

# Rational Action in Open Source Software Development

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## Overview and History

In a capitalist society, individuals may associate the notion of free labor with the forsaken summer internship or, worse, with the writings of Karl Marx. Surely, no rational professionals would supply their labor for free. Yet, the phenomenon of open source software development prevails. Individuals, many of whom are highly skilled, contribute their time to the development of public software. The economic concept of *homo economicus* asserts that the “economic man” acts in accordance with his own self-interest. Does open source software development undermine this theory of rational action?

The first incidence of open source development dates back to the 1970s. Individuals from MIT, AT&T Bell Labs, and General Electric all contributed to the development of the UNIX operating system (which forms the basis for today’s Linux and Mac operating systems). However, disputes over property rights illustrated the need for established rules regarding this collaborative model of innovation. In 1989, the Free Software Foundation established the GNU General Public License (GNU GPL) to prevent future copyright claims on public software. GNU GPLs are consequently referred to as “copyleft” licenses. Parallel to the logic that free markets cannot function without the protection of private property, copyleft

development was vital to the future of public software. With the proper legal framework in place, the outbreak of the Internet in the 1990s brought the potential for rampant open source development.

The historical and legal dimensions demonstrate the potential for open source development; yet these dimensions circumvent the research question. In order to understand the motivations of individual contributors, analysis must take place within social and economic dimensions. Motivations to contribute to open source software do align with the theory of rational action. These motivations manifest through human capital development, professional status attainment, intrinsic satisfaction, and need fulfillment. The forthcoming sections will explore the roles of these stimuli and reconcile them with the concept of *homo economicus*.

## Personal Resource Development

Open source software development is the epitome of learning by doing. The time and skill requirements vary substantially from project to project; thus any individual who is interested in programming can benefit by taking part in the development process. Projects frequently involve a comprehensive peer review process, which heightens the human capital gains. Individuals across the world have access to the in-progress

software, and thus can correct for bugs lurking within one another's code. Furthermore, when a coder knowingly encounters a problem, he or she can reach out to the rest of the hacker community for solutions. These individuals all carry unique sets of knowledge to contribute. Garzarelli and Fontanella refer to this phenomenon within open source development as the "cross-pollination" of ideas (Garzarelli and Fontanella 2011, 941). It leads to an increase in aggregate knowledge, of which the individual hacker is able to reap the benefits.

In many ways, open source software development can be thought of as a complement of, and a substitute for, formal education. Many universities have launched courses in open source software development; educators recognize the scholastic merits of the process. Yet, many coders forego the college experience altogether and rely instead on hacker communities and software development projects.

Studies suggest that human capital development is, in fact, a significant motivation for contributing to open source software. Results from Oreg and Nov's study suggest that self-development is the main driving force behind open source software contribution (Oreg and Nov 2008, 2067). Respondents were asked to rate the importance of different motivations and self-development averages at 78% of the maximum ranking. Though Lakhani and Wolf come to a somewhat different conclusion in terms of ranking the motivations, they find that 41.3% of coders cite self-development as a substantial reason for contributing (Lakhani and Wolf 2005, 23).

Through the cultivation of human capital, hackers can anticipate higher future earnings. In the intertemporal choice utility maximization model, individuals gain utility through their present consumption and their expected future consumption. An increase in future income results in the potential for greater consumption in subsequent time periods; thus this expectation heightens an individual's utility. These developers do, however, face an opportunity cost for engaging in open source software development—their foregone wages. Applying this model to open source software development, an individual's preferences towards present and future consumption will determine the optimal amount of time to spend in development. As it is consistent with utility maximization, human-capital accumulation clearly illustrates one dimension of hacker rationality, despite that the immediate rewards are intangible.

### **Intrinsic Satisfaction**

Despite their intangible nature, intrinsic factors are also powerful forces for the software developer. As hackers can freely choose their projects, they undertake those that appeal to them in one way or another. Lakhani and Wolf find that 44.9% of contributors partake in open source development for the sake of intellectual stimulation (Lakhani and Wolf 2005, 12). For many, the coding projects offer an outlet for creative thought. The process of programming thus supplies the coder with a sense of pleasure. The standard labor-leisure choice utility maximization model depicts the reality that both

consumption and leisure activities boost an individual's level of utility. When hackers contribute to open source software for their own personal satisfaction, they engage in leisure activity. Thus their utility levels rise.

Intrinsic motivations also take root in altruism. Oreg and Nov find that altruism is the second most significant impulse drawing hackers to contribute to open source software (Oreg and Nov 2008, 2067). Though altruism may appear to be inconsistent with rational action, Smith would beg to differ. In *The Theory of Moral Sentiments*, he states, "How selfish soever man may be supposed, there are evidently some principles in his nature, which interest him in the fortune of others" (Smith 1987, 65). Furthermore, according to Smith and Weber, altruistic actions often stem from blatant self-interest in actuality (Smith 1986, Weber 1930). Smith later asserts that individuals "desire both to be respectable and to be respected" (Smith 1986, 87). Altruistic actions allow individuals to pat themselves on the back, while also waving to the bystanders. In the same spirit, Weber argues that virtuous actions are only virtuous to the extent that they are useful (i.e. to the extent that they emit virtue to others) (Weber 1930, 53). Stemming from Weber's logic, it is quite possible that the altruistic motives of these hackers assist in developing their social statuses, and in reality, are far less altruistic than they imply.

### **Status Development**

Hackers realize the benefits of their open source undertakings in realms beyond personal resources and intrinsic

satisfaction; they also develop social resources. Oreg and Nov find that for many open source developers, their "desire to establish their reputation and to gain approval from others in the field" serves as a basis for their contributions (Oreg and Nov 2008, 2059). The social dimensions to this motivation are overwhelming. Development projects create connections between individual coders. These connections are often weak, but powerful nonetheless. Individuals across the world can coordinate on the same project, debug one another's code, and offer programming insights to each other. Most projects contain components with various levels of difficulty and thus connect individuals at every level in the coding hierarchy. When strategically exploited, these vertical connections lend individuals the ability to attain status and climb the social ladder (Lin 1999, 470).

As one might predict, self-development also impacts status development. It would be difficult, if not impossible, to fully distinguish the individual dimensions from the social dimensions of status attainment; the two are inherently intertwined. Be that as it may, research confirms that status acquirement brings about tangible rewards for open source developers. The Apache Software Foundation hosts a plethora of development projects and ranks its contributors based on the quantity and quality of their contributions. Lerner and Tirole find that "individuals who enjoy high rank in the Apache organization enjoy wages that are 14 to 29 percent higher" (Lerner and Tirole 2005, 105). The direct status gains only occur within the open

source Apache organization. Yet, the wage increases suggest that there is more to the story; high status contributors are able to leverage their acquired statuses into other sectors and reap the material rewards. Though irrational at first glance, open source contributors appear to embody rational action when painted in this light.

### **Need Fulfillment**

Finally, the most self-evident motivation for open source software contribution is to fulfill a specific need. The source code for most commercial software is only available to the public in binary code. This code is directly executable by a computer, but extremely problematic for a human to attempt to understand or alter. Thus, when individuals or organizations have specific programming needs that are not directly available on the market, oftentimes their only option is to turn to open source software. In exchange for using the base software, their contributions must also be made public. In this case, the contribution is rational so long as the benefit that the software provides exceeds the opportunity cost, or the compensation foregone by directing labor to the software project.

When an organization requires the software and pays an employee to develop it, the wage clearly represents the coder's incentive to contribute. Lakhani and Wolf find that need fulfillment is the dominant impetus for hackers to develop open source software, with 58% listing it as a motivational force (Lakhani and Wolf 2005, 11). Despite need fulfillment's prevalence as a motivation, it requires little reconciliation with rational action theory. If

an individual has need for undeveloped software, clearly the rational decision is to develop the software if doing so is feasible.

### **Concluding Thoughts**

Individuals that engage in open source software development are not deranged after all. They often contribute code in order to sharpen their programming skills. This development of human capital, in turn, leads to the potential for a higher future income. Status attainment through vertical network expansion can also supply an individual with heightened wages in the future. Enjoyment signifies leisure activity, which can certainly increase an individual's level of utility. Considering the writings of Adam Smith and Max Weber, altruism can denote self-interest and may even take root in the desire for social status. When a hacker codes to fulfill a software need, he or she rationally responds to market forces and weighs the (software) benefits against the (opportunity) costs. All of these motivations illustrate *homo economicus* in action. Despite the increasing complexity of society, classic economic theories still prevail.

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