Motivation in Selection of Open Source Software License: Economic and Social Perspective

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Abstract: Open source software development is widely used practice of software engineering now a day. It is needed to explore the motivational factors for selection of open source software license. The objective of this research is to find out the motivational factors for selection of open source software license with respect to economic and social perspectives. Literature reported motivational factors are verified. Types of different perspectives of OSS license selection are not included in the scope of this study. The research questions are answered through 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 have been verified in this study. There is no significant way/process to adopt any open source software license. To choose OSS license from a huge OSS license population is concerned to the behavior of decision maker personals. These motivational factors are those on which open source software development community has made their choice of 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 that 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 is released under 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 freedoms. 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 which lead an individual to initiate a piece of work and a persistent behavior. It refers to engagement of an individual with pleasure in an activity for his satisfaction and without any external reward. It refers to engagement of an individual without pleasure in an activity but for external reward, it also refers to 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 grey area to make choice of open source software license on social perspective [9]. Open source software is chosen if and only if return on investment on proprietary software is less [8]. There are multiple perspectives for investigation of selection of open source software license, but 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 selection of open source software license in economic and social perspectives.

2.1. OSS Development and Licenses:

In 1960s to 1970s, Berkeley and MIT developed major parts of internet computer operating systems. In those years, sharing of source code between programmer in different organization was took place. In 1970, developers focused their attention in development of such operating systems that could run on different platforms. The initiation of computer network in1979 accelerated the source code sharing. But, till 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 free software foundation which 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 wad developed in 1991, and in 1990s community of open source and commercial firm started to share source with each other. 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 are used.i.e. member characteristics. Its means team member's characteristics, their skills and their work management system, second input is project characteristics. It means that license type under which open source software is released. It is very important characteristic of open source software project because on the basis of it, the participants take decision about their participation in any open source software development activity. This characteristic plays its role in motivating the participant for active participation. It has found that participants are more motivated if license are permissive/non-restrictive. Literature provides evidence that those OSSs become more popular which have non-restrictive license. But on the other hand mostly successful OSSs are those which are released under restrictive license. The third input in the OSS projects characteristic is technology use. This is relevant to that mechanism which is use for communication among the team members. The process on the input is done in following shape. The first process on the input is done is software development process. In this process, the software should be developed as the recommended guidelines are available. But open source software development does not follow the recommended guidelines because those guidelines are for close source software and open source software is totally 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 queue and project does not attain stable position [1].

The second process is social process through which team members manage their interpersonal relationship by their behavior, cognitive and verbal activities. The third process is firm involvement process. Due to the success of OSSs mostly the firms are attracted towards OSSs and they use hybrid process of open source software and proprietary software. The emergent 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 very hard to maintain. The final part of this whole cycle is output. In this part, success of OSSs is 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 improve 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].

Individual's are motivated to take participation in open source software development because of following reasons, permissive license [5,6], 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 owns 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 are motivated to take participation in open source software development because of 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 are motivated to use the open source software because of 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, job's market of developer estimated maintaining cost proprietary software vs. software project coordination. The choice of open source software license affected the economic welfare of development team and its users. A team chooses open source software license if and only if maintenance cost of open source software is less than proprietary software otherwise that team choose the proprietary software [22].These are the motivational factors which influence to an individual for selection of open source software license, return on investment [7],experienced related community, inexperienced related community and own previous experience[13], Business model[14].This is the proposed framework which described that open source software license choice in commercial context. It contains the following parameters Business Model, Patenting, Motivation Creation, leadership, Externalities, company Size, which will affect decision of open source software license selection in commercial perspective[14].

2.4. Critical Review of Literature:

This part of chapter compiled some important 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 is shown in table 1 which is given below [14].

License is a tactic which permits the software is publically accessible or governable. License type influences all open source software development activities.Open source software license allow to 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 major legal effects [16, 17]. GPL adoption is up to 71% and 29 license has compatibility with it and 78 licenses have in compatibility [18]. Both GPL and MPL are incompatible with each other [17]. EPL (Eclipse public license) is incompatible with GPL [19].

3. Selection of Right Research Methodology:

The selection of research method 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 method makes the same sense of the selection of open

source software license. The selection of research method depends on the method, researcher and the circumstances of research [24].

This research wants to see the trends in adoption of open source software license. Therefore, the population of this research is those people, which have taken part in open source software development activity. It is credible for researcher if the community respond. The research study used social approach. It is used for eliciting and understanding the views of open source software community. The researcher interpreted the obtained results from the research. This research is related to adoption of open source software license in open source software community of the whole world.

Literature reported a number of research methods 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 case study and survey belongs to other category. Conceptual studies (interpretive) and experiment are opposite to each other in continuum approach [31].

The aim of the research is to explore the area and describe the reason, problem and give their explanation [26]. Exploratory research tries to find out the happening of event through qualitative techniques but it doesn't necessary. The descriptive research is related to the events or persons through qualitative and quantitative techniques. Explanatory research provides the reason of events and problems by qualitative and quantitative techniques [26, 30, 33]. In point of view of Robson survey is appropriate for descriptive techniques; case studies are for exploratory techniques and experiments for explanatory techniques but Yin stated that each type of technique can be used for any research strategy. These all three techniques provide guideline in adoption of appropriate research methodology as shown in table 3 [34].The scenario of adoption of research methodology is 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 right to choose the open source software license. This research focuses the motivation factors of a project manager due to which he adopted open source software license. Therefore, this research only focuses the open source software community both at national level and at international level.

3.2. Data Collection:

The relevant data is gathered about the selection of license of open source software from those personals, whose background is from open source

software community through questionnaire. The sample is huge in number and scattered in all over the world therefore e-mail is the best way collect data or observe the behavior through attained responses. The questionnaire was sent more than 650 persons.

3.3. Research Setting:

This section presents 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 is presented.

3.4. Sample selection:

This research focuses on the elicitation of data from the perception and experience of community with respect to the motivational factors in selection of open source software license. It is suggested that if you want to get information about any area then questions should ask to 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 researcher took sample of those people in community that are not project managers. We selected individual on the basis of e-mail addresses. A total of 650 members of open source software development community on source forge.net and on paklag.org were sent the email. In the email, we described the purpose of conducting survey. Failure message of 45 emails were received because of invalid email addresses. The remaining 605 members received the email from which 123 members replied. From which 8 were incomplete therefore we didn't count them.

4. Data Analysis:

The statistical analyses are applied through survey tool on the attained data. A variety of issues are found through the responses of questionnaire. The results of survey are interpreted and globally announced trough general/conference publications. The analysis of survey is performed on the basis of motivational factors of open source software development community for selection of open source software license with respect to economic and social perspectives. For achieving research goals, data was gathered from both international and local open source software development community. 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 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 above mentioned factors. This 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.
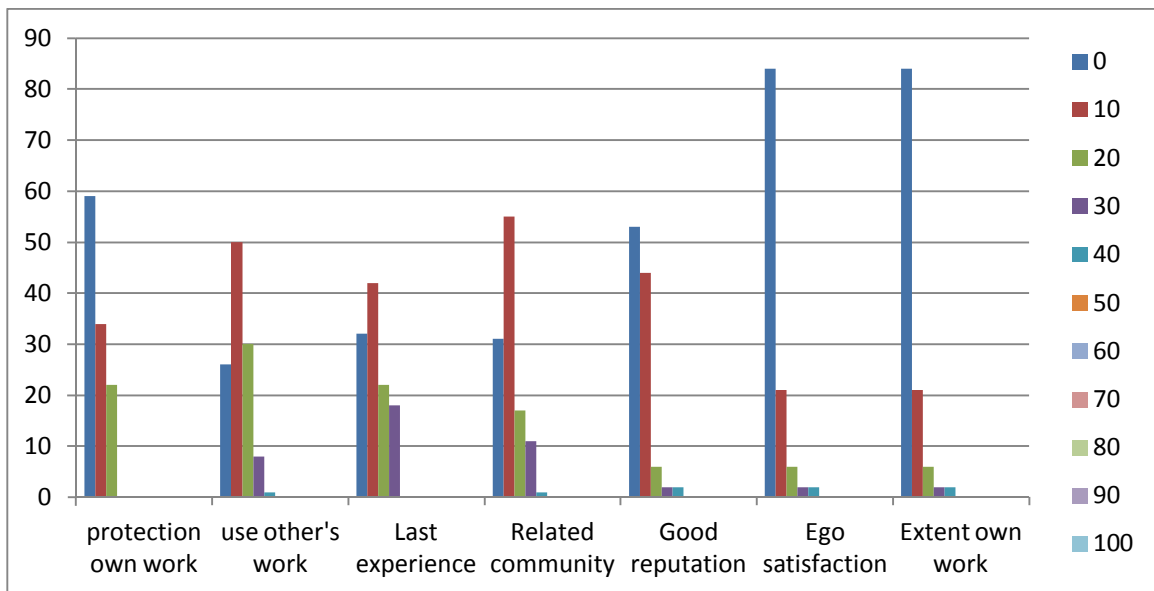

Fig 1. Graphical representation of 1-6 factors

This is graphical representation of 7-13 factors in figure 2.
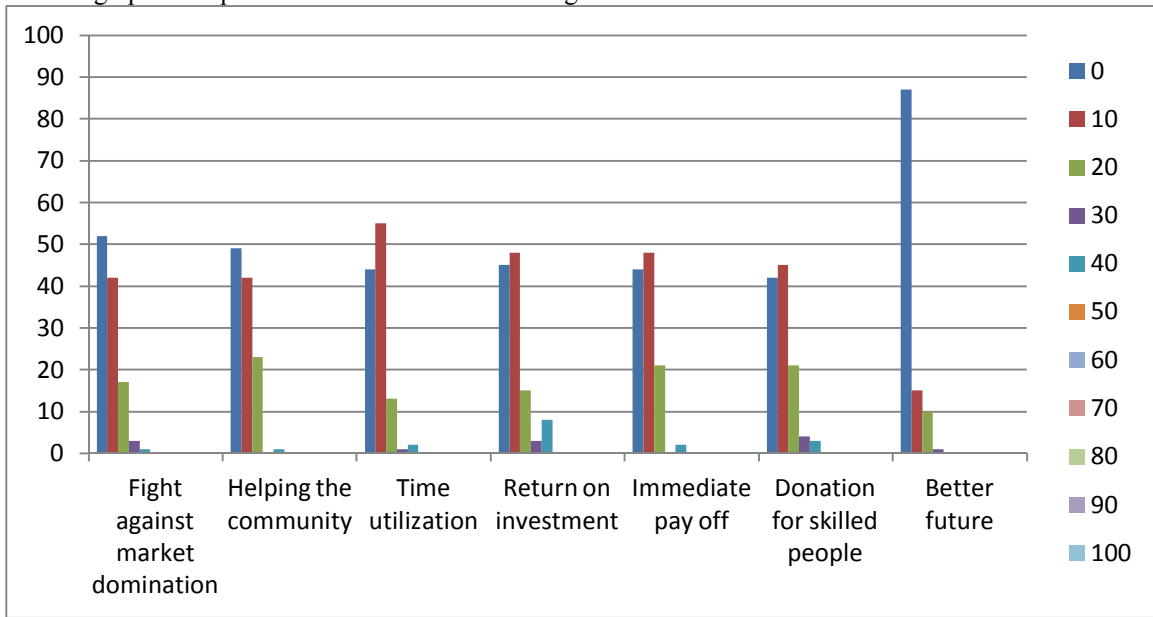

Fig. 2 Graphical representation of 7-13 factors

4.2. Comparison scale:

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

**4.2.1. Comparative Scale for Local OSSD Community:**

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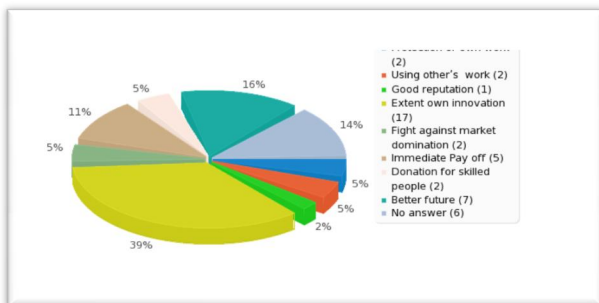
Pie Chart 1. Comparative scale of local OSSD community

**4.2.2. Comparative Scale for International OSSD Community:**

This section analyzes 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 is shown in pie chart which shows more detail about the responses because it also shows percentage of each response as shown in pie chart no 2.
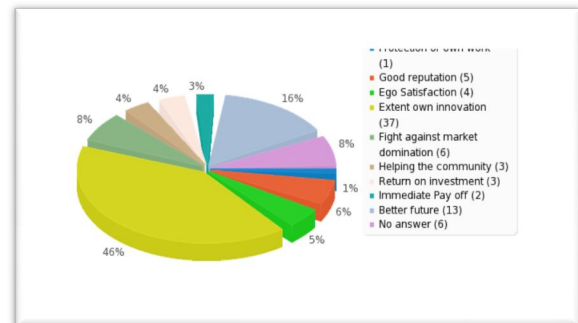
4.2.4. Motivation Factors for Open Source Software License Selection:

Before analysis on motivation factors for selection of open source software license selection with respect to social and economic perspective paper will to discuss covariance and its types.
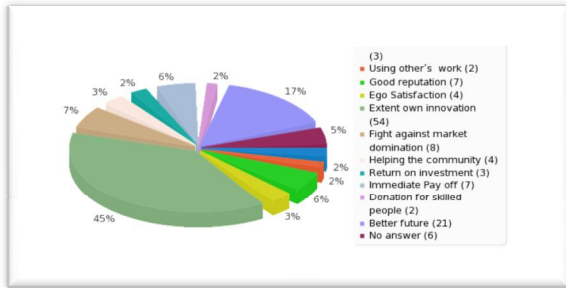
Pie Cart 3. Comparative scale of more influential factors

4.3. Covariance:

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

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

The covariance of A1 and A2 is calculated 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 are varied in same direction and when result is negative then it shows that both variables are varied in opposite direction. As large is the product result, as strong the relation. If the result of covariance is zero then it show that there no relationship among both variables. This section separates local and international motivation factors and analyzes 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 investigation of motivation factors of local OSSDC and International OSSDC, this research applies "Z test", which is implemented below, this "Z test" sets level of significance α = 0.05. We have 1-α= 1-0.05=.095, get the value of Z from the value table as Z.95= 1.645.

It has been proved that the causes of selection of open source software license are freely extension in innovation of individual skills; good reputation of an individual and expectation of better future of an individual.

4.3.1. Covariance analysis among social factors in Local OSSD:

The attained results show that extension in own innovation in local OSSD Community (pakistan) has linear relation with own good 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 international OSSD community is 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 social and economical perspective, but this section shows the relationship between all motivation factors.

The social causes of selection of open source software license are extension in innovations; good reputation, helping the community and protecting own idea of an individual.

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

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

4.4. Covariance between Factors:

This section analyzes relationship among social and economic factors motivation factors of OSS license selection.

4.4.1. Covariance between Social Factors:

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

4.4.2. Covariance between Economic Factors:

This section presents covariance between economic factors. The result shows that own better future, immediate payoff, 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 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 relation with each other in selection of open source software license selection; while protection of own work has nonlinear relation with above discussed factors for open source software license selection.

Conclusion

First of all in this research, literature survey is conducted on open source software development, which revealed that now trends of research are shifted towards the choice of open source software license. But this area is not fully explored till now and limited studies are conducted in this perspective. The idea behind 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 study is to tell the open source software development community through its finding that there are some reasons exist which create motivation in a project manager about the chosen of OSS license and it is as important as development skills for any open source software projects because after releasing of OSS under any license future of both software and development team is depended upon that adopted OSS license. To keep in mind this important aspect, this research conducted survey to determine the motivational factors for OSS license selection with respect to economic and social perspectives. Following issues have been addressed in this research survey.

i. What are the economic motivation factors in selection of OSSL?

ii. What are the social motivation factors in selection of OSSL?

iii. Which factor is more influential to other?

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

There are five reported motivation factors with respect to international OSSD community for selection of OSS license with respect economic, social and commercial perspectives, which are 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 been occurred. At first, these factors are determined from international OSSD community. Later, this research conducted another survey in local (Pakistani) OSSD community, which also gave very good response. The perception of both OSSD communities was almost 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 following results.

In this research, it is revealed that extension in innovation of an individual is correlated to its good reputation, its eagerness to help the community and protection of its idea. Good reputation is correlated to its eagerness to help the community while it has nonlinear relation to the protection of its idea. Helping to the community and protection of idea has nonlinear relation.

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

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

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

From this research it has been found that mostly social and economic factors have correlation among each other but some social factors are not related with other factors. This research will be helpful in understanding of adoption of OSS license.

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