

AN EXPLORATORY STUDY OF IDEOLOGY AND TRUST IN OPEN SOURCE DEVELOPMENT GROUPS¹

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Abstract

Open source (OS) software development has been the subject of heightened interest among organizational scholars because of the novel social coordination practices that signal a departure from traditional proprietary software development. We propose that trust among group members in open source development groups (OSDGs) plays a key role in facilitating their success. Trust is important in this context because of the risk of opportunistic behavior by other members who volunteers may not have met and may never expect to meet, as well as a lack of explicit market contracts or common organizational affiliation. The open source community is differentiated by a coherent ideology that emphasizes a distinct set of interrelated norms, beliefs, and values. These serve to create incentives for open source practices that eschew conventional transactional norms in favor of a gift culture and a focus on reputations. In this study, we primarily examine the role of the shared ideology in enabling the development of affective and cognitive trust in OSDGs. We further examine how this trust leads to desired outcomes – group efficacy and effectiveness. The study is based on exploratory interviews, examination of archival records and a preliminary survey to understand the specific conditions of open source efforts on which this work-in-progress report is based. This is being followed-up by empirical testing of our research model through a survey of a broad variety of OSDGs. This study would contribute to a clarification of the role of trust in enabling software groups to work effectively and help to understand the bases of trust in ideology-permeated groups.

RESEARCH OBJECTIVES AND QUESTIONS

Open source (OS) software, such as Linux, is garnering attention in academic circles (e.g., Feller and Fitzgerald 2000; Markus et al. 2000), in the practitioner press (e.g., Tapscott and Ticoll 2000), and in society at large (e.g., DiBona et al. 1999; Rohm 2000). We offer the following preliminary definition of an open source development group (OSDG). OSDGs are loosely-structured collaborative efforts enabled by the Internet that create software as a public good. These groups are not part of profit-seeking organizations, and their members do not share a common organizational affiliation. They are self-organizing entities that coalesce around the production of a software product. Members of these groups are volunteers, working without financial remuneration from or contractual ties to the group. Their work may be distributed across time and space boundaries. It has been recognized that an important distinction of OSDGs from other software development efforts lies not in technical considerations, but in the social coordination that engenders development. For example, until Linux, it was widely believed that software as complex as an operating system had to be developed in a carefully coordinated way by a relatively small, tightly-knit group of people (Raymond 1999). By contrast, Linux is an operating system developed by a loosely formed group of thousands of developers around the world.

¹**Keywords:** Open source, trust in workgroups, ideology.

Our goal in this study is to build and test a model focusing on the social coordination mechanisms that facilitate work in OSDGs. Preliminary analysis of archival data on OS projects, writings by OS community ideologues, and open-ended surveys of active members of different open source projects led us to concentrate on ideology and trust as important enablers of social coordination processes. We consider two broad research questions: *how does group members' adherence to the open source ideology influence trust within OSDGs, and to what extent does trust within the groups influence their effectiveness?*

Others (Markus et al. 2000) have argued that OSDGs provide a glimpse of future organizational forms in which information technology decreases communication and coordination costs and allows for more fluid work groups. We hope that this study, by providing empirical evidence for the evolution and importance of trust within OSDGs, will increase our understanding of the role trust may play in these kinds of future organizations. We expect our findings will be relevant not only to OSDGs, but also to other groups that share strong norms, beliefs, and values. The following section outlines the theoretical foundations of this study and presents the research model. We then discuss the study methodology.

THEORETICAL FOUNDATIONS

We relied on the trust development literature to build an overarching theoretical framework to guide our study. We consider trust as a psychological construct which, following previous research on trust in work settings, we define as, “the extent to which a person is confident in, and willing to act on the basis of, the words, actions, and decisions of another” (McAllister 1995, pg. 25). Following the work of McAllister, we plan to explore two components of trust: affect-based trust and cognition-based trust. Affect-based trust stems from emotional attachment between a trustor and a trust target, while cognition-based trust relies more on a rational assessment of the target by the trustor. Preliminary qualitative data (displayed in Table 1) supports the appropriateness of this two dimensional conceptualization, in that informants indicated both emotional and cognition-based antecedents to trust are active.

Table 1. Informant Statements Supporting the Two Dimensional Trust Construct

Affect-Based Trust	Cognition-Based Trust
“[if] the sense of community is very strong [then] trust is high”	“[it] takes so much experience to be able to do anything that I implicitly trust anyone who can.”
“successful teams are just like a family”	“the more they contribute and the more they interact with others, the higher the trust level is”
“We tend to hang together with intense loyalty and pride in what we achieved as a group.”	“one needs to be able to trust that others know what they’re doing”
“‘kindness’ to each other is important for trust”	“with trust you can rely on someone to get a piece of the project done”

In keeping with the literature, we position the perceived ability of group members (Ammeter 2000; McAllister 1995), propensity to trust (Mayer and Davis 1999; Mayer et al. 1995; McKnight et al. 1998), and communication patterns (Jarvenpaa and Leidner 1999) as antecedents to trust. Perceived ability of group members may influence trust because it encourages an assessment of others as competent and able to deliver on commitments. This proposition is confirmed in our preliminary data, as demonstrated by the quotations representing cognitive trust above. Jarvenpaa and Leidner argue that communication patterns that include social exchanges and expressions of enthusiasm enhanced trust early in virtual team projects, while the predictability and substance of communication became more important as projects progressed. Data displayed in Table 2 support this view.

Previous research has been done in the context of formal work groups and a contribution of this study will be to explore how these antecedents of trust function within the context of the informal OSDG work groups. It is expected, for instance, that communication patterns may have a greater impact on trust in OSDGs than in more formal work groups because (1) the groups lack other coordinating mechanisms such as contracts and (2) communication is generally publicly visible over the Internet, permitting enforcement of norms.

Table 2. Informant Statements Regarding Communication

“to trust someone you have to ... discuss things informally, also other things than what is strictly related to the project... there are a lot of people to get to know before you get to the more practical problems...”
“I think we tend to trust more people that are ‘always there,’ those that you send and email and you get a fast reply.”
“Fast replies...and direct answers are some ways to gain trust”

Information in the press (e.g., McMillan 2000) as well as our observations of open source projects, led us to believe that the strong ideological commitment of open source group members may be an underlying force that allows them to trust one another enough to work together productively. We expect ideology may influence trust in OSDGs through at least three of the trust development processes outlined by Doney and Cannon (1997). First, the OS ideology positions reputation gains as a main payoff from contributing to a project and implies high reputation costs for breaking OS norms (Raymond 1999). The more a member understands this and believes that others do as well, the higher the perceived value to others of behaving in a trustworthy manner, thereby allowing trust to develop through the calculative process. Second, ideology may strengthen trust through the prediction process because a common set of values, norms, and beliefs will allow one member to believe she can accurately predict the behavior of others and that others will make the same decisions she would in a given situation. Third, ideology may help develop trust through the intentionality process in that common ideology implies similar benevolent motivations (Macneil 1980, cited in Doney and Cannon 1997).

We adopt Trice and Beyer’s (1993, pg. 33) definition of ideology as “shared, relatively coherently interrelated sets of emotionally charged beliefs, values, and norms that bind some people together and help them make sense of their worlds.” In our model, we capture the role that ideology plays in OSDGs through two related constructs. First, the extent to which group members perceive that they share ideology may be expected to have a positive effect on the extent to which they trust each other. Second, there is the reinforcing effect of commitment to the OS ideology in itself, as it emphasizes values and norms that reduce the risk of trust violations.

The importance of ideology within the setting of OSDGs is clearly communicated by prominent members of the OS community. For example, in discussing the success of Linux, Eric Raymond (1999) says, “[a] vital factor was the development of a leadership style and set of cooperative customs...[which] cannot be based on power relationships.” More generally, Raymond (1999, pg. 5) observes “the open-source culture has an elaborate set of customs...[which] regulate who can modify software, the circumstances under which it can be modified, and (especially) who has the right to redistribute modified versions back to the community.” In Table 3, we have developed a preliminary outline of the main features of the open source culture. In Table 4, we note the elements of common ideology reported in our preliminary survey. These emphasize voluntary sharing of knowledge and the cultivation of reputation as judged by one’s peers.

Table 3. Preliminary Description of the Open Source Culture

Norms	Taboo against forking projects Distributing changes without cooperation of moderators frowned upon Removing a person’s name from project history, credits or maintainers list is not done without explicit consent
Values	The best craftsmanship wins All information should be free You don’t become a hacker by calling yourself a hacker – you become a hacker when other hackers call you a hacker Non-trivial extensions of function are better than low-level patches and debugging Work that makes it into a big distribution is better than work that doesn’t
Beliefs	With enough eyeballs all bugs are shallow Practice is better than theory
Ideologues	Stallman, Raymond
Language, Symbols	“distros,” “suits,” Free Software Foundation, copyleft, open source licenses
Narratives	The Halloween Papers The Cathedral and the Bazaar Slashdot, Freshmeat, Sourceforge

Table 4. Common Ideological Elements from Preliminary Survey

“The common ideology is a love of source... joy in developing software” “open mindedness is important”
“unifying feeling of open-source developers is a desire to learn new skills, help out others, and be part of something big”
“like to share knowledge with other”
“One has to build up their ‘reputation’ with hard work, dedication and frankness. Perfectionism, high motivation to do things well (your peers are watching your work), camaraderie (across very broad language and geo boundaries), appreciation of and praise for effort, sense of humour”
“one does what one does both because the result is something one wants, and for ‘egoboo.’ The respect of those I perceive to be my peers is important, and the adulation of the masses”

Because they do not have the structural support of a formal organization to help coordinate their work, we believe trust is especially crucial to the performance of OSDGs. We suspect OSDGs may function somewhat like clans, in which trust reduces transaction costs without the need for explicit contracts or market exchange (Ouchi 1980). The outcomes of trust might include increased group efficacy and effectiveness (Gibson 1999). The higher the level of trust within a group, the more likely members are to believe the group can perform well (i.e., have high group efficacy) and to actually perform well (i.e., have high group effectiveness). The importance of trust to group processes and outcomes in OSDGs was clearly demonstrated in our preliminary data, as shown in Table 5.

Table 5. Informant Statements Regarding the Importance of Trust to Outcomes

“Mutual trust is the glue that holds successful projects together.”
“No project can function without trust... if you can’t trust others, then you’d have to break the project up...”
“Many projects have a more or less formal division into trusted developers and outsiders...one needs to be able to trust that others know what they’re doing otherwise one easily falls into the trap of feeling the need to rewrite everything they’ve done.”
“since I am the project lead I must place my trust wisely on who has master access to the official source code...with trust you can rely on someone to get a piece of the project done.”
“The more we trust each other, the more we’re willing to let go of the reins and still know the work will get done.”
“As [people] participate in their free time, if they don’t feel trusted they will not participate at all or less frequently.”

Figure 1 depicts the research model. Relationships represented in the model are hypothesized to be positive. We include a relationship between ideology and perceived ability of group members because if subscribing to the ideology defines group membership, in-group bias (Tajfel and Turner 1986) may be expected. We propose that holding shared norms may also directly influence group effectiveness by creating coordination mechanisms.

RESEARCH METHODOLOGY

Phase 1: Exploration of Open Source Software Development Contexts [Completed]

The aim of this phase is to understand the conditions in which OSDGs function, develop an initial understanding of the core components of the open source ideology, and gather preliminary qualitative data to refine the model. To do this, we scanned information in the public domain to develop a preliminary understanding of the context. We then identified 48 OS projects using www.sourceforge.net, an on-line open source meeting place that provides information on open source efforts and hosts code repositories. Projects were selected to represent a variety of types of software, licenses, and group sizes. We contacted administrators or project leaders and asked them to complete open-ended questionnaires regarding their experience and views on open source development. The questionnaire is posted at <http://www.rhsmith.umd.edu/dit/kstewart/opensource/questionnaire1.asp>. Eighteen of our contacts completed the questionnaire, a response rate of 37.5%.

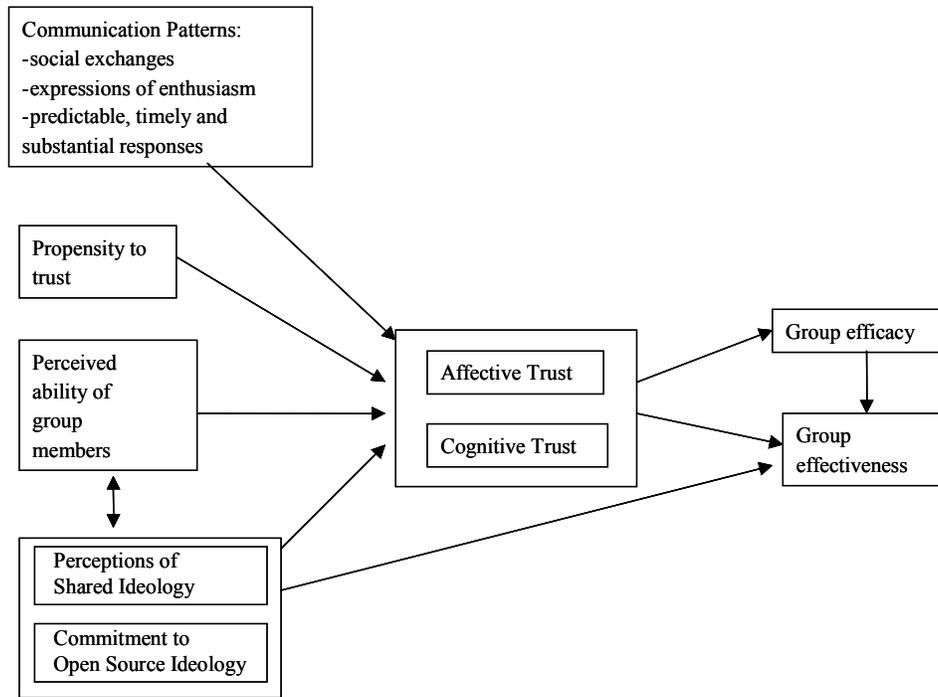


Figure 1. Preliminary Research Model

Phase 2: Survey Development and Piloting [In Progress]

A web-based survey will be created and piloted with a small sample of OSDG members. To create the survey we will adapt and use previously employed scales to measure propensity to trust (Mayer and Davis 1999), cognition and affect-based trust (Ammeter 2000; McAllister 19995), and perceived ability of group members (Ammeter 2000; Mayer and Davis 1999). Other survey items will be based on the data gathered in phase one. For example, we will develop an instrument that asks respondents to indicate the extent to which they subscribe to OS values, norms, and beliefs and the extent to which they perceive that other members of their group subscribe to them. These responses can be used to assess the extent to which each individual perceives similarity in ideologies as well as group commitment to this shared OS ideology.

Phase 3: Data Collection and Analysis

In this phase, we will collect data and analyze the results using confirmatory factor analysis techniques to assess the measurement and structural models. Survey participation will be solicited via e-mail requests sent to active OSDG members. Data on communication patterns will be gathered both by observing the actual communication conducted through project web sites and by asking group members about the group's communication patterns. We will measure group outcomes by asking the group members about their perceptions of the group's performance, quality of software code, and development practices. Group activity metrics regarded by the OS community as performance measures—such as the frequency of code releases, downloads and code repository (CVS)—updates are possible objective indicators being considered as well.

CONCLUSION

Based on observations and qualitative survey data, this paper has presented a preliminary model of how ideology and trust facilitate the effectiveness of open source development groups, along with a methodology for testing the model.

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