Fostering Resilient Community Innovation:

How Boundary Organizations Balance Intrinsic and Extrinsic Motivation

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ABSTRACT

While open, collaborative innovation has taken root in numerous industry ecosystems, the maturing practices followed in open source software (OSS) hold lessons for innovation resiliency. This study compares how two OSS boundary organizations approach "community innovation," *i.e.*, collaborative development within a defined ecosystem. One of their challenges is striking a balance between motivating their collection of developers through intrinsic versus extrinsic means. We posit that getting this balance right will ensure the source code of each project remains healthy while peripheral innovations are developed to meet specific needs of segments in the ecosystem. We will use survey and interview data to analyze these relationships. The findings inform the practicing manager trying to determine the appropriate incentives in the context of community innovation.

Introduction and Research Setting: Community Innovation and Governance Variation

Expected to exceed $8 billion in 2013 (IDC, 2009), the popularity of open source software (OSS) is growing. The sale of software based on open source code by value-added resellers (VARs) is now a well-established trend (Perr, Appleyard, and Sullivan, 2010), as is the implementation of open source projects by consumers across industries and organizations (Watson and Boudreau, 2005). Where open source was once seen as primarily a social movement (Crowston and Wade, 2010), recent research shows that a number of projects have a diverse and complex ecosystem built up around them that requires new ways of managing the varied interests. Successfully doing so can help perpetuate "community innovation," which we define as collaborative development within an ecosystem. This research examines how boundary organizations within an ecosystem shape community innovation by providing both intrinsic and extrinsic motivation for the developers, in this case, of open source content management systems. An apparent tension enters community innovation when commercial interests interact with more altruistic motivations. We analyze how this tension is a false one, and, consistent with O'Mahony and Bechky (2008), we find that seemingly contesting motivations coexist to establish mutually beneficial working relationships. These relationships fuel both core (source code-related) and peripheral innovations (extensions), and the trick is getting the balance right so the core platform is healthy while the extensions meet the specific needs of the players in the ecosystem.

Community-managed OS projects collaborate within and rely upon tight social networks built-upon a fabric of social contracts that guide interactions within the community. In its infancy an OS project is driven by a small group of leaders that are intrinsically motivated to achieve a common goal making it easy to enforce these social contracts. As the project gains in popularity the base of contributors must expand thus introducing external parties and motivations. It is critical to the success of the project that the social contracts are continually enforced to ensure that the project maintains a healthy ecosystem of collaboration and contributions. This prevents a fork or "split" of its community and software source code, which starves a project of the resources necessary to grow. Recognizing these particular challenges of open source projects, boundary organizations that coordinate the developers need to understand how such projects are sustained over time in order to support innovation of both the core software code and the extensions that build off of the core.

This paper analyzes the strategies for resilient innovation, *i.e.*, sustained and adaptive development, of two open source content management software projects. Joomla! and Drupal are competing projects that provide the foundational structure for millions of websites and web applications. These two projects are comparable as each solves a similar need in the marketplace; both utilize a community-based innovation model; and both are licensed under the same GNU General Public License (GPL). However, they differ in how they are organized and these governance structures have ripple effects regarding motivations within their respective communities. Within the context of this study we define innovation as the creation of value through solutions that meet new market needs by implementing new ideas, methods, or a different and more effective use of an existing idea. We suggest that a healthy collaborative network will not only create innovative solutions but will sustain their creation. To determine the health of these collaborative networks this study aims to develop a metric comparing the health of each ecosystem over time. The linchpins of the ecosystems in our study are boundary organizations that employ direct and indirect methods to spur innovation. In crafting their approaches to community innovation, the two boundary organizations in our study, Joomla! and the Drupal Association, balance the intrinsic and extrinsic motivations faced by the developers in their communities. We posit that striking the appropriate balance ensures the core of each project remains healthy while the complementary functionality reflected in commercial extensions fulfill specific needs of segments of the ecosystem. The remainder of the paper introduces our conceptual framework and its usefulness for analyzing an open source

project's activities. We present preliminary evidence from the first phase of a longitudinal field study and discuss potential insights.

Literature Overview

In the context of community innovation, whether it occurs upstream during blue sky exploration and standards development or downstream in new product development, the tension between cooperation and competition frequently surfaces. While the power of the collective mind can heighten the quality and pace of innovation (Allen, 1983; Raymond, 1999), inter-firm collaboration often is tempered by who is going to capture the value created (Appleyard, 1996; Schrader, 1991).

The setting of OSS does not escape this tension (Long, 2006; Shah, 2006; Shaikh and Cornford, 2010; Staudenmayer, Tripsas, and Tucci, 2005; West, 2003). While numerous OSS projects were initially fueled by altruistic motivations often for improved functionality at a lower price point, commercial interests typically become more pronounced as the projects mature and ecosystems grow up around them. Our research is focused on how cooperation and competition is balanced at the level of the people writing the code, and how organizational structure and coordination mechanisms (Long, 2006) such as 'boundary organizations' link these developers with the larger ecosystem thereby influencing this balance (O'Mahony and Bechky, 2008; Shah, 2006). The balance between intrinsic and extrinsic motivation can have a pronounced effect on a developer's willingness to contribute code (Shah, 2006).

Conceptual Framework

Our approach to understanding how intrinsic and extrinsic motivations influence innovation in a community setting is to examine specific defining events within the Joomla! and Drupal communities that had meaningful impact on the source code. The underlying notion is that these events either reinforced or challenged the (implicit) social contracts held between the developers in their respective communities. By characterizing the events as either supporting intrinsic or extrinsic motivations and then assessing who—either the community or the individual—captured the majority of the benefits of the resulting innovation, we can shed light on how developer motivation to create value is associated with value capture.

One of the defining events in each community was the creation of their anchor boundary organization— Open Source Matters in the case of Joomla! and the Drupal Association in the case of Drupal. We consider how they have contributed to defining events in source code evolution and how their respective governance structures influence the resiliency of the innovations core to the health of the ecosystem.

The Origins of the Joomla! and Drupal Projects

The technical architecture of the Joomla! and Drupal projects is a key differentiator relative to other open source software projects, because it allows for mass contributions, and tens of thousands of developers have contributed to each project. The contributions that build off of the source code are called extensions in the Joomla! ecosystem and modules in the Drupal one. In addition the license chosen by both projects, the GPL, allows the software source code to be freely distributed amongst the community without licensing fees or the fear of intellectual property lawsuits providing a base for collaboration.

Joomla!

Joomla! was the result of a fork of the Mambo content management system on August 17, 2005. Originally created by Miro Construct ltd. as a proprietary system in March 2000. In 2001, Miro adopted a dual-licensing policy releasing Mambo Site Server under a GPL license, which later became Mambo Open Source. In 2003, Miro handed responsibility of Mambo Open Source to a volunteer, community-based development team,

which later formed Mambo Foundation, Inc. In August 2005 allegations surfaced that the Mambo Foundation was formed without community input and with insufficient developer control, based on these allegations the core developers left and formed Open Source Matters, forked the code, and called the new project Joomla!. As of August 2012, Joomla! powered over 1.6 million websites and had been downloaded over 35 million times.

Open Source Matters (OSM) was formed to hold the copyright and licenses to the Joomla! brand and to provide leadership and guidance over the project. OSM engages in many activities that support the Joomla! project including management of the joomlacode.org and joomla.org websites, supporting the presence of Joomla! booths and team members at IT events, development of the Joomla! project, and supporting community leadership teams.

Drupal

Dries Buytaert began the Drupal software as a message board in 1999. Within a year or so, people became interested in using and contributing to Drupal, so the project was made open source. Dries' intention was to allow others to collaborate on the development of Drupal's core and for six years Drupal's core was developed by a purely volunteer base. Drupal.org came online in 2001, and the Drupal community gained momentum in 2005, when official code sprints and the DrupalCon conference began. In 2012 over 21,000 developers had contributed over 18,000 modules and perform an average of 3,500 code commits a week.

Several years after the Drupal project began, the Drupal Association was formed to foster and support the project, the community, and its growth. In stark contrast to OSM the Drupal Association is explicitly barred from directly or indirectly guiding or leading the Drupal software project and may not hire developers. In practice, the Drupal Association goes out of its way to avoid any perception that it leads the project, instead continually pointing to the community as the leaders of the project. The Drupal Association supports the project by managing drupal.org, maintenance of code repositories, production of a worldwide conference, legal advocacy work, and helping to maintain the Drupal brand.

Methodology

We describe here preliminary findings generated from the first phase of a planned multi-year research project that began in 2012. By focusing on several illustrative episodes, we produced a measurement of the health of the competing project ecosystems (Drupal and Joomla!) over time. This analysis provides a base measurement of the project's health to determine the positive or negative effects of activities performed by boundary organizations and insight into how these projects create value for their communities by eliciting and sustaining innovation. The goal is to determine the impact that boundary organizations and the enforcement of social contracts have on sustaining innovation within an open source project.

In subsequent phases we will observe the quality and quantity of innovations occurring within the innovation ecosystem over the same period of time to determine if there is a health "sweet-spot" wherein a high level of innovation occurs. We will also review the effect of actions taken by boundary organizations to gain an understanding of how ecosystems can be shifted by their respective boundary organizations.

We adopt a mixed methods approach to fieldwork. Qualitative data such as interviews, observation of meetings/code sprints/conference social events, and document analysis will help us to triangulate our rich descriptions. Additionally, quantitative data such as usage statistics, code contributions, and a series of responses to online surveys will provide insight into the intrinsic and extrinsic motivations of the community.

Preliminary Findings

Our research is framed by focusing on the core development and not on the extensions or modules. Research shows that core developers are crucial to the health and longevity of open source projects, and yet very few studies have contributed to our understanding of core development (Long, 2006). This focus allows us to concentrate on what motivates individuals and companies to consistently contribute to a core product they do not derive direct revenue from. Core contributions are defined as a contribution of software source code for the primary download of the Drupal or Joomla! project.

We organize our preliminary findings into two broad categories to facilitate analysis and interpretation: nature of sustained innovations over time and activities that alter innovation.

Nature of sustained innovations over time

One way to determine the health of an open source project is to analyze illustrative events that typify the work of those within the ecosystem in terms of intrinsic and extrinsic motivation. These include events such as a change or acceptance of IP licenses, creation of an intermediary organization to align divergent interests, or funding core development work. Figure 1 visually displays these activities based first on on intrinsic/extrinsic motivation the event represented in the ecosystem (X-axis) and then compared against the direct benefit of the event to the ecosystem. Events were grouped by year and plotted on a 2x2 matrix to understand the shift in the innovation ecosystem over time.

Preliminary findings demonstrate a unique starting point for each project on opposite sides of the matrix. The Drupal ecosystem begins with strong intrinsic motivations primarily contributed to benefit the project whereas Joomla! begins with extrinsic motivations designed to benefit a single organization. Over time the project's participants make moves to shift the motivations of the ecosystem causing both projects to trend towards the center. The findings suggest that there is a natural tendency for innovation ecosystems to trend towards a balance between intrinsic and extrinsic motivation and a balance of innovations contributed for the benefit of a single company and contributed for the benefit of the ecosystem.

Effects of the health of the ecosystem on innovation

From this primary measurement of the health of the ecosystem, we reviewed the effects the relative health had on new innovations within the Drupal project. To understand this relationship we are looking to develop metrics that quantify the value of the innovation created by the ecosystem. Our initial innovation index focuses on two distinct types of innovation: novel innovation and ported innovation. **Novel innovation** is functionality not available through other open source or proprietary systems and represents new functionality for use in web applications. **Ported innovation** is functionality that is in use in other open source or proprietary software systems but was modified and adapted in an innovative manner. Figure 2 shows a shift from ported innovations to novel innovations.

The question that our overarching research project aims to answer relates to the identification of conditions that enabled this shift to occur. One answer may come through a review of the health of the ecosystems (Figure 3). As a first step, we combined the innovation index (Table 1) with the ecosystem's health measurement (Figure 1) and plotted it over time; a larger bubble represents more innovation occurring within the ecosystem. Our preliminary findings show that innovation increases as the project moves towards balancing intrinsic and extrinsic motivations that benefit both individuals and the ecosystem.

If maintained through continued systematic data analysis, these findings are likely to have significant impact on the practicing manager by demonstrating that it is insufficient to simply contribute financially or to donate one's innovations to the ecosystem. In order for the ecosystem to provide ultimate value contributors must be

intrinsically motivated and work in the best interest of the project, it is insufficient to only financially support the ecosystem.

Identifying major activities and events that cause shifts in the ecosystem

With a base understanding of, and an ability to measure the health of the innovation ecosystem, we can then dig deeper into researching, analyzing, and, ultimately, understanding the events and activities that causes shifts within the ecosystem including the role of boundary organizations. Innovation ecosystems may have one or more boundary organizations making collaboration possible by performing a triadic role structure among firms, projects, and non-profit foundations for the production of open source software (O'Mahony and Bechky, 2008).

Both projects have recognized the need for boundary organizations to broker activities within the project be that development, conference gatherings, educational events, or governance. However, each project has created and used these boundary organizations differently. For example, Joomla!'s Open Source Matters boundary organization guides and leads the project whereas Drupal's Drupal Association is explicitly barred from guiding or leading the project.

Our research dives into the actions and subsequent effects a boundary organization has on an innovation ecosystem. Through the comparison of two innovation ecosystems compromised of similar participants that maintain dissimilar boundary organizations we are able to compare the effects a boundary organization has on an ecosystem. Findings from this final stage of research will provide guidance on how boundary organization can be efficiently leveraged to create radical change, drive strategic innovation, and, most importantly, provide innovation resiliency.

Discussion and conclusions

This exploratory research offers a glimpse into the innovation ecosystems of open source projects and the role that boundary organizations play within those ecosystems. Through the use of surveys, interview data, and quantitative analysis of online interactions we hope to uncover the key elements and activities undertaken by boundary organizations that provide for innovation resiliency. Our preliminary findings have demonstrated that a balance between intrinsic and extrinsic motivation and contributions benefiting an organization or the broader ecosystem are essential to maintaining a health innovation ecosystem. The two open source projects reviewed in this research have identified that a boundary organization is essential to maintaining this balance.

In analyzing these elements, we contribute to existing research on boundary organizations, innovation ecosystems, and open source communities while also providing a guide for the practicing manager to extract value from community innovation.

Tables and figures

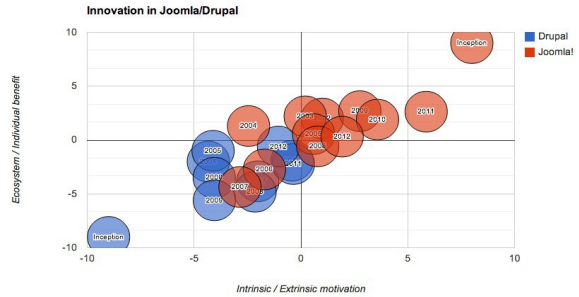

Figure 1

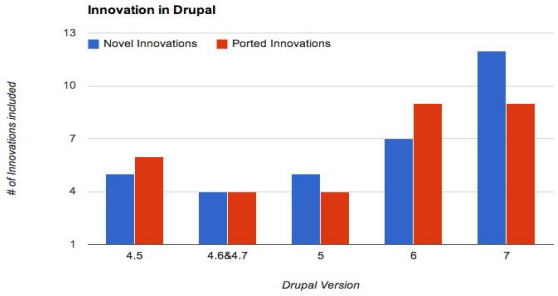

Figure 2

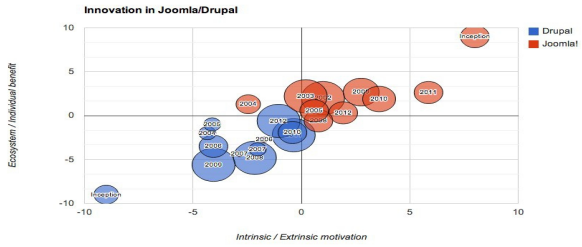

Figure 3

Novel innovations	Ported innovations
• Multi-lingual support • SparQL • Web services (WSSCI)	• Configuration change management • Mobile • Layouts • SQL Views in core • User Experience/ User

Table 1

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