INNOWEB: Gathering the context information of innovation processes with a collaborative social network platform

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Abstract

This paper describes the development of a collaborative social platform to support innovation process management. The Drupal based platform accommodates different types of innovation processes (also called waves or idea contests), enhances collaboration and eases management. The main contribution lies on the gathering of context parameters which helps enterprises on the detection of critical success factors, enabling later reproductions. The development leverages open source social computing, real-time web and semantic web technologies adding new functionality in a modular way. Blogs, wikis, graphical tools and voting systems support collaboration and idea management in the early stages of the innovation process. A workflow module launches customized innovation campaigns where topics, participants, stages, selection criteria and communication methods are optimized to enterprise needs.

Keywords

Collaborative innovation, critical success factors, social web, semantic web, innovation context variables

1 Introduction

Innovation is extremely important for the growth strategy of most enterprises [Capozzi, et al. 2010]. With the rise of emerging economies, business is entering a new era of extreme competition where the only way to survive is to innovate. Many companies and especially Small and Medium Enterprises (SMEs) have problems applying innovation processes, due to the lack of resources, appropriated tools or innovation culture. Without innovation those enterprises are not able to grow and their competitors take advantage of that weakness. Innovation allows enterprises to compete and evolve efficiently.

Many tools have been developed to support innovation processes. Idea Management Systems (IMSs) are employed in the early stages of the process, where ideas are generated. IMSs are idea centred. Thus they collect information about the ideas gathered in the platform. Existent IMSs hardly collect information about the context. That is, the conditions on which those ideas have been gathered are lost. Information such as the type of contest where the idea was conceived, the actions taken during the different stages, the idea contributors or the timing between stages are often forgotten since there is not a platform that gathers that information. Collecting that data is essential to reproduce the conditions and the context for successful ideas. Thus, in most IMS when an idea becomes successful there is no way to identify the context where that idea was conceived.

The work presented in this paper describes the development of an open source community platform for the front end of the innovation process focused on the innovation context. The platform gathers and stores information about environment conditions for different types of innovation processes. The importance of collecting those conditions lies on the possibility of

repeating those contexts where successful ideas have been created. Hypothetically, the re-creation of those conditions will turn into new ideas with higher probability of becoming successful.

The next section outlines the research context introducing the innovation framework for the project and the state of the art on the technologies selected to create the platform. The third section describes the objectives, context metrics, the evolutionary methodology and the structure of the platform presenting the tools and technologies employed in its development. The following section outlines a case study conducted and summarizes the results and contribution of the platform within the research work. The last section presents the conclusions and the future work withdrawn from the project.

2 Relation to Existing Theories and Work

The platform presented in this paper was conceived as the result of previous research. In [Errasti 2010] a thorough study on the innovation process, different innovation models and existent tools and technologies applied to the different innovation stages was conducted.

The innovation process identified in the study is outlined next. The following subsection presents a state of the art on the technologies selected for the development of the platform.

2.1 Innovation Process

Most innovation models show a similar baseline and the differences among them lay in the particularities incorporated to the model in each particular case [Errasti 2009]. This baseline is understood as a process with several stages. Four stages form the first part or front end of the innovation process.

1. **Idea Generation:** creation and collection of new ideas and comments.
2. **Idea Analysis:** the study of created ideas and the search of relations among them, in order to merge, split or complement with other ideas.
3. **Idea Enrichment:** experts add more valuable information into chosen ideas.
4. **Idea Selection:** select the best ideas for their development into projects, using custom criteria and weights.

Figure 1: Full innovation process

In the next stage (**Idea Development**) idea developing planning is approached. Studies are conducted on many issues; market, technology, business plans, risks, possible collaborations or competitors. The last stage is concerned with the implementation of the idea (**Idea Implementation** stage). This is the actual materialization of an idea where it turns, among other things, into a product, process, services, patent, strategy or company.

The front end of the innovation process where idea management is developed is one of the most critical stages.

Thus, the main issue is to manage the innovation process and more specifically the front end of the innovation process, providing an efficient platform for the innovation process. The following requirements have been identified:

- A common space to represent and gather all the information related to innovation processes is needed. This common platform will be used to collect ideas, identify experts, introduce comments and follow idea progress or search for similar ideas.
- Idea context gathering is essential in order to reproduce successful idea contests.
- The advantage of using social networks in organizations is clear; employees could develop contacts, share knowledge, improve communication between experts, gather interest in new projects or ideas, enrich ideas using incremental collaborative contributions and identify professional opportunities.
- The platform has to be flexible enough to accommodate different types of innovation campaign or waves simultaneously; firm-centric innovation process or crowd sourcing contest with hundreds of participants.

2.2 Technology

Our requirement research presents a state of the art where many technologies and tools used to enhance the innovation process are studied. A description of those technologies, classified in three groups; social software and innovation platforms, semantic web and real time web is presented next.

2.2.1 Social software and innovation platforms

Social software is the term used to refer to the different applications and technologies associated to the Web 2.0 term, widely introduced and depicted in a seminal article by Tim O'Reilly [O'Reilly 2005]. James Surowiecki demonstrated [Surowiecki 2005] that complex tasks can be solved more effectively by group collaboration than by any individual of the group.

On the other hand, the term enterprise social software (Enterprise 2.0) refers to the application of Social Web applications to enterprise environments. Most demanded functionalities for these applications are similar to those of Facebook or LinkedIn but with more control and governance. Besides, the increasing interest in IMSs [Conry-Murray 2010] has pushed community platform vendors to integrate idea management and community software into a single type of platform that includes idea management functionalities and social technologies.

As social networking started to grow in popularity a new breed of Web applications took on the market among enterprises; community platforms. Among the core features, community platforms offer all the functionalities inherited from social Web technologies like blogging, wikis or social networking [Parrish 2010].

The last issue of the series of McKinsey reports on Web 2.0 adoption shows very positive results on the use of social technologies and a majority of respondents say their companies enjoy measurable business benefits from using Web 2.0 [Bughin J, Chui M 2010]. The use of social webs in the context of enterprise is very incipient. Many barriers are detected, above all organizational barriers such as no implication of managers, need of a cultural change or hierarchical structure. However, initial data show very quantifiable benefits and there is no doubt

about the upward trend of adoption of these technologies. A high percentage of companies have planned to increase the investment in 2.0 technologies.

Several architectures of participation have been analysed including Facebook, Digg, Wikipedia, IBM Idea Factory, IdeaScale Innocentive, SalesFoce Idea Management, Hominex, Mindmeister, LaboraNova, IBM Lotus Connections 2.5, Microsoft Office Sharepoint, Brightidea, Imaginatik Idea Central, Jive SBS, Elgg, Drupal, Liferay, Joomla and Plone. Over 20 factors were considered as the comparison criteria for the different platforms. The most relevant criteria was; context gathering, type of license, ease of use, developing language, operative system, integration with social networks, integration with real time web, integration with semantic web, blogs, wikis, RSS, email, etc.

The main conclusions extracted from the analysis are:

- All analysed IMSs are idea centred (such as Idea Scale, Mindmeister or Ideatorrent), gathering little context information in the best cases.
- There are open source platforms with similar characteristics to proprietary software. Proprietary platforms are discarded. The inclination to select open source is reinforced.
- Any existent or new innovation support platform must consider the integration of its mechanism with most popular social web platforms, such as Facebook or Twitter in order to be successful by means of participation. Share ideas among those platforms guarantees reaching collaborators and in some cases open the process to new participants.
- Semantic Web technologies can support information management and consequently contribute into better idea generation tasks. Especially, Semantic Web can help in keeping all the information structured in electronic files accessible by anyone from anywhere. Moreover, intelligent agents can then deal with this structured data, to avoid direct human interaction, for instance when searching for new ideas. It can also strengthen ideas by complementing proposed ideas with content found automatically in other sites or repositories.
- Drupal and Liferay have obtained the highest score, but the dimension of actual and potential community of users and the effort made by the community of users to integrate semantic technology or web 3.0 currently favours Drupal.

2.2.2 Semantic Web

Semantic Web consists on transforming plain text found in internet´s content into another one with sense and meaning. It is defined as the web of data that can be processed directly and indirectly by machines. The objective is to build a context around information by adding categories, metadata and relations between things that add sense to that data.

In order to add semantic meaning to data, ontologies are used. Two are the relevant innovation ontologies encountered in the literature; the innovation management ontology presented by Christopher Riedl [Riedl, et al. 2009] and the GI2MO ontology presented by Adam Westerski [Westerski 2009]. The developers of GI2MO ontology have also created a RDF metadata publishing module for Drupal called RDFme.

3 Research Approach

The state of the art shows that although many idea management tools are available, community software platforms found are idea. They do not register the context where ideas are gathered. Thus, a platform that collects ideas and registers the context where they are created is needed. Additionally the platform must enhance integrability [Riedl, et al. 2009] using semantics.

In this section, firstly, the main objectives of the research can be read. Secondly, the metrics and data to be collected by the platform are described. Next, the methodology followed in the

development of the platform is detailed. Finally, the platform itself is presented with all the functionalities.

3.1 Objectives

The main objective is to develop a baseline social networking platform to support the front end of the innovation process, gather context information and enhance integrability of data.

The technological objectives of the research addressed in this paper are the following:

- Deploy the baseline platform on Drupal representing each of the stages for the innovation process and gathering all the context related data (ideas, contests, participants and their skills, outcome, companies, events, etc.). The platform will be made flexible enough to accommodate and adapt to different scenarios.
- Provide a set of tools for each of the four stages identified.
- Be able to articulate a successful architecture of participation around the platform using the possibilities brought by social web and real time web technologies.
- Prepare information collected with semantic meaning enhancing integrability.

The methodological objectives are the following:

- Apply the deployed platform launching idea generation campaigns within a set of companies.
- Gradually establish a cooperative culture in all aspects of innovation through the baseline platform.
- Measure those case studies with previously defined metrics. This will enable a better understanding of the issues related with the innovation process.
- Analyze the success factors of these idea generation campaigns considering the defined metrics.

3.2 Metrics

In order to identify innovation success factors, metrics have to be defined. Environment conditions or context information is an important issue that needs to be addressed. Data and metrics about the innovation process, innovation campaigns, the activity and outcome has been identified and classified according to the following criteria.

3.2.1 General Wave Characteristics

Enterprises usually launch innovation contests (waves) in their innovation processes. Wave information shows the framework environment on which ideas are generated.

- **Innovation type:** stores the level of innovation of the wave (radical, incremental…).
- **Stages:** the stages the wave will follow on the Idea Management life cycle.
- **Status:** describes the current stage.
- **Target:** indicates the objective or target aimed by a wave.
- **Topic:** how the wave has been classified.
- **Contest type:** indicates the type of innovation searched by the wave.
- **Fields of the idea:** the fields will the user have to fill in order to submit an idea.
- **Duration:** the time the wave will last.
- **Situation:** environment in which the wave is created (relaxed, time or condition pressure…).
- **Selection criteria:** indicates the criteria used for idea ratings (set by experts).

3.2.2 Structural Metrics

These metrics measure the structural properties of the contest and their impact.

- **People:** groups, dedication, number of participants, active users, roles…
- **Enterprise:** time and resources assigned to R+D+i by companies.
- **Resources:** locations (e.g. meeting rooms), amount of resources spent on awards and prices…

3.2.3 Activity Metrics

These metrics measure the activity in the platform.

- **Traffic measures:** number of views, unique visitants, average time spent, repeat visitors…

3.2.4 Stimulation Metrics

These metrics register actions or stimuli provided in the wave to boost participation and improve quality of ideas.

- **Events:** the number of events, participants, type, duration, location…
- **Awards:** the number of awards and the amount of money earned in each…

3.2.5 Outcome Metrics

The outcome metrics measure the result of the contests.

- **Wave level:** number of ideas that fit the target, become a product, create a spin off…
- **Idea level:** innovative ideas, innovation level, number of innovations introduced, generated sales...

3.3 Methodology

The agreed methodology approach followed in Innoweb is based on an incremental development cycle, where requirements guide implementation. The experience collected in a cycle will help to improve the next one. The results and conclusions obtained with the developed prototypes can generate new requirements.

Next the phases that summarize each cycle in the development are presented.

1. **Requirements:** a field study is performed through a set of interviews to different representatives of the involved organizations in order to assess the use of Social Web technologies. This input, together with the state of the practice research, is used to depict the case studies.
2. **Implementation:** the necessary prototypes and the methodology are developed. The methodology will provide a stepwise approach for the adoption of the prototypes within an organization.
3. **Validation:** a set of piloting activities are carried out within real production scenarios and are based on the depicted case studies. A set of indicators are set up in order to evaluate the result and the success of the contest.

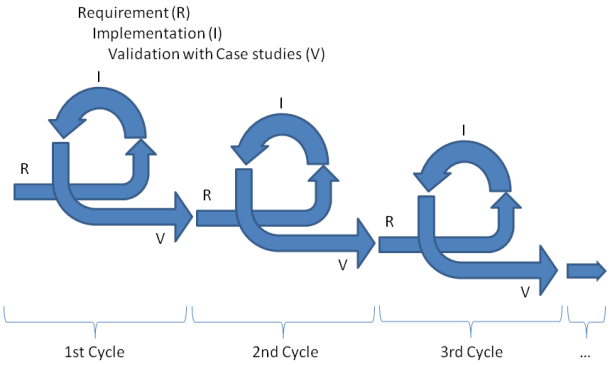

Figure 2: Evolutionary life cycle methodology

3.4 Platform

The innovation platform presented in this paper has been developed in Drupal. Drupal is a powerful open source Content Management System (CMS). One of Drupal´s main assets is its flexibility and modularity. Drupal is like a Lego kit. Skilled developers have already made the blocks or modules that Drupal users need to create their sites; news site, an online store, a social network, blog, wiki, or something else (in our case, an innovation platform).

Drupal's core includes basic community features like blogging, forums, and contact forms, and can be easily extended by downloading other contributed modules and themes. Drupal also provides a set of APIs (Application Programming Interfaces) that bring the possibility of creating new functionalities programmatically and has a very active community that develops and offers a wide variety of modules.

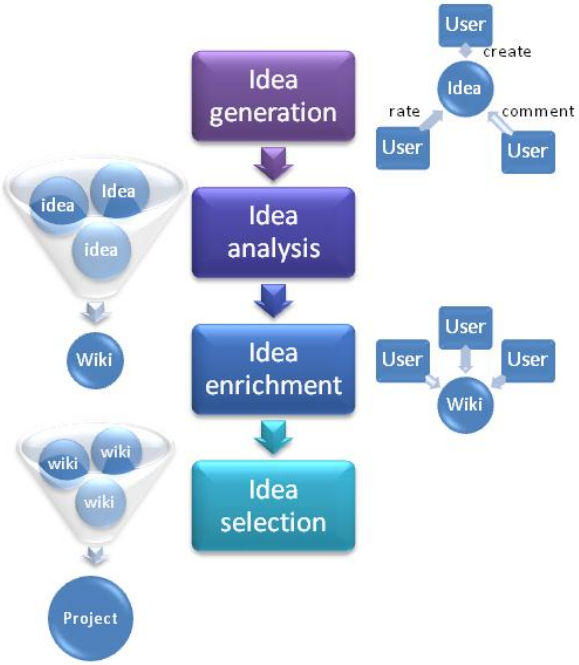

Figure 3: Front-end of the innovation process stages

Innoweb platform not only adds some modules to Drupal in order to transform this CMS into a IMS but the addition of Wave module also allows administrators the personalization of idea campaigns and manage the workflow of the innovation process. Other modules with specific functionalities were also constructed. Next a description of the technological solutions, tools and

modules employed in each of the stages of the innovation process is presented. Finally the ontology and tools used to store data in semantic format is outlined.

3.4.1 Idea Generation

For the first stage of the process a module that collects ideas has been developed. Ideas are collected in blog format and their content stored in database (MySQL). Ideas can be commented by other users contributing or enhancing idea quality at this early stage. Users can also vote upon ideas and comments using community provided *votingapi* and *voteupdown* modules. Comments are stored in databases along with related ideas. Innoweb also offers the option of voting upon ideas. Number of votes is saved providing administrators with valuable information for further stages (analysis or selection). All ideas are linked to the wave they belong.

3.4.2 Idea Analysis

The second stage consists in analysing ideas and preparing them for the next stage. This is, convert ideas in blog format into wikis. For this stage Innoweb provides a set of graphical tools that help managers in the search and comparison of ideas. The following relations are explored; ideas using the same tags, ideas from the same user, most voted/readed/commented ideas… These tools are especially useful when administrators deal with a large amount of ideas and the relation among ideas is not clear. Finding which ideas are well considered in the community and the existent relations among ideas-users-companies make the filtering of ideas an easier task. This turns into an increase on productivity and a better coverage.

Two types of graphical tools are provided in Innoweb; Animated Charts using Google Chart Tools JavaScript API and Blazegraph charts using Blazegraph Flash dynamic graph layout engine. To develop these visual aids new modules were built.

Finally another module has been developed at this stage to convert automatically ideas in blog format to ideas in wiki format. It offers a table for experts to select the best ideas and transform them into wikis.

3.4.3 Idea Enrichment

At this stage a wiki is provided for each filtered idea. Once ideas are in wiki format, experts add valuable information creating richer ideas. All contributions are saved in different revisions in order to identify contributors and idea evolution, and also give the possibility of restoring previous versions. A custom module has been developed to offer wikis linked to the wave and the original idea.

3.4.4 Idea Selection

At this stage of the process Innoweb provides tools to carry out the selection of ideas and to establish customize criteria that support the selection process. A new module has been created to help in this task. This module has been called ***Innoselect***.

Administrators configure the selection framework by adding conditions or questions that will be considered when ideas are evaluated (selection criteria). Each of those conditions can be weighted. That is, different weights can be established depending on the relevance of the criterion.

Once criteria are established, authorized users will have the possibility of rating ideas. There is a box for each criterion-idea relation where the user introduces his grade or rating.

The module offers three rating possibilities:

1. Normal weighting: The user has to enter a value between 1 and 10.
2. Weighted selection: The user has to order ideas from the worse to the best.
3. Criteria matrix: The user can only enter predefined values in the ratings.

As in the Idea Analysis stage, graphical tools have been developed using Google Charts. These tools compare ideas visually depending on the ratings for each criterion and showing the total score. The tools are used to identify selected ideas that will be transformed in future projects.

3.4.5 Wave

One of the objectives for this research work was to create a platform flexible enough to accommodate and adapt different innovation campaigns or waves. Each wave has to be customized according to the requirements suitable for that campaign and yet the baseline platform has to be the same for different innovation experiments. Issues such as stages involved in the process, users allowed, topics, tag vocabularies or idea fields to be collected have to be fully configurable. Campaign owners must be able to configure that process before the campaign is launched and once it is activated they need tools to manage its progress. This module must gather most of the innovation process context information.

A new module that addresses these issues has been developed for the platform. The module, called ***Wave***, allows the creation of different customized idea contests and enables their management simultaneously over the same baseline platform. The customized options included are the following:

- **Stages** of the innovation process. Depending on the wave the process can omit some stages.
- **Dictionaries and tags.** To customize vocabularies and tags to be used in a wave.
- **Events.** Specific organizational actions can be register in order to determine which management actions help in the innovation process.
- **Permissions.** Users are allowed the possibility of viewing/editing/creating content depending on their role.
- **Idea fields.** Administrators define the fields to be collected in each idea.
- **Real time notifications.** Represent the communication networks the platform will use to communicate with users when something relevant happens.

3.4.6 Semantic web

The platform brings the possibility of serving the ideas in RDF format, making semantically stored data interoperable. Not only ideas are stored in RDF, but also idea campaign metadata.

In order to represent the innovation process domain, GI2MO ontology was selected for the platform. Additional classes and properties were added to fulfil the requirements innovation campaigns introduced into the domain.

To present data in RDF format a community module called RDFme has been used. RDFme was developed by the group that created GI2MO. The module allows the mapping of idea fields onto the innovation ontology, converting automatically all ideas in RDF format. The platform also works as a SPARQL endpoint so third parties could send idea or innovation process related queries.

4 Findings

In 2009-2010 [Larrinaga, et al. 2011] a case study was conducted using an early development of the platform. Some structural and traffic metrics were collected. Following the methodology described in section 3.3, a new case study has been conducted with the aim to gather more innovation context parameters.

It has been carried out in Mondragon Corporation (http://www.mcc.es), which is divided into four main areas; Finance, Industry, Retail and Knowledge, and is today the top Basque business group and the seventh biggest in Spain. Mondragon Corporation has a total of 256 companies

and bodies, of which approximately half are co-operatives. The average number of employees at Mondragon Corporation is 83.859 and approximately 9000 students course their studies at Mondragon University.

The case study, named Ekiten, is an idea contest driven by the Engineering, Business and Humanities faculties of Mondragon Unibertsitatea (MU) and the sponsorship of MONDRAGON Corporation itself, SAIOLAN entrepreneurship development centre, Debagoiena commercial development centre, Gazteempresa foundation and Athlon enterprise. The objective of the contest is to promote entrepreneurship among students by collecting their ideas on the creation of new enterprises or business models. Information about Ekiten has been collected using Innoweb from 2010. Wave module has been used since 2011. Each year three main topics were withdrawn; rural development, youth-leisure-sports and innovation enterprise. A wave was launched for each main topic.

Every wave had a sponsor from outside the university as the owner or manager for that wave. An external selection committee was appointed by each sponsor company. Each committee was formed by five external experts that established the selection criteria for each wave and made the actual selection of ideas. The criteria considered in most of the waves was related to the level of innovation, definition and maturity of the idea, the technical and economic feasibility, the level of alignment of the idea with the strategy and the priorities set for the topics dealt with in each wave, and finally, the confluence and leverage of the proposal with the capacities and competences available in Mondragon Corporation´s companies.

Wave administrators set the general parameters for the wave and configured participants, stages, permissions, vocabularies and timelines prior to opening Innoweb idea management tools to users. Students were allowed to introduce their proposals including their description and the title of the idea, the outcome expected (become a new product, process, service or spin-off), the issues addressed with the proposal, the type of innovation and the objective market or customer. Experts used Innoselect to rate and select best ideas. Events were registered in the platform during the whole process. The events registered were of 4 types: success stories, workshops, information bulletins and coaching sessions. The amount of participants, events, experts, etc. can be found on the first table (cf. Table 1). The outcome values, such as amount of ideas, average or promoted ideas, can be found on the second table (cf. Table 2).

Context parameter	**2010**	**2011**	**2012**
Groups	10	27	46
Multidisciplinary groups	0	0	2
Participants	40	92	155
Experts	10	10	10
Evaluators	9	9	9
Companies	6	6	6
Ideas	10	27	49
Promoted ideas	3	2	3
Spin-offs	0	1	1
Events (success stories)	2	5	8
Event (workshops)	1	3	5
Events systematic for each group	8	8	8
Event (boletines)	0	0	3
Events total	11	16	24

Table 1: Inputs.

Outcome	Ekiten 2010	Ekiten 2011	Ekiten 2012
Ideas	10	27	49
Promoted ideas	3	2	3
Spin-offs	0	1	1

Table 2: Outcomes.

As an example of the type of information that can be gathered with the platform, an extract for the three waves hold in 2012 is presented (cf. Table 3). The influence of events in the quality of ideas can be observed. Further tracking of those events can be done in the platform. Thus, while 9 events were common to all campaigns, 4 were specific to the Youth-Leisure-Sports wave that obtained better grades and where all ideas were online with the contest objectives.

Context parameter	Rural Development	Innovation Enterprise	Youth-Leisure-Sports
Ideas	4	33	12
Average grade of ideas	3,17	2,78	6,68
Ideas online contest	2	15	12
Promoted ideas	0	1	2
Spin-offs	0	0	1
Events (success stories)	6	6	8
Event (workshops)	3	3	5

Table 3: 2012 wave comparison.

5 Conclusions

Having presented in this paper the developed platform and the case study where it has been tested, some conclusions have been drawn:

- According to the requirements a platform to support the innovation process has been built. The platform gathers context data that can be further analysed to determine the influence in the outcome and detect success factors.
- The platform offers data in semantic format. This enables interoperability, machine automatic search, exploitation of semantic meaning and the possibility to incorporate ideas to the Linked Data.
- Although the volume of the waves analysed is small it can be concluded that the platform presents not only activity or traffic metrics, but also quality measures such as grades or relation between ideas collected and ideas on target among other.
- The impact of management decisions can also be measured. That is, campaigns can determine if a workshop or brainstorming session translates into more (quantity) and better (quality) ideas.
- The platform provides a better campaign control. Campaigns can be easily stopped, paused, shorten, expanded or re-launched depending on activity or environment conditions.
- Previous examples and experience recorded in the platform will allow a better design of new campaigns.
- The platform permits the identification of active participants and allows co-creation traceability. This is, if multiple users collaborate in the creation of an idea, their inputs can be traced in the platform.

The aim now is to enhance the platform with new functionality taking into consideration the incremental development cycle approach. Thus next cases studies will be conducted at Mondragon Corporation.
The next steps on the research are the following:

- Enhance the platform to contemplate other aspects of the innovation process; technological surveillance, decision making or outcome traceability
- Exploit the semantic possibilities already available.
- Keep on collecting ideas and measuring the performance of the platform.
- Keep on analysing the success factors for the innovation process in case studies.

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