

MOTIVATION IN SELECTION OF OPEN SOURCE SOFTWARE LICENSE: ECONOMIC AND SOCIAL PERSPECTIVE

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ABSTRACT

Open-source software development widely used the practice of software engineering now a day. It is needed to explore the motivational factors for the selection of open source software licenses. The objective of this research is to find out the motivational factors for the selection of open source software licenses concerning economic and social perspectives. Literature reported motivational factors are verified. Types of different aspects of OSS license selection do not include in the scope of this study. The research question answered through the survey research method. We floated the survey in both local (Pakistani) and international open-source software development community. The results show motivational factors for open source software license selection with respect to economic and social perspectives according to the expectations of local (Pakistani) and international open-source software development community. Literature reported motivational factors verified in this study. There is no significant way/process to adopt any open source software license. To choose an OSS license from a huge OSS license population is concerned about the behavior of decision-maker personals. These motivational factors are those on which the open-source software development community has made their choice of the open-source software license.

Keywords: *Open Source Software, Open Source Software Development, Open Source Software License, Open Source Software Development Community, Free Software*

1. INTRODUCTION

License is also one of the most important tactics used by a project to allow its intellectual property to be publicly and freely accessible and yet governable [1]. Open-source software is that software which released under an open-source software license. Free software is about granting users the freedom to run, copy, distribute, study, change, and improve the software. Free software is any software that provided the following privileges. The freedom to:

- Run the program, for any purpose (freedom 0).

- Study how the program works and adapts it to your needs (freedom 1). Access to the source code is a precondition for this.
- Redistribute copies so you can help your neighbors (freedom 2).
- Improve the program, and release your improvements to the public so that the whole community benefits (freedom 3). Access to the source code is a precondition for this [2].

It refers to internal /external forces that lead an individual to initiate a piece of work and persistent behavior. It refers to the engagement of an individual with pleasure in an activity for his satisfaction and without any external reward.

It refers to the engagement of an individual without pleasure in an activity, but for external reward, it also refers to the participation of an individual for avoiding punishment [3]. On close evaluation, it becomes apparent that the existing literature does not provide sufficient knowledge about the motivational factors for selecting an open-source software license in economic and social perspectives. It is still a grey area to choose open source software licenses on a social perspective [9]. Open-source software was chosen if and only if the return on investment on proprietary software is less [8]. There are multiple perspectives for the investigation of the selection of open source software licenses. Still, this research focused on economic and social perspectives because of easily available literature on these perspectives. Therefore, the intention is to explore this knowledge area.

2. LITERATURE REVIEW

This literature survey provides the history of open-source software development and its licenses. It also discusses the concepts of motivation. It also accumulates the motivational factors of taking participation in open source software development and the motivational factors for the selection of open source software licenses in economic and social perspectives.

2.1. OSS Development And Licenses

In the 1960s to 1970s, Berkeley and MIT developed major parts of internet computer operating systems. In those years, the sharing of source code between programmers in different organizations took place. In 1970, developers focused their attention on the development of such operating systems that could run on different platforms. The initiation of computer network in 1979 accelerated the source code sharing. But, till the beginning of the 1980s, there was not made of any effort to describe the copyright of any contribution [6]. In 1983, Richard Stallman made an effort to provide copyright and found a free software foundation that introduced a license named GPL. [20,6]. Aim of the OSS license is to provide the

copyright to the concerned person and enhance the sharing of source code. UNIX developed in 1991, and in the 1990s, a community of open source and the commercial firm started to share the source. 1993 Berkeley introduced another license named BSD, which provided choice to the community. In late 1997 Christen Peterson, named this movement as open-source [6].

The research on open source software development provides a whole activity of development of open-source software .i.e. Input, process, and output. As input in open source software development, these factors used .i.e. member characteristics. It means team member's features, their skills and their work management system; second input is project characteristics. It means that the license type under which open-source software released. It is an essential characteristic of open-source software projects because, on the basis of it, the participants decide their participation in any open-source software development activity. This characteristic plays a role in motivating the participant for active participation. It has found that participants are more motivated if the license is permissive/non-restrictive. Literature provides evidence that those OSSs become more popular, which have non-restrictive licenses.

But on the other hand, mostly successful OSSs are those who released under a restrictive license. The third input in the OSS project characteristic is technology use. It is relevant to that mechanism which used for communication among the team members. The process on the input did in the following shape. The first process on the input did the software development process. In this process, the software shall be developed as the recommended guidelines are available. But open-source software development does not follow the recommended instructions because those guidelines are for closed source software and open source software is different from that. In open-source software, volunteers provide their services, and they do not know each other and do not communicate directly. There is no single method of release of open-source software. It

once released then new version remains in the queue, and the project does not attain a stable position [1].

The second process is the social process through which team members manage their interpersonal relationships by their behavior, cognitive, and verbal activities. The third process is the firm involvement process. Due to the success of OSSs, mostly, the firms are attracted to OSSs, and they use the hybrid process of open source software and proprietary software. The new states are those that are essential for processing input to develop output. There is trust among team members and their role in the projects. It is tough to maintain. The final part of this whole cycle is output. In this part, the success of OSSs measured, and software is implemented and evolved [1].

2.2. Motivation For Participation In OSSD

Motivation means a person goes to do something. If anybody does not want to do something, then it is called unmotivated. There are two types of human motivation, which are (1) intrinsic motivation (2) extrinsic motivation. Intrinsic motivation has three types which are (1) pleasure of seeking (2) pleasure of improving own skills (3) artistic sensory satisfaction. Extrinsic motivation has four types (1) integrated regulation (2) identified regulation (3) interjected regulation (4) external regulation [3, 4].

Individuals motivated to take active participation in open-source software development. There are twenty-six motivational factors of individuals for taking part in open-source software development, which is a permissive license [5,6] and Protection of ideas[5,7]. Get degree from university, ego satisfaction, sense of enjoyment/achievement, extension in innovation of an individual, better performance, full initiative, credit to author, material benefits given to skilled people by organization, ability to breakdown whole work, ability to pursue challenges [6], Better future job, good reputation, improve social status, fight against market domination, economic benefits, maximum

time/resource utilization [5,6,7,8,9], Recognition of own skills[5,6,7,8], Own need of software, Gift Benefits[9], Providing service of open-source software, Donation to developers[10], Helping of community, Improving the society Status [11], Own name in contribution list [12].

Organizations motivated to take participation in open source software development because of the following reasons, acquire more clients, and acquire More Employer/Developer and Fights against market domination [5], increase pressure on its competitors, save resources [7].

Users motivated to use the open-source software because of the following reasons free of cost, free availability, free analyzing of code, and free distribution [5, 6, 7, 10].

2.3. Motivation For Selecting OSSL

The selection of open source software license depends upon software user's characteristics, the job market of developers estimated maintaining cost proprietary software vs. software project coordination. The choice of open source software license affected the economic welfare of the development team and its users. A team chooses open source software license if and only if the maintenance cost of open source software is less than proprietary software; otherwise, that team chooses the proprietary software [22]. These are the motivational factors that influence an individual for the selection of open source software license, return on investment [7], experienced related community, inexperienced related community, and own previous experience[13], Business model[14]. It is a proposed framework that described that open source software license choice in the commercial context. It contains the following parameters Business Model, Patenting, Motivation Creation, leadership, Externalities, company Size, which will affect the decision of open source software license selection from a commercial perspective[14].

2.4. Critical Review Of Literature

This part of the chapter compiled some crucial facts from literature which addressed to this research. License is a technical, commercial, political, and juridical tool. Open Source Initiative (OSI) defined that there are two types of open-source software exist (1) restrictive license (2) permissive license. GPL, LGPL and MPL are examples of restrictive license and MIT, BSD and Apache are examples of permissive license. The description of these licenses shown in table 1, which is given below [14].

License is a tactic that permits the software is publically accessible or governable. License type influences all open source software development activities. The open-source software license allows the community to use, redistribute and inspect and modification of that software's code which is released under it [15]. GPL is the most commonly used open-source software license and it has significant legal effects [16, 17]. GPL adoption is up to 71% and 29 license has compatibility with it, and 78 grants have incompatibility [18]. Both GPL and MPL are incompatible with each other [17]. EPL (Eclipse public license) is inconsistent with GPL [19].

3. SELECTION OF RIGHT RESEARCH METHODOLOGY

The choice of research methods not only depends on the area of research but it also depends on the following factors such as research type which is acceptable to university, researcher sponsors and evaluators of research [23]. The selection of research methods makes the same sense of the selection of open source software licenses. The selection of research methods depends on the technique, the researcher, and the circumstances of research [24].

This research wants to see the trends in the adoption of the open-source software license. Therefore, the population of this research is those people who have taken part in open source software development activities. It is credible for

the researcher if the community responds. The research study used a social approach. It used for eliciting and understanding the views of the open-source software community. The researcher interpreted the obtained results from the research. This research is related to the adoption of the open-source software license in the open-source software community of the whole world.

Literature reported many research methods to exist in the field of software engineering named mathematical model, controlled experiment, case study, action research, field experiment [25,26,27,29,30]. Experiment and phenomenal study are straightforward while the case study and survey belong to other categories. Conceptual studies (interpretive) and experiment are opposite to each other in the continuum approach [31].

The research aims to explore the area and describe the reason, problem, and give their explanation [26]. Exploratory research tries to find out the happening of the event through qualitative techniques but it doesn't necessarily. Descriptive research is related to events or persons through qualitative and quantitative techniques. Explanatory research provides the reason for events and problems by qualitative and quantitative techniques [26, 30, 33]. In point of view of Robson, the survey is appropriate for descriptive techniques; case studies are for exploratory techniques and experiments for analytical techniques but Yin stated that each type of technique could be used for any research strategy. These all three techniques provide a guideline in the adoption of appropriate research methodology as shown in table 3 [34]. The scenario of the adoption of research methodology based on the research situation, researcher background, and the possible available research method [26, 33].

3.1. Unit Of Analysis

Project managers usually know the development activities of open-source software. They also have the right to choose the open-source software license. This research focuses on the

motivation factors of a project manager due to which he adopted an open-source software license. Therefore, this research only focuses on the open-source software community both at the national level and at the international level.

3.2. Data Collection

The relevant data gathered about the selection of license of open source software from those personals, whose background is from the open-source software community through a questionnaire. The sample is huge in number and scattered all over the world; therefore, e-mail is the best way to collect data or observe the behavior through attained responses. The questionnaire sent more than 650 persons.

3.3. Research Setting

This section presents the setting of our web survey. The sample selecting process for this web survey design of instrument of research, i.e., questionnaire and process of data gathering presented.

3.4. Sample Selection

This research focuses on the elicitation of data from the perception and experience of the community for the motivational factors in the selection of open source software licenses. It suggested that if you want to get information about any area, then questions should ask those who have more knowledge in that area [35]. As literature reported that a project manager has more knowledge about any project; therefore, we targeted the project manager. For verification, the literature claims the researcher took a sample of those people in the community that are not project managers. We selected the individual based on e-mail addresses. A total of 650 members of the open-source software development community on source forge.net and paklag.org sent the email. In the email, we described the purpose of conducting a survey. Failure message of 45 emails received because of invalid email addresses. The remaining 605 members received the email from which 123

members replied. From which eight were incomplete therefore we didn't count them.

4. DATA ANALYSIS

The statistical analyses applied through the survey tool on the attained data. A variety of issues found through the responses of the questionnaire. The results of the survey interpreted and globally announced through general/conference publications. The analysis of the survey performed based on motivational factors of open source software development community for the selection of open source software licenses for economic and social perspectives. For achieving research goals, data gathered from both international and local open-source software development communities. This chapter shows the demographic analysis of responses; secondly presents the priority ranking of factors, which gets from receiving responses.

4.1. Demographic Analysis

From the receiving responses, 34 responses are from the local (Pakistani) open-source software community, and the remaining 81 responses are from the international open-source software community.

4.1.1. Priority Ranking

This section describes the priorities of both economic and social factors. To show the clear picture in graphical form, draw two graphs of the factors mentioned above. It is the graphical representation of 1-6 factors in figure 1, in this graph motivational factors are on X-axis while no. of responses on Y-axis, whereas dark blue color line, indicates the critical importance, red color lines represent the high importance, green lines show medium importance, dark grey lines reflect the low importance and light blue lines indicate the no importance.

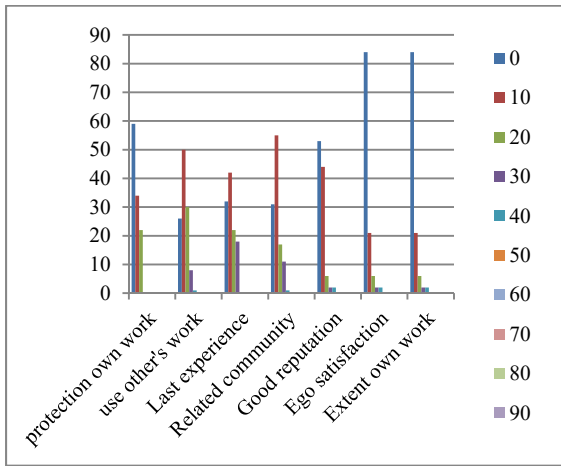


Fig 1. Graphical representation of 1-6 factors
It is a graphical representation of 7-13 factors in figure2.

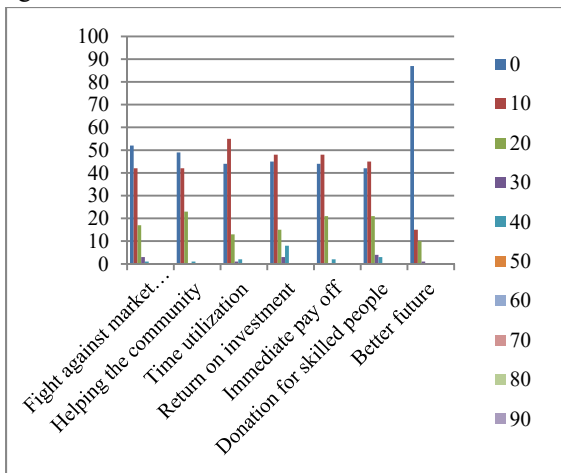


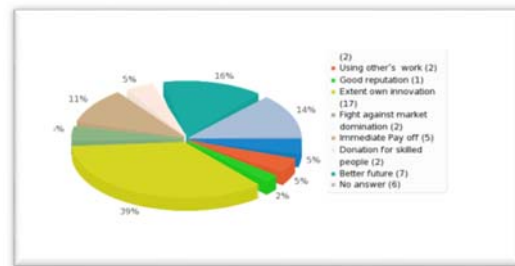
Fig. 2 Graphical representation of 7-13 factors

4.2. Comparison Scale

This section analyzes which factors comparatively more influencing to personnel to choose a specific open source software license. In the first section, the frequency of the local OSSD community will be present. In the second section, the frequency of the international OSSD community will be present, and in the third section combination of both communities, frequencies will be present.

4.2.1. Comparative Scale For Local OSSD Community

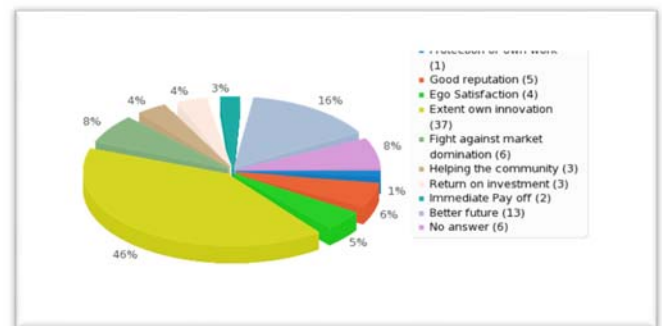
This section analyzes that which factor comparatively more influences to the personnel to choose specific open source software license in local OSSD community. The frequency of responses for factors shown in the pie chart which provides more detail about the responses because it also shows the percentage of each response, as shown in the pie chart no 1.



Pie Chart 1. Comparative scale of local OSSD community

4.2.2. Comparative Scale For International OSSD Community

This section analyses that which factor comparatively more influences to personnel to choose specific open-source software license from international OSSD community. The frequency of responses for factors shown in the pie chart, which shows more detail about the responses because it also shows the percentage of each response, as shown in the pie chart no 2.

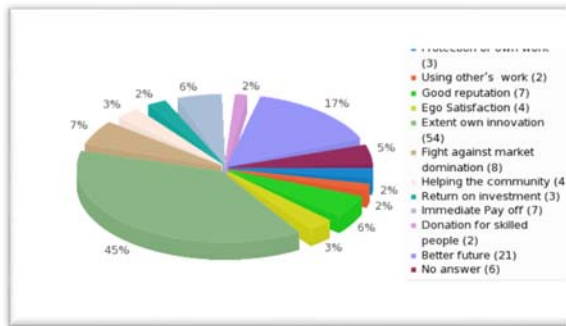


Pie Chart 2. The comparative scale of international OSSD community

4.2.3. International And Local OSSD

Community Comparative Analysis

It is the frequency of responses for both international and local OSSD community for the draw pie chart to show the responses in pie chart no 3.



Pie Cart 3. Comparative scale of more influential factors

4.2.4. Motivation Factors For Open Source Software License Selection

Before analysis on motivation factors for the selection of open source software license selection to social and economic perspective paper will discuss covariance and its types.

4.3. Covariance

For two variables A1 and A2 having means E (A1) and E (A2), covariance defines as,

$$\text{Cov} (A1, A2) = E [\{A1-E (A1)\} \{A2-E (A2)\}]$$

The covariance of A1 and A2 calculates as take their difference from their mean value and multiplies their difference. If the result of covariance is positive, then it states that both variables vary in the same direction. When the result is negative, then it shows that both variables varied in the opposite direction. As large is the product result, as strong the relation. If the result of covariance is zero, then it shows that there no relationship among both variables. This section separates local and international motivation factors and analyses them. In the end, combine comparison on the responses will be implementing.

4.3.1. Motivation Factors For Local OSSD For Oss License Selection

For the investigation of motivation factors of local OSSDC and International OSSDC, this research applies the “Z test,” which implemented below; this “Z test” sets the level of significance $\alpha = 0.05$. We have $1 - \alpha = 1 - 0.05 = .095$, get the value of Z from the value table as $Z .95 = 1.645$.

It proves that the causes of the selection of open source software licenses are a free extension in the innovation of individual skills, the excellent reputation of an individual, and the expectation of a better future of an individual.

4.3.1. Covariance Analysis Among Social Factors In Local OSSD

The attained results show that extension in its innovation in local OSSD Community(Pakistan) has a linear relation with its excellent reputation; own better future, and vice versa.

4.3.2. Motivation Factors For International OSSD For Oss License Selection

The basis of selection of open source software license in the international OSSD community is an extension in innovation, good reputation and expectation of better future of an individual is a cause of selection of open source software license and vice versa.

4.3.3. Motivation Factors For Local And International OSSD For Oss License Selection

There are three most voting new motivation factors which come to know from the survey in international and local open-source software development community with respect to the social and economic perspective. Still, this section shows the relationship between all motivation factors.

The social causes of the selection of open source software licenses are the extension in innovations, good reputation, helping the

community, and protecting the own idea of an individual.

The expectation of a better future, immediate payoff, a donation to skilled people, and using the other work are the economic cause of the selection of open source software licenses.

The test results indicate that both the open-source software development community's .i.e. locally (Pakistani) and internationally made the selection of their open-source software license choice on these factors also.

4.4. Covariance Between Factors

This section analyses the relationship between social and economic factors motivation factors of OSS license selection.

4.4.1. Covariance Between Social Factors

This section presents the covariance between social factors given below. The above result shows that these three factors i.e. extension own innovation, good reputation and helping the community have a linear relationship with each other while protection of own idea has nonlinear relation with all the factors as mentioned above for open source software license selection.

4.4.2. Covariance Between Economic Factors

This section presents the covariance between economic factors. The result shows that own better future, immediate payoff, a donation to skilled people, and using other's work have linear relation for open source software license selection and vice versa.

4.4.3. Covariance Between Economic And Social Factors

This section presents the combine covariance of economic and social factors.

The above result shows that these factors, i.e., better future, extension in innovation, immediate

payoff, donation to skilled people, using other's work, good reputation, helping the community have linear relationship with each other in selection of open source software license selection; while protection of own work has nonlinear association with above-discussed factors for open source software license selection.

5. CONCLUSION

First of all, in this research, a literature survey is conducted on open source software development, which revealed that now trends of research are shifted towards the choice of the open-source software license. But this area is not fully explored until now and limited studies conducted in this perspective. The idea behind the research study is to explore this area and create awareness in the open-source software development community about the open-source software license adoption. The focus of the findings of this study concerns the open-source software development community. The results of this research are also for project managers about the choice of OSS licenses; it is as important as developing skills for any open-source software projects because it relies on that approved OSS license after launching OSS under any possible license of both the software and development team. To keep in view this critical aspect, this research surveyed to determine the motivational factors for OSS license selection concerning economic and social perspectives. The following issues have been addressed in this research survey.

- i. What are the economic motivation factors in the selection of OSSL?
- ii. What are the social motivation factors in the selection of OSSL?
- iii. Which factor is more influential to others?

The research addressed research questions are the following: *What are the motivation factors when choosing open source software license: An economic and social perspectives with respect to the software community? Are the results of RQ1*

are in accordance with the perception of the local (Pakistan) open-source software community?

There are five reported motivation factors with respect to the international OSSD community for selection of OSS license with respect to economic, social, and commercial perspectives, which are a return on investment, our self, previous experience, related community and business model. In this research, we found out more motivational factors with respect to economic and social perspectives on which adoption of OSS license had occurred. At first, these factors determined by the international OSSD community. Later, this research conducted another survey in the local (Pakistani) OSSD community, which also gave an outstanding response. The perception of both OSSD communities was almost the same on the motivational factors which had been found out in this research. In this research, in-depth statistical analysis applied on the results, which produces the following results.

This research revealed that extension in the innovation of an individual correlation to its good reputation, its eagerness to help the community and the protection of its idea. A good reputation correlated to its desire to help the community while it has a nonlinear relation to the protection of its idea. Helping the community and protection of ideas has a nonlinear relationship.

This research found out that a better future is correlated to the immediate payoff, a donation to skilled people and using other's work. The immediate payoff has a linear relation with donation to skilled people and using other's work. Donation to skilled people correlated with using other's work.

In this research, it found that extension in innovation, Good reputation and helping the community correlated to better future, immediate payoff, a donation to skilled people and using other's work while protection of own idea has nonlinear relation with better future, immediate

payoff, and donation to skilled people and using other's work.

The statements mentioned above described that the relationship between social and economic factors is correlated in both situations individually and simultaneously. It means that these factors influenced the project managers of OSS when they decided on any OSSL adoption.

From this research, it finds that most social and economic factors correlate with each other, but some social factors do not relate to other factors. This research will help us understand the adoption of OSS licenses.

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