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Open source communities: an integrally informed approach

Open source
communities

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Abstract

Purpose – To reframe analysis of the open source software (OSS) phenomenon from an AQAL perspective

Design/methodology/approach – The approach is a review of current research thinking and application of the AQAL framework to suggest resolution of polarizations.

Findings – The authors find that AQAL is valuable as an integrating framework allowing a more holistic understanding of the complex economic, social and cultural characteristics of open source communities.

Originality/value – The original value of this paper is to link, within the AQAL framework, current parallel streams of OSS research, the traditional economic and the social and anthropological, by introducing considerations of psychological contract and intrinsic motivation.

Keywords Organizational restructuring, Computer software, Motivation (psychology), Psychological contracts, Property rights

Paper type Conceptual paper

Introduction

The rapid proliferation of open source software (OSS) development projects following the opening up of the internet has led to the formation of numerous globally-dispersed communities of developers. There are more than 10,000 OSS projects, which involve internet-based communities of developers, which openly publish their source code, under terms specified by each project (von Hippel and von Krogh, 2003; Perens, 1998). The growth and success of this phenomenon has been studied quantitatively (von Hippel and von Krogh, 2003; Maggioni, 2002; Zeitlyn, 2003), and has raised questions about the nature of collective action (Olson, 1965; Hardin, 1982; Ostrom, 1990; Raymond, 1999), the nature of private and social innovation (von Hippel and von Krogh, 2003) and rights to privacy and intellectual property offered or exchanged on the internet. OSS is of considerable commercial importance as it produces products with significant market share, such as Linux (server operating systems), Apache (the dominant web server), Perl and PHP (web scripting languages) and MySQL (relational databases).

While the sharing of source code and cooperative development of software predated the opening up of the internet to the general public by at least 20 years, (Moody, 2001, p. 17), the OSS movement became self-conscious only as tensions developed between the wider



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software development industry's commercial, extrinsically motivated processes and systems came into conflict with the UR values of key individuals, most famously Richard Stallman at MIT, and later, Linus Torvalds, who led the creation of the Linux kernel. With wide access to the internet after 1994, communities quickly emerged around projects and developed shared values and culture, some of which was naturally borrowed from the academy. In the decade that followed the wider industry realised that the OSS movement was producing high quality public goods that could be exploited commercially, and in ways that were quite consistent with the values of the OSS movement. Many commercial organizations began to contribute to the OSS movement by allowing their staff to participate or, in some cases, making other contributions in cash or kind, including by releasing proprietary code or other intellectual property for use in OSS projects. In AQAL matrix terms, a tension between left and right quadrants led to new communities with cultures and values which evolved to the point of mutual accommodation.

Current thinking about the OSS phenomenon is polarized into two schools of thought: one, which is based on traditional economic thinking (Lerner and Tirole, 2002; Iannacci, 2002), and another, which is inspired by social and anthropological research into reciprocity, kinship and gift economies (Zeitlyn, 2003). In this paper we propose that the OSS phenomenon, as a disruptive change in the organization of software development work, can be better understood if it is framed within the all-quadrant-all-levels (AQAL) matrix (Wilber, 2000).

The neoclassical economic understanding, grounded in the upper right (UR) quadrant of the AQAL matrix, seeks to analyse OSS using a model of market-based, self-interested behaviour, where individuals are motivated by the desire to increase their future potential earnings by developing suitable market signals (Spence, 1973) about their personal reputation. In contrast, the social and anthropological approach tends to be located in the lower left (LL) and upper left (UL) quadrants of the matrix. It is based on the literature on gifts (Mauss, 1955; Titmuss, 1971; Strathern, 1992), and kinship, trust and reciprocity (Schwimmer, 1995).

In this paper we use the AQAL integrally informed framework to "round out" these two approaches by integrating the concepts of psychological contract and intrinsic motivation, which bridge the gap between the polarized views. We emphasize the community aspects of motivation and regulation of productive activity.

The concept of psychological contract was introduced by Schein (1965) and Levinson *et al.* (1962). Rousseau and her colleagues (Morrison and Robinson, 1997; Rousseau, 1989; Rousseau and Greller, 1994) further developed the theory. We propose that OSS developers enter into psychological contracts within their global community of software. These contracts are underpinned by trust, shared values and professional backgrounds. The collective, public provision of open source software is possible because these psychological contracts proscribe certain kinds of commercial behaviour that would undermine the OSS effort.

The theory of intrinsic motivation was introduced by social psychologists (Deci, 1975; Deci *et al.*, 1999), and further developed by some economists (Frey, 1997; Frey and Jegen, 2001; Kreps, 1997). The theory reflects a long-standing interest among psychologists in the distinction between intrinsic and extrinsic motivation (Day 1981; Deci, 1975; Mortimer and Lawrence, 1989). An important aspect of this distinction is the contrast between extrinsic value: the value of something as a means to an end, and intrinsic value: the value of something sought for its own sake – as an end in itself (Day, 1981). Individuals with

strong tendencies towards intrinsic motivation may respond negatively to monetary compensation or reward (extrinsic motivators) when they are proposed as inducements for their intrinsically motivated behaviour (Shalley and Oldham, 1985; Shalley *et al.*, 1987). For example, Titmuss (1971) describes how monetary compensation offered to blood donors would conflict with their social values and personal motivations and actually reduce their willingness to donate blood (Titmuss, 1971; Frey, 1997).

We will argue in this paper an integrally informed framework can accommodate these two sets of apparent opposites: the economic versus the social theories of exchange, and extrinsic versus intrinsic motivation. We pay particular attention to issues surrounding the definition, ownership and enforcement of intellectual property rights, as these are central to the OSS concept.

Reciprocal exchange

A central concept in this paper's analysis of OSS is that of "exchange" (Durkheim, 1974; Mauss, 1955). Economists, especially in the standard (simple) model of agency theory, characterize exchange as the transfer of money for a product or self-gain. Without extrinsic incentives, effort is necessarily at the lowest possible level. Social psychologists consider exchange in the context of the relationship between two actors, while anthropologists tend to study the different functions of exchange within a specific group or organization. Both tend to emphasize the element of reciprocity in exchange relationships (Mauss, 1955; Titmuss, 1971). The global OSS social community has an anthropomorphic identity (Rousseau, 1989; Morrison and Robinson, 1997), thus the individual's relationship with it can be similar to that of employees to their employing organization, with all the complexity that follows. Behaviourally oriented sociologists have helped to show that, in such contexts, the complexities of imperfect competition and exchange based on social structures, personal contacts and relationships better reflect reality than models of perfect competition with frictionless exchange. (Burt, 1992; Granovetter, 1985; Polanyi, 1957). Such social capital structure and relational effects especially hold in knowledge-based industries such as software development (Dalle and Jullien, 2003; Hertel *et al.*, 2003; Lanzara and Morner, 2003; Spender, 1996). In this paper we therefore adopt the complex conceptualisation of exchange, as it lends itself to the identification of issues that may be overlooked if we adopt the perspective of economic market exchange.

Common to all attempts at explanation of exchange is the concept of value. In line with Durkheim (1974), we begin by distinguishing between two different concepts of value: "economic value" in which social interaction plays a negligible role, and ideal value created by strong social interaction (Sørensen, 2002). The former applies most strongly to the market exchange of commodities, where the assets being exchanged are focalized, quantified, and valued in the market at a particular price (Gell, 1982). This market price serves as a universal and transparent mechanism to facilitate the exchange of these physical assets. However, tacit and intangible assets, such as knowledge, are difficult to evaluate, and thus the value can be context or situation specific to particular actors or organizations (Grant, 1996).

Property rights and OSS

Notwithstanding a vast amount of literature on networks in management (Burt, 1992; Gulati, 1995; Jones, 1993), there has been insufficient exploration of two key features that distinguish cooperative networks from pure economic markets. First, there is the

operation of exchange and property rights in networks, and the ways they can be made more effective. Second, we need a better understanding of the role of shared collective values (Etzioni, 1988; Hardin, 1982; Olson, 1965) in accommodating the different individual interests and incentives of actors in networks.

These aspects of cooperative networks have been much more fully explored in social anthropology (Blau, 1964; Ekeh, 1974; Levi-Strauss, 1996; Sahlins, 1972; Simmel, 1978;), law and economics (Alchian, 1965; Bernstein, 1992; Coase, 1960; Posner, 1992; Rubin, 1997), and political science (Hardin, 1982; Olson, 1965; Ostrom, 1998). The key distinction is that tangible, physical, quantifiable objects can be priced in an economic market, which services as a universal, transparent exchange mechanism (Gell, 1982). However, intangible assets with tacit and social elements, such as OSS, are difficult to fix, quantify, price, and may have value that is context or situation specific, or symbolic (Polanyi, 1957; Spender, 1996). Indeed open source software may have a symbolic value (Bourdieu, 1977, 1990; Douglas and Isherwood, 1979; Zeitlyn, 2003) along with a purely economic and monetary value.

Research in social anthropology has shown that societies that employ multi-purpose money can sustain parallel spheres of exchange, trading, for example, foodstuffs and raw materials for money, but intangible items with uncertain monetary value traded only as gifts (Appadurai, 1986; Sahlins, 1972; Simmel, 1978). If we accept that social and community driven assets such as OSS may be reliant on spheres of exchange other than markets for tangible assets, for example, systems of socially embedded exchange (Baker, 1990; Granovetter, 1985; Marsden and Campbell, 1984; Mizuchi and Galaskiewicz, 1993), then analysis in terms of the UR AQAL quadrant is bound to be inadequate. We must seek to understand the complexities of collective ownership and the transfer and protection of economic property rights as they operate with intangible assets such as OSS.

Defining property rights

The nature of cooperation is such that it requires ongoing cooperation between actors in the network (Burt, 1992), and that, in turn, requires shared understanding of property rights. In the social science literature, there are two main definitions of property: one in terms of traditional, legal, property rights granted by the state, and the other, an economic definition, linked to the value of assets and resources (Bernstein, 1992; Demsetz, 1967; Hart and Moore, 1990). These definitions reflect the distinction we drew above between extrinsic and intrinsic value. Legal property rights are extrinsic: the rights themselves are the means to the end; economic property rights are intrinsic: the rights themselves are the end (Barzel, 1997).

Property rights require recognition as well as enforcement (Barzel, 1982; Bernstein, 1992; Demsetz, 1967; North, 1991; Posner, 1992). Legal (extrinsic) property rights tend to be enforced by the state, but even in highly legally oriented societies social enforcement often replaces legal contracts (Ellickson, 1991). It has been shown (Demsetz, 1967) that where the value of particular resources can be quantified by singular market valuation, economic (intrinsic) property rights become more important as the value increases. The development and use of internet-based assets such as OSS requires mechanisms that take into account the transfer, capture and protection of property rights in the assets (Barzel, 1982; Bernstein, 1992; Posner, 1992; Rubin, 1990). However these economic property rights mechanisms are especially complex for OSS because of the social community and tacit elements (Polanyi, 1957). This is reflected in,

for example, the distinction drawn by Stallman (2002) between “free” and “open source” approaches to software development and distribution. Groups supporting these two approaches have concerned themselves with developing licensing regimes that accord just the degree of openness that corresponds to their own insight.

Enforcing property rights

Enforcement of property rights agreements is crucial for continued success of collective action towards public goods and common property resources such as OSS. Better-defined rights facilitate exchange, and the value of the exchange increases with the value of the rights:

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... a system of contract enforcement is more valuable if property rights are clearly defined ... better defined rights facilitate exchange, and the value of the exchange increases with the value of the rights (Rubin, 1990).

Existing research assumes the relatively automatic and smooth transfer and protection of economic property rights (Bradach and Eccles, 1989; Burt, 1992; Gulati, 1998; Zajac and Olsen, 1993). This assumption is more justified if there is homogeneity in the backgrounds of the network actors. For example, commonality of ethnic background can play a crucial role in the formation of networks (Landa, 1994; Bernstein, 1992), which rely greatly on informal social codes and mechanisms for achieving co-operative and trust based results.

However, the nature of global competition and the internet have created heterogeneous networks and strategic collaborations involving actors from diverse ethnic, industrial and cultural backgrounds. Disciplines such as social anthropology, law and economics (Bernstein, 1992; Greif, 1993; Landa, 1994; Posner, 1992; Schelling, 1960), have long studied the complicating effects of such heterogeneity on cooperative decision-making. In the modern context there is an additional layer of complexity resulting from the continuous change and uncertainty in the global business environment. It cannot be assumed that the enforcement of property rights in global OSS development is automatic. At a basic, practical level there is an absence of properly resourced bodies to police property rights, so conventional means are unrealistic.

Psychological contract and intrinsic motivation

The majority of publications on OSS have concentrated on the market versus social and public good elements, and the role of OSS in technological innovation (Kogut and Metiu, 2001; Lerner and Tirole, 2002; von Hippel and von Krogh, 2003). Our focus on property rights highlights the importance of psychological and social community factors. We believe that these frameworks can be synthesized by incorporating the research on psychological contracts (Rousseau, 1989; Morrison and Robinson, 1997) and intrinsic motivation (Deci, 1975; Frey, 1997).

Psychological contracts

Several researchers (Schein, 1965; Levinson *et al.*, 1962) have highlighted the importance of expectations about reciprocity between employers and employees, the role of promises and implied contracts and expectations (Rousseau, 1989; McLean Parks and Conlon, 1995), and the negative motivational impact of psychological contract violation (Morrison and Robinson, 1997). The global community of OSS developers has an anthropomorphic identity in the eyes of its participants (Levinson

et al., 1962; Morrison and Robinson, 1997; Rousseau, 1989; Schein, 1965), and psychological contracts are possible between the community and the individuals within it, in a way that is analogous to an employer and employees. In particular there is a contract not to engage in individual and commercial behaviour (Morrison and Robinson, 1997). Together, OSS developers form a group who have significance in Wilber's LR quadrant, which can be taken to be based on shared community values, organizational processes and systems (Wilber, 2000).

Such a contract does not bind those outside it, but while the lack of traditional enforcement mechanisms makes it possible for outsiders to violate OSS property rights, this appears to be restrained by respect for the OSS community. At the same time the OSS communal ethic (LL, shared values, culture), is to oppose proprietary software and this renders members of the community relatively unconcerned about outside users, especially if such use reduces the influence of competing proprietary products.

Intrinsic motivation

The motivation of OSS developers presents a puzzle:

Why should thousands of top-notch programmers contribute freely to the provision of a public good? (Lerner and Tirole, 2002, p. 198).

The explanation offered by traditional economics points to the enhancement of individual reputation, which can lead to increased income and employment prospects. Frey and Jegan (2001) provide a more realistic explanation by distinguishing between extrinsic or monetary motivation and intrinsic or psychological motivations (Frey, 1997; Frey and Jegan, 2001). The account of intrinsic motivation, which has been termed "crowding", develops research such as Deci (1975), which suggests that the existence of extrinsic or monetary rewards can indeed undermine intrinsic motivation, for example the case of blood donors to which we referred earlier (Titmuss, 1971).

We have drawn attention to the polarization of academic debate about OSS into a mainstream economic approach according to which OSS developers are extrinsically motivated by the economic benefits of enhanced personal reputation (Iannacci, 2002; Lerner and Tirole, 2002), and an approach based on social and collective values, which sees OSS activity as driven by values that promote the private provision of public goods (Harhoff, 1996; Raymond, 1999; Zeitlyn, 2003). We attempt to bridge these polarized frameworks by introducing psychological concepts, which can be seen as the primary driving force in the proliferation of OSS. As OSS resources are created, the open access and reusability that are fundamental to the movement's goals produce a benefit for community members, and together with intrinsic motivation effects create identification with that community. This forms a community with a shared value system, including the psychological contract mechanism, which reinforces the commitment of individual contributors. These effects do not preclude the UR quadrant benefits from reputational effects, or from skill improvements or networking opportunities arising from membership of the community.

Figure 1 uses Wilber's matrix to display the drivers, their precedence, and their impacts across a much wider range of experience than can be comprehended in traditional anthropological or classical economic treatments alone. Personal values, including propensity to intrinsic motivation, are the principal drivers which stimulate individuals to contribute work to the complex organizational system in which OSS is developed. Within the OSS community an individual's contribution to development may lead to reputation

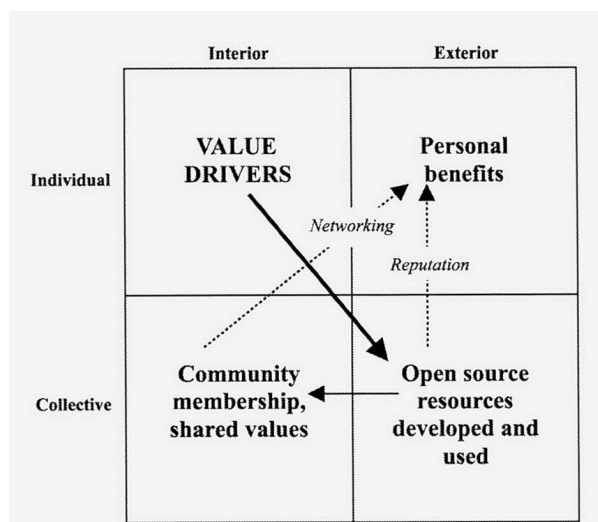


Figure 1.
Values and motivation for
open source software
developers

enhancement which in turn may be rewarded by personal benefits (job offers, promotion and the like). It is also the case that personal benefits may accrue as a side-effect of the shared values and culture that characterise the OSS community – this may, for example, take the form of job offers in which a subjective assessment of individual “fit” plays an important part. The processes and systems of OSS, in particular the communication processes and protocols for virtual teamwork, support and encourage the culture, shared values, sense of participation in a common effort.

Conclusion and scope for further research

The rapid growth of open source software development has led to a vast amount of literature, using a range of frameworks and models, to analyze this phenomenon. We believe that open source communities can be better understood from the perspective of integrally informed approaches to organizational transformation of the software development industry. Questions of intrinsic and extrinsic motivation, economic and ideal value, psychological contract, property rights and their enforcement, can be synthesized and illuminated by the AQAL approach.

In OSS communities there is generally a very strong psychological contract relating to attribution of intellectual property in development work, accompanied by a strong shared value that the work itself should be available, without expectation of extrinsic reward, such as royalties, if that work is appropriated. The usual expectation is that the source is attributed, which provides more of an intrinsic reward, and under some OSS licensing schemes, that the OSS licence propagates recursively. Attribution is also likely, of course, to play a role in the application of extrinsic rewards in the form of reputational pay-off. Propagation of the OSS licence means that the contributors' work is “on display” wherever it is used, and that too might lead to greater potential in terms of extrinsic rewards.

Two areas warrant further research. First, a further conceptual development of open source software developments, with global comparisons and implications for organizational transformation. Second, further empirical research is warranted on the extent to which the license and distribution schemes adopted by different OSS projects can be explained by AQAL profiles of their communities.

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