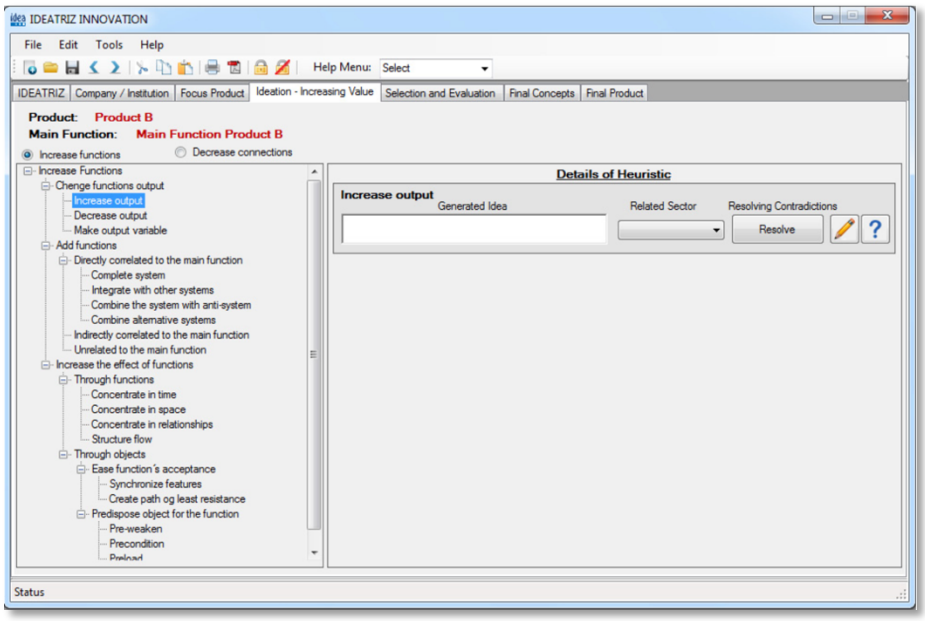

Figure 1: IDEATRIZ Innovation software – Ideation tab [12].

Information/ inspiration proposed by Bhamra T.A. et Lofthouse V.A [11] is a sustainable design web-based tool combining sustainable design information with a selection of inspirational ideas. As stated by authors, a web-based format was chosen since it *"allows content presented in a highly visual and interactive way, supports the opportunity for the user to access content on demand, provides a good opportunity for the eco-design information to be kept up to date"*. Two types of data are included: *"Information"* and *"Inspiration"*. The former aims to be as appropriate as possible to the type of work that industrial designers become involved in: strategies, recycling, use, materials, packaging, etc. The later contains case studies grouped according to the product type: 'electrical products', 'white goods', 'packaging', etc. *"The aim of 'Inspiration' is to encourage, inspire and educate designers, by providing them with product examples of eco-design work, to help them build up their tacit eco-design knowledge, and/ or support idea generation at the beginning of an eco-design project"* [11]. By selecting a particular product, users can see detail information about it such as description, image, functions, eco-design strategies, etc. The platform was developed a long time ago, the web interface is too simple and not really intuitive. It lacks also filter functions or navigation tools to move between eco-design cases.

IDEATRIZ Innovation software is a desktop software, based on IDEATRIZ methodology proposed by Carvalho M.A et al [12] that aims at generating ideas that are both new and valuable to company's customer. The software allows users to create new

product and provides them a list of heuristics (from IDEATRIZ methodology) to freely generate ideas without have to worry about storing them in the eco-ideation phase. The main limitation of IDEATRIZ Innovation software is that it doesn't allow a collaboration work among different users.

The next sub-section presents three methods used to identify relevant ESMs for ideation phase, proposed in the context of ALIENNOR project[1].

2.2 Three methods to identify relevant ESMs

The table 1 describes in detail seven Eco-Ideation Stimulation Mechanisms (ESMs) proposed in the ALIENNOR project. These mechanisms are used mainly in the very first phase of the eco-innovation process to generate ideas with high environmental and social impacts. However, for a particular eco-innovation cases, only two or three (at most) should be used. Three methods have been proposed to facilitate the selection of appropriate ESMs to be used.

No	ESM	Raises questions about
1	Innovate with stakeholders	Stakeholder network, through the value creation for the users, the environment, society, and all other relevant actors value creation for all stakeholders.
2	Innovate through biomimicry	The similarities between man-made industrials practices and natural strategies of development at several system levels (organ, organism, ecosystem).
3	Innovate through sustainable mode of consumption	The unsustainable use of products/services and how the system can fit the system to end users and territorial specificities (skills, resources, et.)
4	Innovate through Product Service Systems	The optimization the functionality of the materials and energy consumed by the system (use intensity, dematerialization) and of dissociating the product property and the consumption.
5	Innovate through territorial resources	The integration of territorial capitals in design strategy: natural capitals, industrial ecosystems, social capitals and anthropic
6	Innovate through circularity	The different ways to design a product in closed loop (of material, energy, information). It also questions the question of recycle, repair, upgradability
7	Innovate through new technologies	The possibility to integrate new technologies, new process and organization, new material, in the design of the system.

Table 1: Seven Eco-ideation Stimulation Mechanisms used in eco-ideation sessions [13].

- **Method 1: Identification of relevant ESMs through an analysis of eco-innovation problems**. In this approach, the participants identify environmental problems from the design brief and connect them to the most appropriate ESMs using Problem-ESM relationships sheet (figure 1).
- **Method 2: Identification of relevant ESMs through a systematic reformulation of the design brief according to each ESM**. Each participant reformulates

the design brief according to each ESM. All reformulations are then grouped and summarized to deduce which ESMs are the most relevant for the case study.

- **Method 3: Identification of relevant ESMs through inspiring case studies**. Participants choose from a predefined base of cases the ones that they evaluate as the most associated to the current case study (same category, same environmental issues, etc.). Selected cases are then grouped and clustered into different categories according to types of issues faced by the current case study. Relevant ESMs are then identified from these clusters.

In the next section, we present how the ALIENNOR platform can be used to support these three methods.

3 ALIENNOR platform

Three methods presented in section 2 require the participants from different disciplines: eco-innovation scientists, designers, students, etc. A web-based platform enables geographically distributed participants to work remotely together instead of going to face-to-face work sessions. It also allows to capture and summarize discussion sessions' results in a more efficient way.

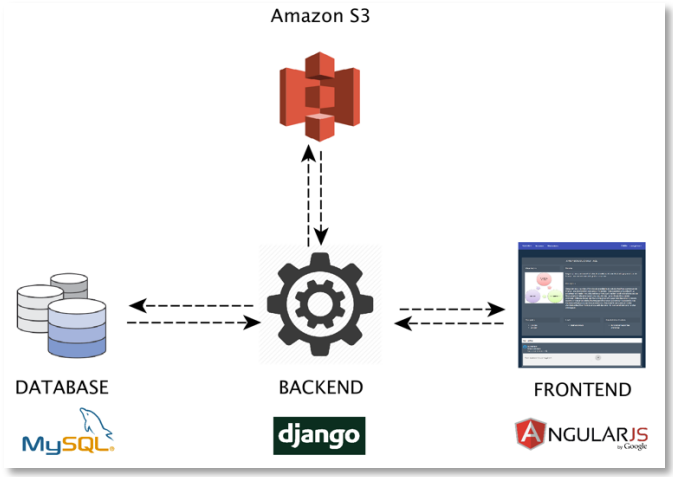

Figure 2: Overview of web-based ALIENNOR platform's architecture. Eco-innovation cases are stored in a MySQL database while the Amazon S3 service is used to stock cases' images.

3.1 Platform's functions summary

The main advantages of the ALIENNOR platform (Figure 2) can be summarized as follows:

- **Provides a rich base of 120 eco-innovation cases** classified in two groups: tagged and non-tagged. The first group contains cases that are already linked to two or

three ESMs and will be used as inspiring cases in the method 3 (see above). Cases in the second group have not been tagged yet, that means they are not linked to any ESM and the main purpose of all three above methods is to identify what ESMs are relevant for these cases.

- **Provides a detailed presentation of each ESM** among seven ESMs (Table 1) with description, explanation of each step to follow, etc. User can consult the content of each ESM directly on the platform or through the attached .pdf document.
- **Provides navigation tools** between eco-innovation cases and seven mechanisms that allow users to easily consult all cases associated to a particular ESM. Some **filters** have been implemented to refine eco-innovation cases based on categories or associated mechanisms. All **links between eco-innovation cases and mechanisms are also represented visually** through a graphical representation. These functions help users more understand eco-innovation cases and facilitate them in querying particular cases.

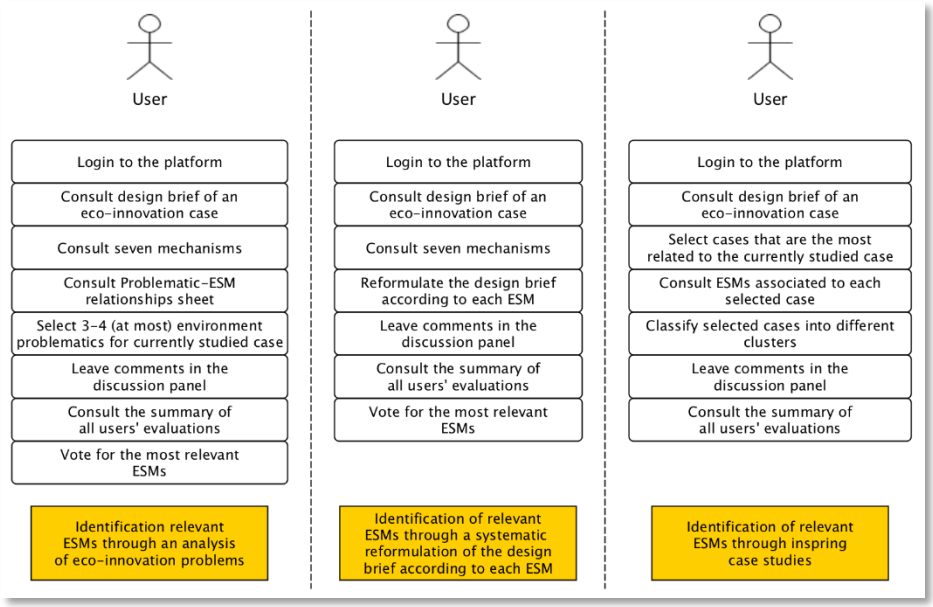

Figure 3: Three scenarios of ALIENNOR platform corresponding to three ESMs identification methods.

3.2 Scenarios

With eco-innovation cases and mechanisms implemented, the ALIENNOR platform allows the creation and animation of a community between scientists, small and medium companies, and students the helps to promote the eco-innovation product design.

Besides, it can also be used (as mentioned above) to facilitate the identification of relevant ESMs used in eco-ideation phase. Three scenarios have been identified according to three methods (presented in Section 2):

- **Scenario 1**: After logged in to the platform, users consult the design brief of a particular eco-innovation case through its detail page. This page contains different fields such as title, promise, visualization (product's photo, company's logo etc.) and description with information about environmental factors, economic values, etc. Users then consult seven mechanisms and the Problematic-ESM relationships sheet to select from 3 to 4 at most environment problematics related to the currently studied case. They can leave any comment in the discussion panel to discuss more about their decisions or view evaluations of other users. Platform's admin can decide which ESMs are the most relevant based on users' evaluations or users can vote for them directly on the detail page of eco-innovation case.
- **Scenario 2**: Like in the scenario 1, after logged in, consult the design brief of a particular eco-innovation case and seven ESMs, users have to reformulate the design brief according to each ESM through a dedicated page. They can also leave their comments for each reformulation in the discussion panel and view the evaluations' summary of all other users. The most relevant ESMs are selected by platform's admin based on the voting results of all users.
- **Scenario 3**: After logged in and consult the design brief of a particular eco-innovations, users use implemented filters and navigation functions to navigate through all eco-innovations cases existing in the database and select a set of cases that are the most related to the currently studied case. Users can see what ESMs are associated to each selected eco-innovation case in its detail page. They then classify the set of cases into different clusters according to types of issues faced by the studied case. They can leave comments in the discussion panel to explain the why a case is classified into a cluster but not the others. The most relevant ESM are then selected by the platform's admin according to the clusters established by all users.

We are going to illustrate in the next section the third scenario: *"Identification of relevant ESMs through inspiring cases studies"* with real examples of eco-innovation cases.

4 Identification of the ESM through inspiring case studies on ALIENNOR platform

With 120 implemented eco-innovation cases and 7 mechanisms, the ALIENNOR platform is notably helpful in the third approach. It facilitates the selection of inspiring cases by providing users a structured and intuitive representation of all eco-innovation cases with appropriate navigation, visualization functions.

In order to identify ESMs adapted to a non-tagged case, after logged in, users consult the design brief included in its detail page (see Figure 4). In the next step, users select from the database a set of tagged cases (inspiring cases) that are the most related to the currently studied non-tagged case. To facilitate this selection, the platform provides

users with an overview page of all tagged-cases represented in grid. In this grid, each cell contains case's title and a product's image or a logo of the company that the product belongs to. Users can refine tagged cases by associated mechanisms or categories. Tagged cases selected as inspiring cases are marked with a blue tick (see Figure 5).

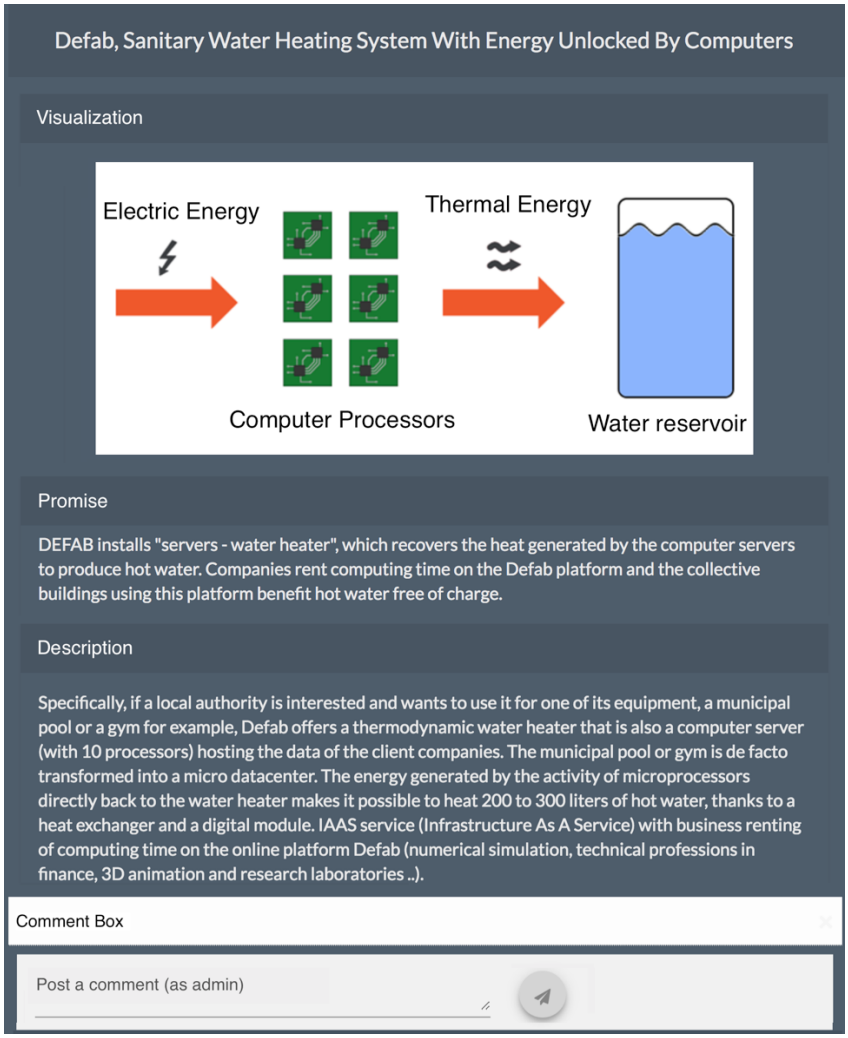

Figure 4: Detail page of a particular eco-innovation case. Different fields are included: Visualization, Promise, Description. Users can leave their comments at the discussion panel.

Figure 5: Tagged cases are represented in grid and can be refined by mechanism or category. Users click on each cell to see detail page of corresponding eco-innovation case. Selected inspiring cases are marked with blue tick.

In the same time, users can consult all cases associated to a particular mechanism through the visualization panel. In the Figure 6, orange circles represent cases that are linked to the mechanism *'Innovate by territorial resources'* as the best matching mechanism while green circles represent cases that are linked to the mechanism as the second most relevant mechanism.

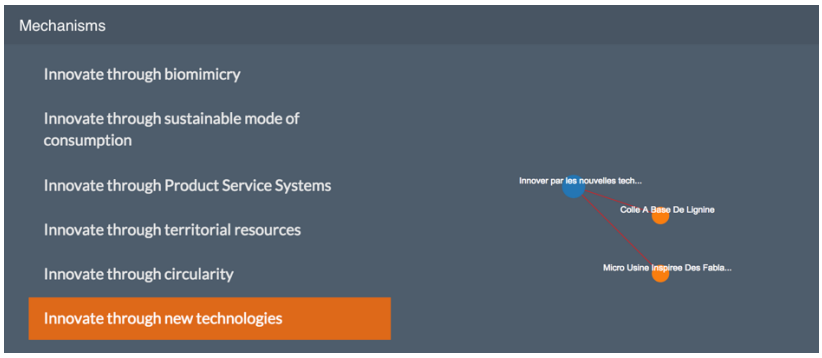

Figure 6: Graphical representation of all tagged cases associated to the selected mechanism.

Platform's admin groups and classifies inspiring cases selected by all users into different clusters. Users then vote for the most relevant ESMs according to these clusters

classification. Voting results are represented at the end of the detail page as we can see in Figure 7.

Figure 7: Summary of voting results for the most relevant ESMs.

5 Conclusions and perspectives

Eco-ideation phase is crucial for any eco-innovation process. Seven ESMs have been proposed in the ALIENNOR project to facilitate the generation of useful ideas in this important phase. This paper presents ALIENNOR platform as a supportive tool for the identification of relevant mechanisms used in the eco-ideation phase.

The ALIENNOR platform provides necessary tools to support users in three different ESMs identification methods*: Identification of relevant ESMs through an analysis of the environmental problems from the design brief*; *Identification of relevant ESMs through a systematic reformulation of the design brief according to each ESM* and *Identification of the ESMs through inspiring case studies*. The main advantage of the platform is it provides an intuitive and user-friendly interface, implemented navigation, visualization and filters tools that help users to understanding quickly integrated eco-innovation cases and mechanisms. It enables also the collaboration of users coming from different disciplines in geographically distributed locations.

As perspective, some additional tools will be implemented such as the **"community module**" (to improve the collaboration among users). Besides, currently implemented visualizations need further testing to be enhanced.

Acknowledgement

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