The Development of a Cross-Industrial Community of Practice Using Participatory Design

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Abstract
Manufacturing organisations require strategies to promote collaboration and innovation, to maintain a competitive advantage in the current industrial marketplace. Many organisations are now employing Communities of Practice (CoP) to manage complex knowledge for manufacturing purposes, with some focusing on virtual communities to support collaborative activities, over geographically distributed locations. The Use-it-Wisely (UIW) project (EU-FP7-07-609027) aims to develop a cross-industrial virtual community that crosses traditional organisational boundaries, to provide a platform for collaboration between manufacturing industries. This paper describes a participatory design process to elicit requirements for the virtual community from potential members. The findings were used to establish a development plan that linked the identified requirements to the most appropriate platform. The initial platform of the UIW cross-industrial virtual community is presented.

Background
Improved industrial performance is associated with the extent to which organisations can collaborate within and between groups (Patel et al., 2012; Pan & Leidner, 2003). An increasing number of organisations are using CoPs to support collaboration and assist with innovation and complex working activities, with the aim of increasing productivity and creativity (Reinau, 2011; Wenger, 2009). A CoP consists of individuals who routinely engage with members, in response to a collective interest to form a shared practice, each being jointly responsible for the development of a pool of knowledge that is focused around the shared practice (Eckert, 2006; Wenger et al., 2000).

Collaborative technologies support virtual communities, facilitating innovation over geographically distributed locations (Farooq et al, 2007; Johnson, 2001) and work activities across time zones (Alisis 2009; Scarso & Bolisani, 2008). While research into virtual communities has been dominated by studies on intra-organisational platforms, fewer efforts have been made to investigate platforms that can be configured to the needs of a number of organisations to facilitate external collaboration. Therefore there is limited understanding of the potential of virtual communities to foster the creation of cross-industrial knowledge (Reinau, 2011; Scarso & Bolisani, 2008).

To address this need, the UIW project aims to establish a platform that provides opportunities for knowledge exchange between different industries. The cross-industrial element to the virtual community creates a number of issues such as a domain that is too general and cannot be personalised to the individual members and their activities; further, a lack trust and confidence between industries may negatively affect relationships and the members' ability to learn from each other. This problem can be partially overcome through good design techniques that encourage engagement, along with the implementation of the appropriate platform (Johnson, 2001).

A participatory design approach involved individuals who are potential members of the UIW cross-industrial virtual community during the early stages of its design. This can increase feelings of ownership of the community and ensures the required functionalities are implemented, therefore increasing its potential utility. This paper reports on a study which identified the main user requirements for the initial design and development of the cross-industrial virtual community.

Method

Stakeholders from the UIW consortium took part in the study, including representatives from the research partners and the six industries: energy, machinery, space, office workspace, vehicles, and ship-building. All consortium members had considerable experience with communication technologies and were to be the initial members of the virtual community. Two workshops were held to elicit their requirements and to establish a design for the initial platform.

Workshop 1
The first workshop took place in September 2015 in Helsinki, Finland with 29 UIW consortium members. The aim of this workshop was to identify the main functions required by the consortium for the virtual community.

A PowerPoint presentation provided detailed information on virtual communities and a specific mission statement on the UIW platform to ensure participants clearly understood the purpose of the virtual community. After the presentation, participants were asked to think creatively about how they would use the virtual community and what functions they would like to see included. Participants were encouraged to choose as many functions as they wished, and write each one on a single note. This resulted in a large number of notes which were recorded and categorised into groups (see results).

Workshop 2
The second workshop took place in December 2015 in Malaga, Spain and consisted of 28 participants from the UIW consortium. The findings of Workshop 1 were presented, that is, the elicited functionalities, requirements and their subsequent categorisations. Participants were grouped according to their industries and were asked to freely discuss the categories, requirements and functions in order to
- identify one important function from each category

- discuss how the function would be used
- discuss the content that would be associated with the function.

Each group illustrated their ideas on paper and presented their findings to the whole consortium, including the virtual community development team. The results were recorded and used as a basis for the selection of an appropriate platform.

Results

The data collected from Workshop 1 was analysed using keyword identification content analysis (Neale and Nichols, 2001). This was achieved by identifying keywords in the requirements list and categorising them into four main categories:
- virtual tools and strategies
- contacts and communication
- repositories and articles
- news and conferences.

These categories and the identified requirements are shown in columns one and two of Table 1, with column three showing the amount of times the requirement was identified. Within the *Virtual Tools and Strategies* category the requirements identified included tools for sharing information, with the 3D model viewer being the most requested tool by the participants, while the *Repository* category contained requirements for storing information with live chat and social networking tools being the most requested. The *Contacts and Communication* category includes the tools for networking with individuals or groups with a document repository being the most requested tool by the participants. Finally, the *Articles, News and Conferences* category provides a system for the introduction of new material into the community, and a tool for the management of marketing material was the most requested requirement. In Workshop 2, each group prioritised one requirement in each of the four categories, along with how it would be used and what content it would contain, with columns four and five of Table 1 summarises the findings.

The overall findings from both workshops formed the basis of a discussion to implement a platform for use as the initial UIW cross-industrial virtual community. This discussion involved surveying the platforms available on the market to find the most appropriate to cover the requirements presented in the workshops. In addition, the selection process also considered the flexibility and adaptability of the software tools to allow the nature of the community to evolve as the group dynamic develops over time, while not being too prescriptive in how the tools were to be used.

Table 1; Functionality requirements, usage and content of the virtual community

Functionalities	Requirement	Number	Usage	Content
VIRTUAL TOOLS AND STRATEGIES	3D model online viewer	8	Sharing information with AR/VR/MR function	HOM3R- Hierarchial products Model 3D viewer for sharing documents, photos, videos, CAD files, technical data etc.
	Webinar	2	Cross functional collaboration tool	Sharing tacit knowledge through video calling functionality.
	Wiki	4	Knowledge and data sharing in a public space	Cross functional collaboration through subject specific function e.g. subject search, past behaviour link etc.
	Sharing information tool	4	Open source project places and private spaces to help with decision making, document and data sharing and storing	Community documents with links to external documents, software, CAD files, photos, spread-sheets, etc.
	Lessons learnt system	1	For technical solutions	Content for the lessons learnt space
CONTACTS AND COMMUNICATION	Forums and focus groups	5	Getting members together to discuss common topics and challenges and calls for collaboration	Business issues and the use of AR and VR technologies social networking (LinkedIn connection) and forums proposal/collaboration preparations
	Internal and external contact network	3	Different places for different people e.g. owners, manufacturers, surveyors etc. networks	Network of industrial actors
	Live chat and social networking	6	For special interest groups	Networks for experts/contacts and posting page e.g. for issues, Q & A, FAQ, etc. along with a LinkedIn plug in
REPOSITORY	Software repositories	2	Functionality and downloads space for software	Software applications
	3D model repositories	2	Base for implementing additional tools	HOM3R- model 3D viewer structural engineering calculations
	Document repository	7	Easy to use, easy to manage and private space for documents	Memos, slides, new guides, procedures and legislation, public working documents, standards, knowledge
ARTICLES, NEWS CONFERENCES	Paper/articles	2	Repository (including private places) and communications	Industry news blogs and articles about industrial processes and applications such as HOM3R etc.
	New guides, procedures, legislation	1	Learning new things, getting benefit and concrete information	Guides on how to use tools and operating models
	Marketing material	7	Advertising of industrial articles and conferences	Brochures, public working documents/ standards Networks – experts/contacts along with media monitoring and alerts for signed up members

From the discussions, Bitrix24 was chosen and provides advanced web applications for collaboration and communication and covers all the categories and most of the requirements identified in the workshops. In addition, it supports all major operating systems, has the ability to output text and image files and can support a range of databases and data exchanges between the majority of Web program languages. A screenshot of the virtual community main web page is shown in Figure 1.

Figure 1. The UIW cross-industrial virtual community interface (Bitrix24 platform)
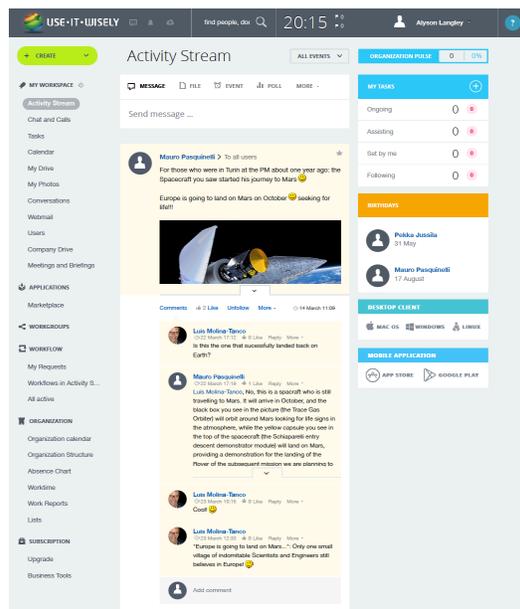
Discussion

In this paper, the initial functionalities and design of the UIW cross-industrial virtual community was presented. Potential members took part in workshops to identify functions, features and capabilities of the virtual community, increasing its potential utility in sharing experience, ideas and knowledge across different industries. The workshop findings drove the initial implementation of Bitrix24 as an appropriate platform for the UIW cross-industrial virtual community, as it provided the main range of functions identified in the workshops.

The UIW virtual community is in its first stage of development and requires further evaluation and development. If cross-industrial virtual communities are to be employed, evidence is needed on their ability to create an environment in which individuals from different domains can collaborate and exchange knowledge. The current understanding of cross-industrial virtual communities is limited and more theoretical and empirical investigation is required on how cross-industrial communities support collaboration activities and innovation as well as address the fundamental issues of trust and competition between different industries.

Researchers will also need to consider organisational, social, cultural, economic and technical characteristics of each type of organisation, which will all have an effect on the success of the community.

Conclusion

This paper described how participatory design methods contributed to the early development of the UIW cross-industrial virtual community. Requirements obtained from potential members of the virtual community determined the most appropriate platform that was capable of supporting a number of different industries and their activities. The ability of virtual communities to meet the needs for cross-industrial collaboration has yet to be established; however, this study has advanced the concept and commenced the development of a platform that has the potential to support collaboration and innovation between different manufacturing organisations. Future evaluation of the virtual community has the potential to contribute to concepts of knowledge creation and exchange between different industries and organisations.

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