Supporting the Selection of Open Innovation Software Tools

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Abstract

In this paper, we present a Web Mining exploratory approach to establish a comparative selection of current Open Innovation (OI) software tools. The starting point of this study is related to "ELLIOT" European project (FP7 ICT) that aims to develop an Internet of Things (IoT) experiential platform involving citizens and users from the early stage of idea creation to the further implementation of innovative IoT applications and services. In this project, one of the objectives is to help the citizens exchanging ideas and co-creating new green services based on environmental data. For this purpose, we develop an exploratory assessment approach based on the QSOS method to elaborate a feature grid in order to support the selection of OI Tools. We find that most of the related works focus on theories about innovation process or product life cycle to classify OI Tools. Our approach combines web mining techniques to finally instantiate the first QSOS reference criteria template dedicated to OI Tools.

Keywords

Open Innovation, assessment methodology, data visualization, QSOS

Sommaire

1   Introduction

We present here our Web Mining exploratory methodology to select the best Open Innovation (OI) tools regarding our needs. The starting point of this study is related to the European project "ELLIOT" (FP7 ICT) that aims to develop an Internet of Things (IoT) experiential platform involving citizens and users from the early stage of idea creation to the further implementation of innovative IoT applications and services. In this project, one of the three specific use cases is dedicated to the deployment of a green services portal, connecting environmental sensors and providing environmental data to citizens. One of the pursued objectives is to help citizens in exchanging ideas and co-creating new services. Our intent is to focus our attention on OI Tools regarding more specifically Idea Management Process. For the rest of this paper, we adopt Prof. Henry Chesbrough's definition of Open Innovation as « … the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology. » [Chesbrough, 2006]. In other words, we consider Idea Management Systems as a part of Open Innovation technology, which qualifies a new type of tools dedicated to enterprises helping them to efficiently tap into the creativity of all of their employees. So, in this study, we focus our attention on tools "for collecting and organizing input from people regarding proposals for innovation of products and services" [Westerski, Iglesias, & Rico, 2010].

We begin with related works on OI Tools comparison (section 2). Then we deploy our own exploratory methodology (section 3) mixing the matrix we find, with some relevant information gateway websites and web mining data gathered with web mining techniques (section 4). The resulting assessment measures are detailed in the section 5 with our QSOS based selection method.

2   Related Works on Open Innovation Tools Comparison

In this section we report relevant studies related to the comparison of Innovation tools. In fact, our first work consists in scanning the literature to find comparative studies on OI Tools. The relative poor results we obtained by consulting the international scientific database INSPEC[1] gave us a hint on the multifaceted definition of Open Innovation and for most concerning the tools that enable the process of Open Innovation for the enterprises. In the following subsections, we focus our attention on two main states-of–the-art that present different but complementary theoretical backgrounds to classify OI Tools.

2.1   OI Tools Categories from a Top-Down Innovation Cycle Perspective

In [Cascini, 2004] and [Hüsig & Kohn, 2011], we find some interesting approaches regarding the concept of Computer Aided Innovation (CAI), aimed at supporting "firms throughout the entire innovation process" and integrating "other ICT systems and firm processes". Hüsig & Kohn analyzed 114 tools belonging to the whole innovation circle (see Figure 1) which encompass the process of Idea, Patent and Strategy Management. Regarding their thorough study on CAI concepts, methods and tools, they found out that historically, under CAI term, there was a small core of tools implementing theories and methods of Inventive Problem Solving (see TRIZ[2]). For example, the tool TechOptimizer of Invention Machine[3] [Busov, Mann, & Jirman, 2009] or the

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[1] I.e. 262 articles (updated research on the 14/04/2011) with the sentence "open innovation", no result with "open innovation tool" and "open innovation software"

[2] Cf. http://en.wikipedia.org/wiki/TRIZ or ARIZ

[3] http://www.inventionmachine.com

Creation Suite of Creax[4]. But new entrants of software vendors coming from GDSS (Group Decision Support Systems) or PLM (Product Lifecycle Management) to Business Intelligence areas enlarged their features to knowledge and innovation management. As a result, for comparing their CAI Tools list, Hüsig and Kohn proposed 16 subtopics generating the whole innovation cycle (see Figure 1).

Figure 1 The Innovation circle featuring CAI tools categories [Hüsig & Kohn, 2009, p. 553]

While Hüsig and Kohn 's researches embraced a very wide range of innovation cycle features, other authors considered the innovation cycle through a more restrictive innovation process, focusing especially on the Idea Management Process. Inspired by the earlier works of [Cormican & O'Sullivan, 2003] and [Bothos, Apostolou, & Mentzas, 2009], we find in [Hornitzky, 2010] or [Westerski, Iglesias, & Rico, 2010] the focus placed on the innovation flow and backflow with three main stages: the idea creation and capture stage, the idea assessment and enhancement stage and the final idea implementation stage. Westerski, in his PhD Thesis (under progress), develops a more detailed Idea Lifecycle around which he has created a dedicated semantic ontology that models Idea Management Systems[5] around five main stages which constitute the Idea Life Cycle process, that are : Idea generation, Idea Improvement, Idea Selection, Idea Implementation and Idea deployment [Westerski & Iglesias, 2011].

2.2   OI Tools Categories from a Bottom-Up Perspective

We focus here on the thorough work of Hrastinski & all [Hrastinski, 2010], the starting point of our study. Their methodology is a pragmatic one, beginning from a deep observation of 51 OI Tools. They used an exploratory search on Google with the 4 terms[6] (related to OI) to select a list of commercial tools and applied a statistical and iterative classification analysis to compare them into a matrix regarding the main features of technology for Open Innovation [Hrastinski, 2010, p. 9]. Their purpose was to find ways to classify OI tools, so they identified 43 features classified into seven main characteristics : *idea submission* (ways to post ideas), *problem submission* (like help-desk problem), *problem solving and analysis* (like TRIZ methods or mind mapping), *evaluation* (ways to rate the quality of ideas), *collaboration* (to share and communicate around ideas), *expert directory* (find experts to speed up the problem solving process) and *marketplaces* (describing places that connect solutions seekers with innovators). While analyzing correlations between these characteristics, they finally highlighted four main categories of Open Innovation Softwares. The first encompasses **Idea Management Systems** with submission, evaluation and discussion features, the second concerns **Problem Solving Solutions** whose features are more related to searching, expressing and solving problems, the third category is about **Innovation Marketplaces** where experts can solve suggested questions with rewards and recognition as

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[4] http://www.creax.com/

[5] http://www.gi2mo.org/

[6] I.e., « innovation system », « ideation », « idea management » and « open innovation »

incentive features, and finally, **Innovation Analysis Softwares** is the last category, with sophisticated tools for evaluation features.

2.3   Preliminary Conclusion

These preceding approaches are inspired on one hand, by theoretical points of views on Innovation process, on the other hand, we find bottom-up approaches from a market perspective, like in the PhD thesis work of James Hornitzky presenting a comparison matrix of 73 tools simply categorized by their market positioning (i.e. *Commercial organizational tool, Open intermediary, User innovation, Individual tool, Open source tool* and *service*) [Hornitzky, 2010].

It is quite interesting to note that there are only 4 tools in common by comparing Hüsig's list from a top-down point of view with Hrastinsky's list from a bottom-up perspective coming from commercial OI Tools analysis. So we consider this last study as a first cornerstone for defining a good selection criteria's list in order to assess and compare OI Tools. We present in the following section our methodological proposition to enhance for supporting the selection of best OI Tools according to some defined features.

3   Our Web Mining Exploratory Methodology for OI Tools Selection

Our intent is to find out how to make the best choice of an OI tool in order to animate idea exchanges among a community of participants. Comparing the methods used in the scientific literature explained in the previous section, our actual choice is to broaden the range of observations from a web mining point of view, coming from web analysis. We therefore give more details (see Section 3.2) on the exploratory method we built for our purposes and applied for the elaboration of an assessment grid of OI Tools based on the QSOS[7] method (cf. Section 3.1).

3.1   Introducing the QSOS Evaluation Criteria Method

We introduce in this sub-section our proposition to compare several tools according to a specific comparison grid. Even if there are others methodologies [Deprez & Alexandre, 2008], we decided to choose a comparative feature guidelines based on QSOS which is an open source methodology for assessing softwares, that can be summarized in four steps[8] :

1. Define the generic assessment grid by identifying and classifying the features to be compared via the analysis of the most relevant tools of the targeted market (i.e. survey tools, groupwares, wiki, etc...),

2. Assess the competing softwares by scoring the features individually,

3. Qualify the criteria that meet your needs, by assigning specific weight,

4. Select the tools by using QSOS filtering system that scores all competing softwares into a comparison grid and radar positioning visualization (cf. Figure 2 to see the complete QSOS process from the weighting template sheet grid to the assessment of the different selected OI Tools).

The QSOS evaluation criteria method is based on a tree-hierarchy grid with, at each ended criterion, a scoring procedure of three-leaf criteria (from $0 -$ "not covered" to $2 -$ "completely covered")[9].

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[7] QSOS = Qualification and Selection of Open Source software, see http://www.qsos.org

[8] See for more details the QSOS manifesto : "Method for Qualification and Selection of Open Source software" http://www.qsos.org/?lp_lang_pref=en&page_id=3

[9] The QSOS evaluation template sheet is always divided into two sections: the generic section includes criteria that are commonly applied to all software products (such as maturity, adoption, community of developers,

Generic template Grid   Weighting criteria Grid   Selection of OI Tools to be compared
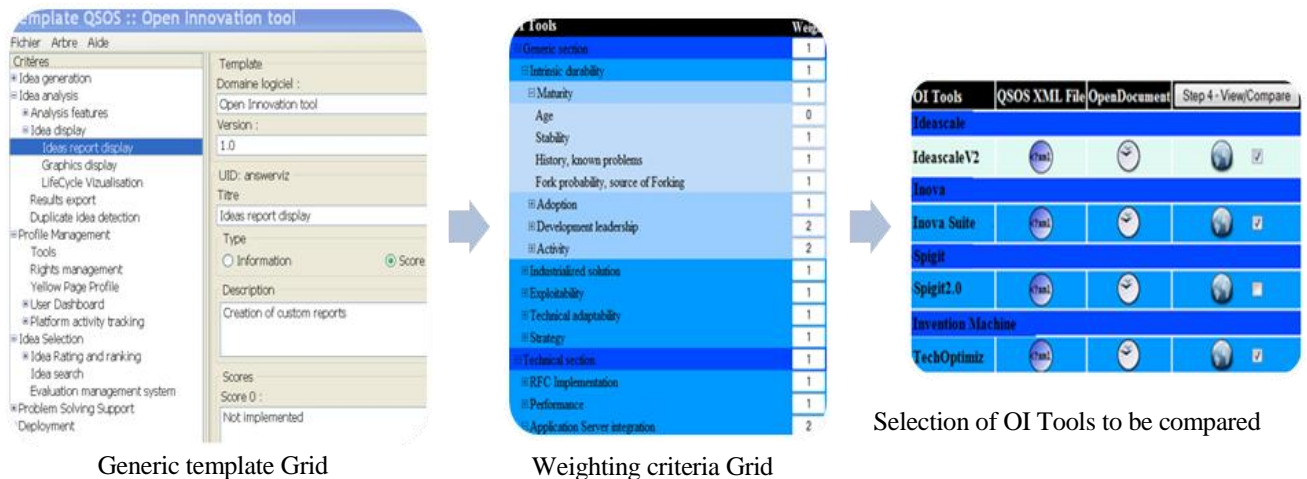
Figure 2 QSOS Define/Assess/Qualify/Select Software Selection Method

Once the reference criteria template is achieved (cf Figure 7 for map illustration), the intermediary step of the QSOS method is, for each tool belonging to the analyzed category, the creation of a dedicated template sheet that evaluates each criterion/feature of the tool according to the original reference template sheet. The final step is the use of the web application O3S[10] that supports QSOS method to access a selection of tools, using weighted scoring of criteria, and to allow the visualization of the results according to multiple axes. The resulting visualization (cf. Figure 8 for illustration) aims to help us choosing the best tool according to the criteria we defined as important for our needs.

The main difficulty of the QSOS method is concentrated in the first step to define the generic assessment grid of features that best describes the tools to compare. In the following subsection, we present our proposition to realize this first step as a generic and pragmatic approach.

3.2 A Web Mining Pragmatic Approach to Assess OI Tools

To achieve the construction of the OI Tools criteria assessment grid, we develop our pragmatic methodology based on web mining techniques (usage and content) to select top rated tools and to highlight generic technical and functional features belonging to Open Innovation, summed up in the following tasks :

1. Crawl the visible and invisible web to find relevant information sources that provide list of tools: begin with scientific literature on the web via Google Scholar or via dedicated databases such as INSPEC, ACM Portal to find comparative tools matrix, and align the comparison criteria. Then, use Google as a starting point by combining more than 3 and 4 tools names, to detect some gateway websites dedicating their content on software vendors [Borodin, & all, 2001]. Be sure of the relevancy and accuracy of these sites by checking the last updated modifications or the number of dead links in the tools list.

    The output of this task is to form the lines of your matrix with a full list of tools.

2.   Build up classification criteria to enhance multiple comparison axes. We decide to lay the emphasis on the popularity of these tools, by testing their citation degree in scientific portals such as ACM Portal[11] and using their Page rank[12] that shows the position of one or more sites in the top 1000 results for a particular list of keywords in Google and their

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documentation, packaging etc…) whereas the criteria belonging to the specific section are restricted to the functionalities mainly shared among the compared family product.

[10] Open Source Selection Software see : http://www.qsos.org/o3s/

[11] http://portal.acm.org/

[12] http://en.wikipedia.org/wiki/PageRank

positioning on Alexa (which benefits from millions of Alexa's toolbar users in order to check the popularity of websites in the world).

The output of this task is to constitute the columns of your matrix.

3. Make your tools selection with data mining techniques that highlight top rated tools and analyze the technical and functional features of the selected tools to find generic and common comparison criteria.

The output is finally the creation of your generic template sheet of criteria and the specific tool's sheets to compare them with the QSOS method.

The following section explains this pragmatic approach instantiated with the market of OI Tools, leading to the final QSOS Assessment Grid.

4 Our QSOS Selection Method of Open Innovation Tools

First the next three subsections address the step 1 of the QSOS method (cf. Section 3.1) applying our web mining approach to built the comparative assessment grid in the context of OI Tools. Then, we show various result visualizations related to the three last steps of the QSOS method.

4.1 Crawling Related Reference Data Sources

As a results of our web crawling, we find 4 gateway websites relevant to OI : **Capterra**[13] (a B2B marketplace), **Innovation Tools**[14] (website animated by an expert community), **Idea Management Blog**[15], **Ideaconnection**[16] (B2B platform dedicated to Open innovation and experts finding). From them, we extract a list of 84 tools, encompassing 38 from the 51 tools listed by Hrastinski (where 13 tools weren't active anymore) with 46 new tools to compare. We propose to modify the Hrastinski's functionalities classification by gathering under **Idea management System** term, the following categories : *idea submitting*, *evaluation* and *collaboration*, under **Problem solving system term** both *problem submitting* and *problem solving and analysis categories*, and mixing *marketplaces* and *expert directory* together. We have also extended it by another new category called **Social feedback tool**, encompassing suggestion box and user feedback for CRM applications. We propose our matrix inspired from Hrastinski'one in Table 1 adding details which are the tool country origin (cf. Figure 3 for a country focus), its presence in the previous related gateway web sources and the frequency of publications that cite the tool in the ACM Portal. Our matrix contains 84 lines for OI Tools.

Characteristics Open Innovation Tools	Idea management system	Problem solving system	Innovation and expert marketplace	Social feedback tool	Country	Nb of citation in Gateway sources*	Freq. of citations in ACM Portal**
1. e-Tipi	X	X			France	3	
2. UserVoice				X	US (California)	3	1
3. …							

Table 1 Enhanced Matrix of OI Tools comparison

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[13] Capterra is offering many lists of software vendors according to different topics, such as Call Center Software, Construction Management Software, Distribution Software, Document Management Software or Help Desk Software see : http://www.capterra.com/idea-management-software

[14] http://www.innovationtools.com/Products/ideamanagement.asp

[15] http://www.ideamanagementsystems.com/2010/10/44-idea-management-software-solutions.html
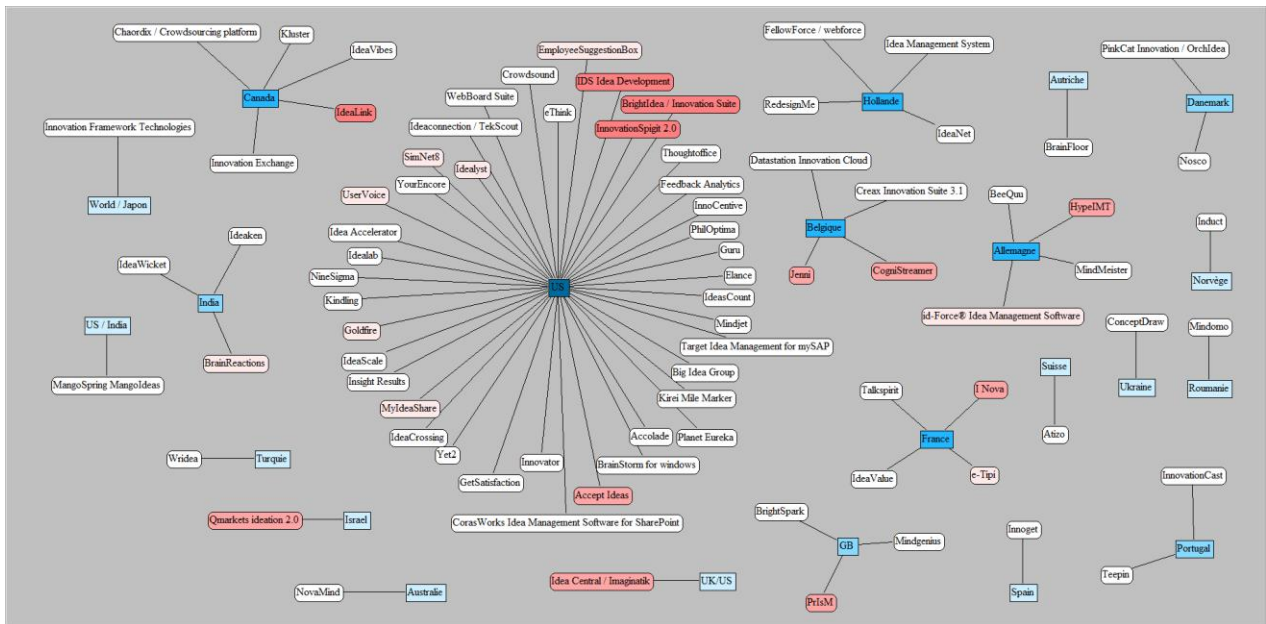
[16] http://www.ideaconnection.com/software/

Figure 3 : Network Analysis of the country's origin of the Tools (the countries in square boxes, the OI Tools in oval ones, the more reddish, the more popular in gateway sources they are)

4.2 Building up Classification Criteria based on Web Mining Techniques

To achieve the search of classification criteria, we use the web spider Matheo Web®[17] in order to extract from each website (of our 84 tools list) the metadata placed in the HTML source code to be better indexed by search engines and very useful for implementing some analysis, i.e. in our case the **keywords** and **description metadata**. Figure 4 represents the tag cloud of the main metadata keywords from our 84 OI tool list, with a frequency higher than 2.

In this tag cloud, even if the word "feedback" has a small frequency number, it is related with the expressions "customer feedback", "enterprise feedback" and "user feedback", that is why we decide to add the criterion **Social feedback tool** in our enhanced matrix adapted from Hrastinsky's work. We will see later in the analysis, that, even if these tools don't strictly belong to the idea management systems category we focus on (aimed at gathering customer feedbacks openly on products or services), they are also very popular on the web with high score of page ranking.
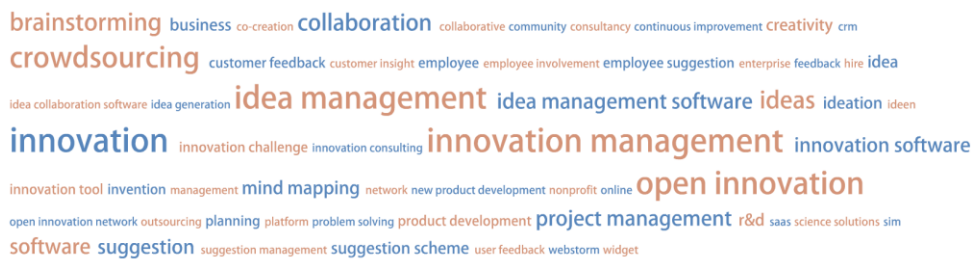

Figure 4 Keywords coining Open Innovation Tools (the biggest, the more frequently cited they are)

As a second "web mining" characteristic, we also choose to take into account the popularity of the OI tool's websites of our list. We query the SEOAnalyzer[18] for analyzing Google Pagerank with the list of our 84 OI Tools on the Top Open Innovation coined keywords we extract with our Web Spider (the keywords are with frequency from min 6 to 17), ie *open innovation, idea management, mind map, innovation software, ideation, crowd sourcing, suggestion box, problem solving, innovation, innovation tool, brainstorming, ideation, innovation system, innovation tool*.

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[17] http://www.matheo-web.com

[18] http://code.google.com/p/seoanalyzer/

One of the many ways to emphasize the top rated tools according to specific Open Innovation Keywords is to use data visualization means, such as the open source data visualization ManyEyes from IBM/Cognos[19], a public website where people can upload their own data, create interactive visualizations and carry on open discussions [Viegas, Wattenberg, van Ham, Kriss, & McKeon, 2006]. We see in Figure 5 the ranking of OI Tools on the two keywords "Idea Management" and "Brainstorming"
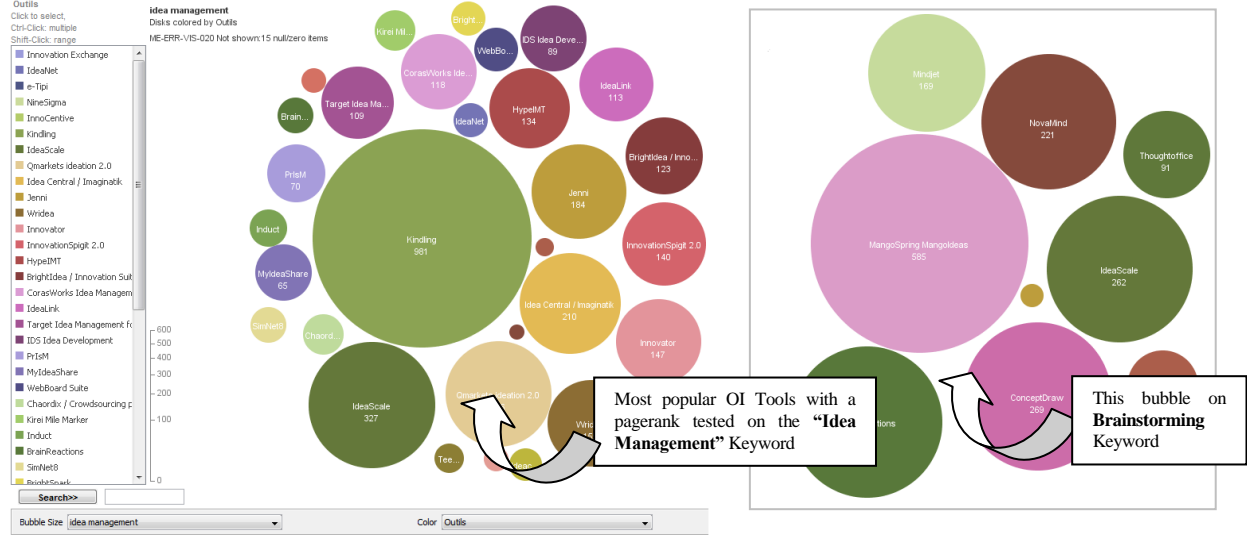

Figure 5 Top rated OI Tools with Google Pagerank on specific keywords. The bubble chart represents items by labeled circles (in our case : OI Tools), where areas are proportional to the given quantity (in our case : the highest Pagerank scores on OI keywords). On ManyEyes Site, this figure is interactive, and it is possible to export it as a widget on a web page.

4.3 Selecting Open Innovation Tools for Features Identification

We decide to keep only the 29 top rated OI Tools on our classification matrix (cf. Table 1) that satisfy the two following conditions: a) to be the most cited in the gateway websites (from 4 or 5 co-presence) and b) to belong from the top popular ranked tools (from Google PageRank and Alexa). Figure 6 shows OI Tools satisfying at least one condition gathered in three categories **Idea Management System** (which encompasses also tools dedicated to Problem Solving System such as Invention Machine or IdeaCentral of Imaginatik to simplify our primary analysis), **Social User Feedback** where we find that tools dedicated to customer suggestion are very popular (like the two Californian startups Uservoice or GetSatisfaction) and **Open Innovation Marketplaces**, proposing for online communities Client-Server idea management features. We decide also not to represent the tools dedicated to Mind Mapping i.e. Mindjet, MindMeister, ConceptDraw, NovaMind, because we consider Mind Mapping as a specific feature of Idea Management system :

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[19] http://www-958.ibm.com/software/data/cognos/manyeyes/

Figure 6 Our selection list of Open Innovation Tools. NB : the tool Crowd-Sound shut down in march 2011, leaving the place to the top sites in the category : Uservoice and GetSatisfaction, evident hint of a very high competitive market

Finally, we found only 6 OI Tools (mostly commercial) satisfying the two conditions a and b (**BrightIdea**, **InnovationSpigit 2.0**, **HypeIMT**, **Idea Central**, **Innovator**, **Jenni**), in order to realize a QSOS-based generic criteria grid for Open Innovation softwares. We first extract the technical and functional features of our 6 selected OI tools to find common shared categories with regard to related works described previously. Then, we group the Open Innovation features finally around **six main categories** (that will certainly evolve with further user experiences and feedbacks during the ELLIOT Project): **Idea Generation** with the submission process and means to discuss and collaborate, **Idea Analysis** with all the different analysis features, idea visualization, export of results, **Idea Selection** with rating and ranking mechanisms, evaluation systems and searching features, **Problem Solving Support** with specific features around solutions implementation, and two specific functionalities concerning the software platform, the **OI Tool deployment** and the **Profile Management**.

Figure 7 visualizes the full comparison tree-map categorization we use to build the reference software criteria sheet for the OI Tools to be compared.
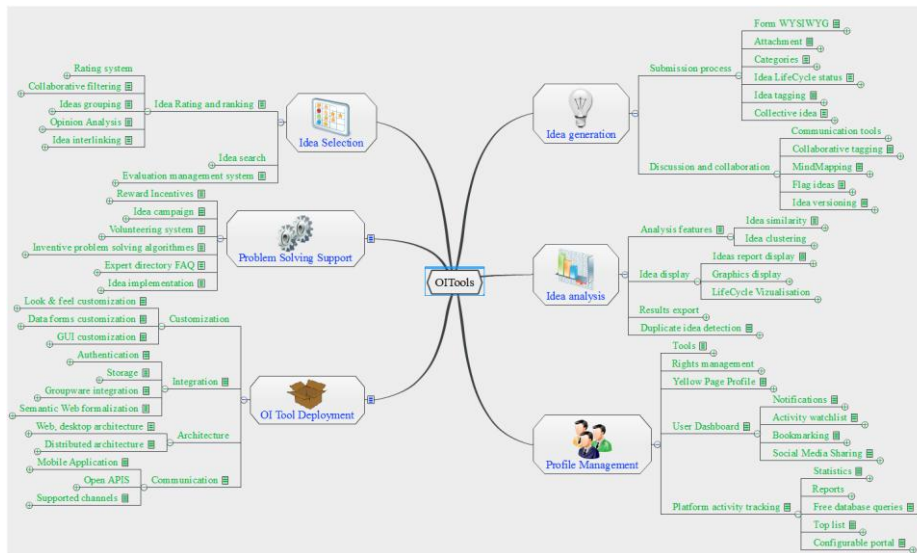
Figure 7 Our Comparison Grid for Open Innovation features

4.4 Result Visualisations of the last steps of the QSOS Method

This section aims to visualize results of the last third steps of QSOS method (cf 3.1) which have been applied on 4 top selected OI tools (Kindling, Ideascale, Invention Machine and Inova, a French company). Based on the previous generated comparison grid, step 2 and 3 of QSOS method are performed (cf. Figure 2). Then we create a dedicated template sheet that we manually fulfill for our 4 tools. Figure 8 shows the last step of the QSOS process. It allows to play with several selected comparison criteria of OI Tools.
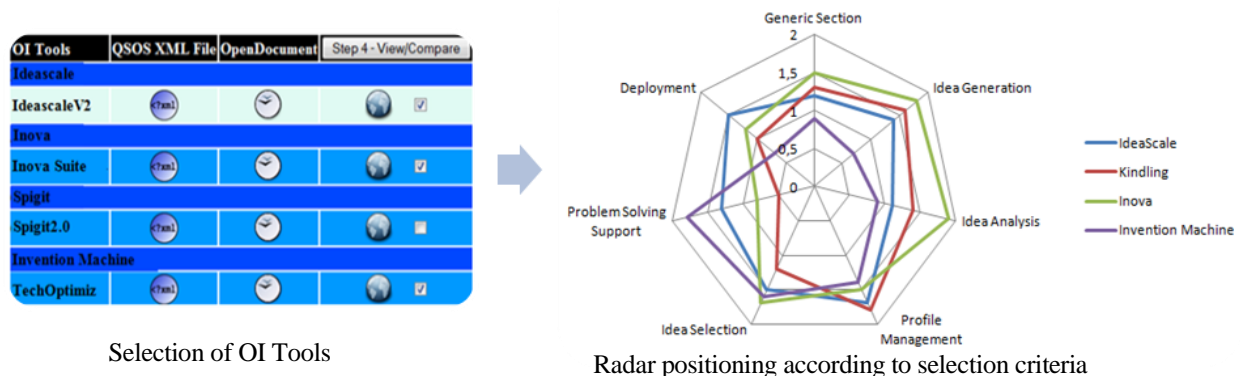

Selection of OI Tools

Radar positioning according to selection criteria

Figure 8 O3S web interface to visualize, compare and export evaluation

5 Conclusion

To conclude, this study proposes an exploratory methodology to best select commercial OI Tools according to specific needs : it is based on a new OI tool matrix (cf. Table 1), on web content mining techniques (keywords, metadata, pagerank) and finally on the selection of most relevant OI Tools for building the generic comparison grid. We then show the usefulness of the generated assessment grid in the context of QSOS evaluation method and the interest of the produced visualization according various features proposed by O3S application.

Future work aims to propose to the open source community our OI Grid keeping our contact with the QSOS team development team. We also plan to help them optimizing the actual methodology, being inspired by more interactive tools like the Mindomo[20] platform or the open

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[20] http://www.mindomo.com : Mindomo enables widgets of easy created Mindmaps

data publishing site TableFly[21], that puts any data into comparison tables. Future investigation is planned to strengthen our reference OI criteria grid by comparing it with other works on categorization of OI process, like in [Reinhardt, Wiener, & Amberg, 2010] or [Iversen, & all, 2009]. Finally, we intend to pursue this primary work by experimenting some idea generation platforms with end-users during the ELLIOT Project, in order to get their feedbacks.

Acknowledgement

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[21] http://tablefy.com/