

# EXPLORING THE IMPACT OF ORGANIZATIONAL AND WORKING MODELS, INCENTIVES AND COLLABORATION STRATEGIES ON INNOVATION DEVELOPMENT IN ONLINE COMMUNITIES OF PRACTICES

Alessandro Annarelli<sup>1</sup>, Cinzia Battistella (lead author)<sup>1</sup>, Fabio Nonino<sup>2</sup>

<sup>1</sup> Faculty of Science and Technology, Free University of Bolzano-Bozen, Bolzano-Bozen, Italy, [alessandro.annarelli@natec.unibz.it](mailto:alessandro.annarelli@natec.unibz.it); [cinzia.battistella@unibz.it](mailto:cinzia.battistella@unibz.it)

<sup>2</sup> Department of Computer, Control and Management Engineering, Sapienza University of Rome, Roma, Italy, [fabio.nonino@uniroma1.it](mailto:fabio.nonino@uniroma1.it)

**Abstract:** The aim of the research is to evaluate the actual phenomena of online communities for software development and their potential expansion as intermediary platform in open innovation processes. Consequently, the present paper propose an in-depth analysis of the characteristics of the virtual communities of practice that drive the innovative development of web applications. The driving research questions are:

- Which are the preeminent characteristics of practice communities that can favor the process of creation and realization of a web application?
- Do these characteristics differ in the different phases of web-application building project (ideation, design, realization and verify)?

We adopted a multiple case study research design. After a selection of communities of practice related to the development of a web application, we obtained a sample of 46 communities of practice. We classified them basing on the different processes that support the different phases of the innovation process in software development analyzing six important characteristics for each one.

The results of the empirical analysis shows that best practices are:

- In reference to members' involvement (strategies to attract and to permit to collaborate), the use of open source projects or challenges as organizational and working models to attract and to motivate community's members and strategies like royalties concession, direct charging of participation task from the community and fixed project deadline as form of incentives to be used;
- In reference to the role of the community and of community members in software development, the support from other developers, involvement of professional developer and direct contact as form of strategies of collaboration.

**Keywords:** Online communities of practice, web applications projects, innovation

## 1. Introduction

A virtual team/community of practice is a group of knowledge workers (often temporary) who work geographically, organizationally and/ or time dispersed with links strengthened by webs of communication technology (Powell *et al.*, 2004; Ebrahim *et al.*, 2009). Virtual communities of practice represent a new learning, network collaboration and innovation paradigm (Wenger *et al.*, 2002). Online social communities represent a form of interaction among people enabled by ICT. They created new means for knowledge and information sharing, making easier and intuitive cooperation, facilitating interaction between different people dislocated far away in the world and permitting innovation.

Examples are different. Communities of Practice like Sap's SDN developer network, Adobe's XMP forum, Sermo for physicians, or domain-specific corporate-internal communities such as those found at HP, revolve around people's professional or vocational needs for connections, information, identity and sense of belonging. Online communities of practice run the gamut from forums, faqs, to email list serves. Offline communities of practice include user groups such as ASUG and eBay's annual "Live" event.

Communities of practice provide a critical resource to professionals who want and need recommendations, pointers, tips and tricks, best practices, insights and innovations. Part of what makes a community practice strong is the aggregation of relevance; that is, people and information related to a coherent set of topics, which certain people will find interesting, useful, and potentially profitable. Advantages for companies derive by the fact that they can procure the best talent without geographical restrictions (Vlaar, 2008) but also difficulties of coordination and management can arise. According to Hambley *et al.* (2007), "virtual teams require new ways of working across boundaries through systems, processes, technology, and people, which requires effective leadership...".

Wenger *et al.* (2009) argue that virtual communities change the way we think of community. Online communities of practice are novel keystone for the software innovation process (Hugher *et al.*, 2007) and for knowledge development, knowledge sharing and knowledge exploitation in a virtual context. So, the in-depth

comprehension of their characteristics, and how these characteristics are associated to an high quality innovation process, contributes to innovation and knowledge management research providing both academic and managerial implications. From an innovation and project management point of view, the question is which static and dynamic characteristics (the structure of the website and the behaviour of the community management) can favour innovation. This paper focuses on the innovative cases of web application development, as virtual communities are widely used for software development.

The aim of the research is to evaluate the characteristics of the virtual communities of practice that drive the innovative development of web applications. In particular, we would like to identify the characteristics of practice communities that can favour the process of creation and realization of a web application and investigate if these characteristics differ in the different phases of a web-application building project (ideation, design, realization and verify).

After presenting a theoretical background of communities of practice and virtual communities of practice, the paper will carry on an analysis of the major virtual communities nowadays active, with a focus on their possible contribution to web applications development, followed by a discussion of the results obtained.

## **2. Theoretical background**

### **2.1 Communities of practice and project teams**

CoPs appear to be an alternative to traditional project teams for solving a problem. First of all, the group in virtual communities is composed by auto-selection (there can be full-time and part-time members, or also members who join the team for free) and it is an informal and self-organised organisation, while project team members are selected for their ability to contribute to objectives and it is a hierarchical organisation with a project coordinator. A leader leads a project team with predefined goals, stages, and roles that generally do not change during the project, and the team ungroups after project completion. Instead a (V)CoP is often created structurally, with many goals as many as those of community members; roles are defined by each member's knowledge, and they have a dynamic nature; a (V)CoP can exist as long as its members have interest in it and in related issues (McDermott, 1999).

The points of attention for management of virtual communities are different from that of management of project teams, and in particular:

- *Motivation* is a key factor for the success of a CoP: people are motivated to actively participate in a CoP when they see knowledge as a public good, a moral duty, or as a common interest. Some members can be motivated with tangible rewards (Ardichvilli *et al.*, 2003). There are three main aspects of a virtual team - purpose, people and links. While purpose is an important aspect for all organizations, it is the most critical aspect for virtual teams; purpose is what holds a virtual team together. Virtual teams do not have hierarchy or any other common structures because they may not be from the same organization, and purpose here brings and holds the team together. Purpose is generally translated into certain action steps for people to work on with a defined structure consisting of common goals, individual tasks and results.
- Social presence can be defined as "the degree of relevance of a person in an interaction and the resulting importance of interpersonal relationship" (Tu, 2002): it can influence the individual degree of engagement in a CoP (especially virtual), breaking several barriers that can inhibit knowledge sharing.
- *Collaboration* is an essential element to guarantee the success of a CoP. Usually more experienced members, and those with a higher educational level, are more likely to promote collaborative culture (Sveiby and Simon, 2002).

Therefore, the problems for management regard from one side motivations and engagement (because members are self-selected) and from the other connection and coordination of many interdependent members and tasks (because there is no hierarchy).

### **2.2 Research gap: suggestions on how to manage communities of practice**

In literature, there can be found suggestions and indications on how to manage (V)CoP in a proper way but the suggestions are mainly directed toward *improving learning conditions and outcomes, and not innovation outcomes*.

The literature presents studies directed on analysing the structure of the community and the specific characteristics that improve outputs. Rutkowski *et al.* (2007) identify as influencers also the specific characteristics of the members. For example, team members with a higher degree of focused attention and aggregate lower levels of temporal dissociation may have higher performance. Other characteristics such as

the technical expertise of a team seems to have a positive effect on the team's performance and the satisfaction of belonging to the team (Van Ryssen and Godar, 2000).

Other authors begin to identify the ways to manage the community in order to improve. Wenger *et al.* (2002) for example, considering that is not possible to "plan learning process", define some conditions for managing communities in order to improve learning outcomes:

- Avoid an excessively formalization of the community and facilitate and promote the community integration into the organizational structure. Design of a virtual team means that forming a VT should be planned and the interactions should be structured. Research has found that team building exercises, the establishment of shared norms and the establishment of a clear team structure helps the team to succeed (Sarker *et al.*, 2001). Communication tools such as knowledge databases and sharing of language and mental models are substitutes for the important face-to-face time (Kirkman *et al.*, 2004). Coordination is positively associated with virtual team performance. However, it is difficult for virtual teams to coordinate across time zones, cultural divides and divergent mental models (Kayworth and Leidner, 2000). The development of a type of collaboration norms within the team are necessary for a team to meld team members' contributions (Sarker *et al.*, 2001).
- Promote learning and processes of identification with the community. A way to improve team performance is to have consistent training (Kaiser *et al.*, 2000). For instance, mentoring is a good way to make personal ties to more experienced virtual team professionals (Suchan and Hayzak, 2001). According to Tan *et al.* (2000), consistent training fosters cohesiveness, trust, teamwork, commitment to team goals, individual satisfaction and higher perceived decision quality. Leadership and cultural differences also have a large impact on the effectiveness of communication (Kayworth and Leidner, 2000).
- Encourage learning-by-doing processes instead of formal ones and foster learning that integrates the three forms of belonging to the community: commitment, imagination, and alignment. Because of geographical distribution, face-to-face time occurs only rarely. This results in weaker social links between teammates and leads the team to be more task-focused than socially focused (Powell *et al.*, 2004). Meetings should be held as much as possible at the beginning of the team formation in order to bring teammates closer and form interpersonal bonds. These meetings should focus more on relationship building than on actual business (Robey *et al.*, 2000).

When comparing the performance of traditional and virtual teams, the results are mixed. Some studies find traditional teams and some virtual teams to be better. The majority of studies have found the teams to be about at the same level. Powell, Piccoli and Ives (2004) list many studies that have found different factors, which make virtual teams successful. These found factors are: Training, team building and team cohesiveness; strategy/goal setting, coordination and commitment of the teams and competitive and collaborative conflict behaviors; and developing shared language and communication.

*As regards innovation, research is more concentrated on performance than on characteristics and management of virtual communities.* The majority of research has not found significant evidence of difference between the decision quality of virtual and traditional teams and the number of ideas that were generated (Archer, 1990; Lind, 1999). However Chidambaram and Bostrom (1993) found that virtual teams generate more ideas compared to traditional teams. As there are many constraints with working virtually, virtual teams require a longer time to reach a decision.

We think that virtual communities are new forms for generating innovation, we consider important to analyse characteristics of the community and management practices directed to improve innovation performance. Moreover, we suppose that these different ways to manage a (Virtual) Community of Practice *are dependent and differ depending on the project phase in which we are operating.*

Literature in this sense presented only research focused on the different effects of virtualness on teams depending on the length of team duration (de Guinea *et al.*, 2000) and on communication efforts (Solomon, 2001).

### **3. Research methodology**

#### **3.1 Research questions**

The aim of the research is to evaluate the actual phenomena of online communities of practice in software development and their potential expansion as intermediary platform in open innovation processes. Consequently, the present paper proposes an in-depth analysis of the characteristics of the virtual communities of practice that drive the innovative development of web applications. The driving research questions are:

- Which are the preeminent characteristics of practice communities that can favour the process of creation and realisation of a web application?
- Do these characteristics differ in the different phases of web-application building project (ideation, design, realization and verify)?

### 3.2 Method

We adopted a multiple case study research design. After a selection from the web of communities of practice related to the development of a web application, we obtained a sample of 46 communities of practice. These are reported in Table 1.

**Table 1:** Virtual Communities of Practice.

Alioth (debian)	Innocentive
Amazon mechanical turk	Innoget
Applits	Innovation exchange
Appsquare	Javaforge
Berlios	Kick stater
Betavine	Linux
Big idea group	My startbucks idea
Chaordix	Napkin labs
Clickworker	Ninesigma
Cmnty	Ohloh
Collabnet(tigris.org)	Ow2 consortium
Connect+develop	Presans
Datastation	Qmarket
Dell ideastorm	Skild
Flintbo	Sourceforge
Funding circle	Topcoder
Gnu savannah	Utest
Google code	Venture spirit
Hypios	Wellspring worldwide
Ideaconnection	Wikipedia
Ideaken	Xircles (codehaus)
Ideasbrewery	Yahoo answer
Imaginatik	Yet2.com

Some preliminary considerations led to the exclusion of less interesting communities. We first excluded the communities directly connected to a company, in particular: Connect+Develop, My Starbucks and IdeasBrewery. Then, we excluded online communities not directly connected to web applications, e.g. OW2 Consortium, Funding circle, Wikipedia and Yahoo Answer. Subsequently we excluded those platforms made by companies that create online communities or contests under request of organizations: Big Idea Group; Chaordix; CMNTY; Datastation; Venture Spirit; Wellspring Worldwide; Imaginatik; Napkin Labs; QMarket; Skild. This exclusion was made because we are looking for already existing communities, thought to facilitate applications development phases, and not those that have yet to be realized. Finally we obtained the list of (V)CoP to be analysed, reported in Table 2.

**Table 2:** Final set of Virtual Communities of Practice.

Alioth (debian)	Gnu savannah	Linux
Amazon mechanical turk	Google code	Ninesigma
Applits	Hypios	Ohloh
Appsquare	Ideaconnection	Presans
Berlios	Ideaken	Sourceforge
Betavine	Innocentive	Topcoder
Clickworker	Innoget	Utest
Collabnet (tigris.org)	Innovation exchange	Xircles (codehaus)
Dell ideastorm	Javaforge	Yet2.com

Flintbo	Kickstarter
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#### 4. Characteristics of virtual communities for web application development

For each virtual community, we identified and classified the following characteristics in order to have a structured classification of the communities (Figure 1):

- *Posting new idea/project*: a user can post his/her new idea or create a new project on the site.
- *Votes/Comments on ideas*: a user can express a preference for an idea and comment it.
- *Survey*: a user can create a survey to know what other users think of his/her idea.
- *Contest/Marketplace*: users and/or companies can create contests on the site.
- *Only students/professionals*: a user to register must be a student or professional worker.
- *Participation on invitation/confirmation*: related to projects and/or contests.
- *Forum/New discussion*: existence of a space where users can talk and discuss about their ideas.
- *Monetary reward/Royalty/Reputation*: regarding rewards for contest winning.
- *Hardware/methods*: the community realizes physical products or projects methodologies.
- *Desk app/Mobile app/Middleware*: the community realizes software of one or different kinds.
- *Crowdsourcing*: a user can rely on community support to solve a specific problem.
- *Collaborative crowdsourcing*: a user can enter a group to solve a problem or win a contest.
- *User's dashboard*: existence of a dashboard for each user.
- *Wiki/Explanation/Online chat*: to consult information, solve problematic, receive assistance.
- *Development software*: community offers software and/or development tools to users.
- *Link to external resources*.
- *Open source*: open source nature of the project.
- *Document hosting/management*: the site offers tools to manage/host project documents.
- *Social connections*: possibility to connect with major social networks.
- *Test/issue tracker*: possibility to test realized projects with the community and specific tools.

After the identification of these characteristics, we classify communities in order to identify those more suitable for a specific phase of web applications development. To do so, we grouped (V)CoP characteristics with the most suitable phase of project development :

1. Concept: application design and feasibility analysis
  - *Posting new idea/project*
  - *Votes/Comments on ideas*
  - *Survey*
2. Design and Requirements: definition of application functions and specifics.
  - *Contest/Marketplace*
  - *Only students/professionals*
  - *Participation on invitation/confirmation*
  - *Forum*
  - *Monetary reward/Royalty/Reputation*
3. Implements: realization of the application code respecting requirements.
  - *Hardware/methods*
  - *Desk app/Mobile app/Middleware*
  - *Crowdsourcing*
  - *Collaborative crowdsourcing*
  - *User's dashboard*
  - *Wiki/Explanation/Online chat*
  - *Development software*
  - *Link to external resources*
  - *Open source*
  - *Document hosting/management*
4. Test: application test with possible corrections.
  - *Social connections*
  - *Test/issue tracker*

Finally we calculated percentages for each phase and for each (V)CoP and we group (V)CoP basing on relevant percentages in each phase.

From this re-classification of (V)CoP we can observe that some of them present a high score in more than one phase in application development. In particular, we decided to analyse in detail the communities that obtained the highest percentage score in a single phase or more. For the analysis, we have considered only the communities with highest score in one or more of the six phases of Application development process. These (V)CoP are:

- Appsquare: Concept phase
- IdeaConnection: Design phase
- Sourceforge: Implements phase
- Utest: Test phase
- Innocentive: Concept & Design phases
- Betavine: Concept & Implements
- TopCoder: Design & Implements

COMMUNITY OF PRACTICE	POSTING NEW IDEA/PROJECT	VOTES/COMMENTS ON IDEAS	SURVEYS	CONTEST/MARKETPLACE	ONLY STUDENTS/PROFESSIONALS	PARTICIPATION ON INVITATION/CONFIRMATION	FORUM/NEW DISCUSSION	MONETARY REWARD	ROYALTY	REPUTATION	HD/METHODS	DESK APP	MOBILE APP	MIDDLEWARE	CROWDSOURCING	COLLABORATIVE CROWDSOURCING	USER'S DASHBOARD	WIKI/EXPLANATION/ONLINE CHAT	DEVELOPMENT SOFTWARE	LINK TO EXTERNAL RESOURCES	OPEN SOURCE	DOCUMENT HOSTING/MANAGEMENT	SOCIAL CONNECTIONS	TEST/ISSUE TRACKER
ALIOTH (DEBIAN)																								
AMAZON MECHANICAL TURK																								
APPLITS																								
APPSQUARE																								
BERLIOS																								
BETAVINE																								
CLICKWORKER																								
COLLABNET (TIGRIS.ORG)																								
DELL IDEASTORM																								
FLINTBO																								
GNU SAVANNAH																								
GOOGLE CODE																								
HYPIOS																								
IDEACONNECTION																								
IDEAKEN																								
INNOCENTIVE																								
INNOGET																								
INNOVATION EXCHANGE																								
JAVAFORGE																								
KICKSTARTER																								
LINUX																								
NINESIGMA																								
OHLOH																								
PRESANS																								
SOURCEFORGE																								
TOPCODER																								
UTEST																								
XIRCLES (CODEHAUS)																								
YET2.COM																								

Figure 1: (V)CoP with characteristics.

COMMUNITY OF PRACTICE	POSTING NEW IDEA/PROJECT	VOTES	COMMENTS ON IDEAS	SURVEYS	%	CONTEST/MARKETPLACE	ONLY STUDENTS/PROFESSIONALS	PARTICIPATION ON INVITATION/CONFIRMATION	FORUM/NEW DISCUSSION	MONETARY REWARD	ROYALTY	REPUTATION	HD/METHODS	DESK APP	MOBILE APP	MIDDLEWARE	CROWDSOURCING	COLLABORATIVE CROWDSOURCING	%	USERS'S DASHBOARD	WIKI/EXPLANATION/ONLINE CHAT	DEVELOPMENT SOFTWARE	LINK TO EXTERNAL RESOURCES	OPEN SOURCE	DOCUMENT HOSTING/MANAGEMENT	%	SOCIAL CONNECTIONS	TEST/ISSUE TRACKER	%
ALIOTH (DEBIAN)					50														38							83			0
AMAZON MECHANICAL TURK					0															23							17		50
APPLITS					75															46							0		50
APPSQUARE					75															46							0		0
BERLIOS					20															38							67		100
BETA VINE					75															46							83		50
CLICKWORKER					0															31							17		50
COLLABNET (TIGRIS.ORG)					25															38							100		100
DELL IDEASTORM					75															46							17		50
FLINTBO					25															23							33		50
GNU SAVANNAH					25															38							67		100
GOOGLE CODE					25															31							83		100
HYPLOS					75															54							17		50
IDEACONNECTION					75															85							50		0
IDEAKEN					25															62							50		0
INNOCENTIVE					75															77							33		50
INNOGET					20															62							33		50
INNOVATION EXCHANGE					0															54							17		0
JAVAFORGE					75															38							100		100
KICKSTARTER					75															46							17		50
LINUX					25															31							17		0
NINESIGMA					75															54							50		50
OHLOH					75															31							67		100
PRESANS					25															62							33		0
SOURCEFORGE					75															31							100		100
TOPCODER					50															70							83		50
UTEST					25															54							67		100
XIRCLES (CODEHAUS)					25															46							100		100
YET2.COM					25															70							33		50

Figure 2: (V)CoP and related percentages for each set of characteristics, grouped on the basis of development phases.

### 5. Detailed analysis of virtual communities

**APPSQUARE:** It is the community with the highest rank in Concept phase for Application development. It was created by Italian mobile services provider Tre Italia, as an online platform open to anyone interested in applications development, which can be an expert or simply someone with a good idea: on the board they can discuss about implementation/design of applications, and developers can also find work announcements. The site is well structured, with a user-friendly design, and a clear explanation on the home page of what Appsquare is and how it works. Users' commitment is ensured by the possibility of accumulating royalties of developed and commercialized applications; moreover for developers there is the possibility to improve their own skills and work thanks to ads structured as virtual contracts (users' posting idea set a budget limit).

**IDEACONNECTION:** It is a community of problem solvers, whose scope is synthesized in the mission statement "To give business access to the world's most creative and innovative people, who work collaboratively to solve problems and develop innovations". It obtained the highest ranking in Design phase. This platform was born with the idea to solve problems submitted by North American and European firms, widening in every sector and industry, thanks to teams of "great minds" who co-operate in "virtual ThinkSpace". Organizations decide the reward that will be paid to teams only if the proposed solution truly satisfies specific criteria. This community is open to anyone with problem solving skills, with the site providing them lots of links to knowledge contents and technological solutions. Users' commitment is ensured by the rewards offered by organizations proposing problems, together with the visibility the community gives to winning teams, which is an important aspect considering that many companies using IdeaConnection are big organizations belonging to Fortune 500 ranking.

**SOURCEFORGE:** With the highest score in Implements phase, this community is designed for software developers who want to control and manage open source software's development, configuring itself as the main source for developing and distributing the software. An interested developer can become part of a group

already working on a project, or start an entirely new project on its own: SourceForge makes available a code depository, where is possible to save source codes, a platform for managing team communications, an environment for testing software, and the possibility to make them available for users. The community (and the site) is designed to foster communication and resources sharing between users, in order to make available for the greatest amount of people open source software. Furthermore this ensures users' commitment to the community and its ideals.

UTEST: This is one of the greatest marketplaces in the world for software testing, and it presents the highest ranking in Test development phase. The organization behind Utest constituted a community of testers from around the world, in order to test other organizations' websites and/or applications. Clients specify their "testing requirements" and Utest selects the testing team that best fits with these requirements, considering languages, operative system, browser, and other parameters like platforms and/or mobile devices. The community is open to anyone who can contribute in conducting these tests, to which they are invited to participate by the company, and in case of acceptance they are rewarded on the basis of the results obtained.

INNOCENTIVE: This can be considered the real first innovator (appeared in 2001) and is one of the best platforms in its category, that of online marketplaces, connecting private and public companies, academic institutions, and non-profit organizations with its community of problem solvers. For many characteristics is similar to IdeaConnection, also if would be more proper to say that IdeaConnection resembles Innocentive, which has been the first community of this kind. Problems are submitted to the community by many different organizations, which set a reward for problem solution. The site, with a clear layout, provides users with useful tools and a blog where they can share best practises and discuss issues. Commitment is achieved with the monetary dimension of problem solving activity, with the possibility of entering in contact with competent professionals, together with chances of improving reputation inside and outside the community.

BETAVINE: An open community and resource website, developed and managed by Vodafone R&D department, it presents the highest score in Concept & Implements. It has been created in order to support and foster online and mobile applications development, giving developers all the necessary tools to upload and show the alpha and beta versions of their applications, together with the possibility of interacting with other users and share ideas and opinions. The site is well structured and organized as a platform for programmers, with a clear focus on its "open source" nature and environment of sharing and cooperation. However the structure of the site, organized in sections and sub-sections, is not completely clear, with the drawback of discouraging possible newcomers. Despite this, users' commitment is guaranteed by the availability of many useful resources and contents; together with the chance of realizing an application entirely for free and winning a competition based on the solution of a specific problem.

TOPCODER: It is a site run by the same company, hosting weekly competitions of algorithms and software development. All the work produced by users in these competitions is patented and commercialized by TopCoder. This platform obtained the highest scores in Design and Implement phases. The community is open to anyone potentially capable to contribute to the various tests organized by the company, helping it in creating, developing and testing software. Active participation is stimulated thanks to a ranking system, connected to the presence of monthly and annual rewards for most productive users; together with this incentive, there is also the possibility for users to earn money through royalties of developed programs.

## **6. Results and discussion**

Table 3 shows the cross-comparison among these virtual communities. Following the considerations on communities examined, we can observe that is possible to use (V)CoP for web applications development with more success managing and focusing on the following key elements:

- Open Source Project (as evidenced by SourceForge, Betavine);
- Competition-based Project (present in each of the analysed platforms);
- Royalties (as evidenced by Appsquare, TopCoder);
- Direct participation of the community in the project (as evidenced by IdeaConnection, Innocentive, UTest);
- Direct contact with developers (as evidenced by Appsquare, Betavine, SourceForge);
- Possibility to receive direct support from skilled developers (as evidenced by Appsquare, Betavine, SourceForge);



- High quality of work created (as evidenced by each of the analysed platforms, especially IdeaConnection, Innocentive and UTest).

**Table 3:** Analysed (V)CoP and key elements.

VCoP	Users	Structure	Graphic	Commitment	Characteristics	Development contribution
<b>Appsquare</b>	Anyone interested in mobile applications development	Clear and simple, user-friendly	Clean design with few essential modules	Royalties, skills improvement and contracts for developers	Problems and challenges proposed by users, users' ranking, visual representations of apps	Concept phase
<b>Idea Connection</b>	Potential problem solvers and innovators	Oriented to foster cooperation and information sharing	Characterized by many effective figures	Monetary rewards and visibility offered by companies	Problem solving, high information exchange, creative structure	Design phase
<b>SourceForge</b>	Software developers	Designed as a repository platform	Reflecting a sense of seriousness and freedom	Contribution in open source scope	Participative collaboration, open source innovation, elite community	Implements phase
<b>UTest</b>	Anyone who can contribute to tests	Complete platform with tools for testers	Extremely clear and simple	Remuneration based on time spent and results, participation, knowledge improvement	Problem solving, competition as a stimulus for participation	Test phase
<b>Innocentive</b>	Problem solvers	Focused on challenges, with blog and forum to help sharing and cooperation	Professional style, with few images and videos, clear layout	Monetary rewards, competition with users, visibility	Information exchange, challenges, problem solving, focus on best solvers	Concept phase; Design phase
<b>Betavine</b>	Mobile applications developers	Platform for developers, with focus on sharing and cooperation	Simple, stylized figures, transmitting open source character and responsibility	Availability of useful resources and contents, chance to realize applications, competitions	Information exchange, users' ranking, focus on social exchange, open source projects	Concept phase; Implements phase
<b>TopCoder</b>	Anyone who can participate to tests and challenges	Environment focused on sharing and cooperation	Simple layouts and themes, majority of dark tones	Monthly and annual rewards, reputation, royalties	Problem solving, users' ranking, information exchange	Design phase; Implements phase

The results of the empirical analysis, synthetized in Table 4, show that best practices are:

- Open source projects or challenges as organizational and working models to attract and to motivate community's members.
- Royalties' concession, direct charging of participation task from the community, fixed project deadline as form of incentives to be used.
- Support from other developers, involvement of professional developer and direct contact as form of strategies of collaboration.

Moreover, evidences suggest that to further increase the effectiveness of (virtual) communities of practice in realising an application an organization can:

- Have a user profile reporting interests, competences and successes in previous projects, available in all communities analysed, and in some cases it is compulsory in order to participate to community activities, like Innocentive.
- Dashboard and chat box with the possibility to monitor the on-going project, which appears to be very useful in case of developers like SourceForge and Betavine, or also in communities based (almost exclusive) on competitions like IdeaConnection, Innocentive and TopCoder.
- Newsletter, to update about projects and related topics, empowered by all communities analysed.
- Wiki section with common questions and answers, posting problems and voting answers, developed in particular by Betavine, UTest, TopCoder and SourceForge.

- Project repositories, like SourceForge, which has been designed as a “code repository”, or TopCoder, with a dedicated section of the site.
- Section with rankings with best ideas and with winners with their interviews, which helps in fostering commitment, particularly in communities like IdeaConnection, Innocentive, UTest and TopCoder.
- Possibility for the company to contact solvers, filtering on competences and interests: this a real good incentive appreciated especially by IdeaConnection and Innocentive communities.
- Links to social communities for advertisement, available in all platforms.

## 7. Conclusions

(V)CoP are novel keystone for the software innovation process and for knowledge development, knowledge sharing and knowledge exploitation in a virtual context. They represent an advantage of companies such as:

- Lower costs than development based on “traditional” projects, near zero regarding wages.
- Short applications development, related to competitions deadline.
- Access to high-expertized users of worldwide communities.
- Immediate feedback on the project.
- Higher visibility obtained by users and organizations, in case of a competition.
- Engagement of users’, who can be potential customers of contracting companies.

Despite different disadvantages such as:

- Higher costs to reach acceptable results.
- High chances of project failure, because of poor economic incentives, low number of participants, low quality, and difficulties in managing large-scale projects, like linguistic barriers.
- Absence of contracts and/or agreements to clearly ensure developers’ participation and commitment.
- Lack of secrecy of the project.

this research shows the ways a virtual community can be characterised and managed in order to improve innovation performance, differing the way of managing it basing on project phases differences.

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