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

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Final Approval

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LIST OF ACRONYMS

Abbreviation	Title
OS	Open Source
OSS	Open Source Software
OSSP	Open Source Software Projects
OSSD	Open Source Software Development
F/OSS	Free or Open Source Software
OSSDC	Open source software development community
OSSL	Open source software license
SE	Software Engineering
TSD	Traditional software development
PSL	Proprietary software license
Covariance Formula	Cov (X, Y) =E (XY)-E (X) (Y)
E(X)	Expectation of X

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. 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. 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*

Table of Content

Chapter #1 Introduction

1.1. Introduction:

This chapter explores the motivation, importance and theme of the research. Research assumptions are declared with respect to open source software, open source software license, motivation, intrinsic motivation and extrinsic motivation. Thesis structure is also presented at the end of this chapter.

1.2. Problem Statement:

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 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.

1.3. Research Question:

This research is concerned to explore the current trends of open source software license selection. The aim of research is to identify the factors which affect during the choice of open source software license and give the relationship of factors with the license for making efficient decisions about taking open source software licenses. Following are the questions which we aimed to answer through our research.

- **RQ1:** What are the motivational factors when choosing open source software license: An economic and social perspective with respect to software community?
- **RQ2:** Are the results of RQ1 are in accordance with perception of local (Pakistan) open source software community?

1.4. Technical Terms:

This section defines those terms, which are essential to understand for OSS community. The most essential terms are free/libre open source software, license, motivation, intrinsic motivation, extrinsic motivation and research methodology named survey.

1.4.1. Survey:

It is a method of collecting information from people about their characteristics, behaviors, attitudes, or perceptions.

1.4.2. Free/Open source Software:

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].

1.4.3. License:

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].

1.4.4. Motivation:

It refers to internal /external forces which lead an individual to initiate a piece of work and a persistent behavior [3].

1.4.5. Intrinsic Motivation:

It refers to engagement of an individual with pleasure in an activity for his satisfaction and without any external reward [3].

1.4.6. Extrinsic Motivation:

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].

1.5. Thesis Structure:

This thesis is organized in the following sequence; chapter 1 describes the motivation for conducting this research and our perception about the free/libre/open source software, license, motivation, intrinsic motivation and extrinsic motivation. Through literature review it is investigated that there is need to conduct research in the area of selection of open source software license.

Chapter 2 accumulates the relevant literature on the motivational factors of open source software community and of an individual for participation in open source software development and motivational factors for selection of open source software license with respect to economic and social perspectives.

Chapter 3 analyzes the different research methodology in software engineering and also gives the justification for adapting survey approach for conducting this research.

Chapter 4 describes our empirical work and detailed description of different techniques that are applied for attaining results.

Chapter 5 presents conclusion of this research in the light of our statistical analysis of survey results. The discussion revolves around the idea of motivational factors in selection of open source software license with respect to social and economic perspectives. The summaries of previous discussion are generated. These tell the contribution in knowledge and limitation of this research. The research is evaluated and further future directions are identified.

Chapter # 2 Literature Review

2.1. 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.

2.2. Open Source Software 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 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 was 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's members characteristics, their skills and their work management system, second input is project characteristics. It means the 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 in the input 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 remain in queue and project could not attain stable position.

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 OSS mostly the firms are attracted towards OSS 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 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]. As shown in figure 1.

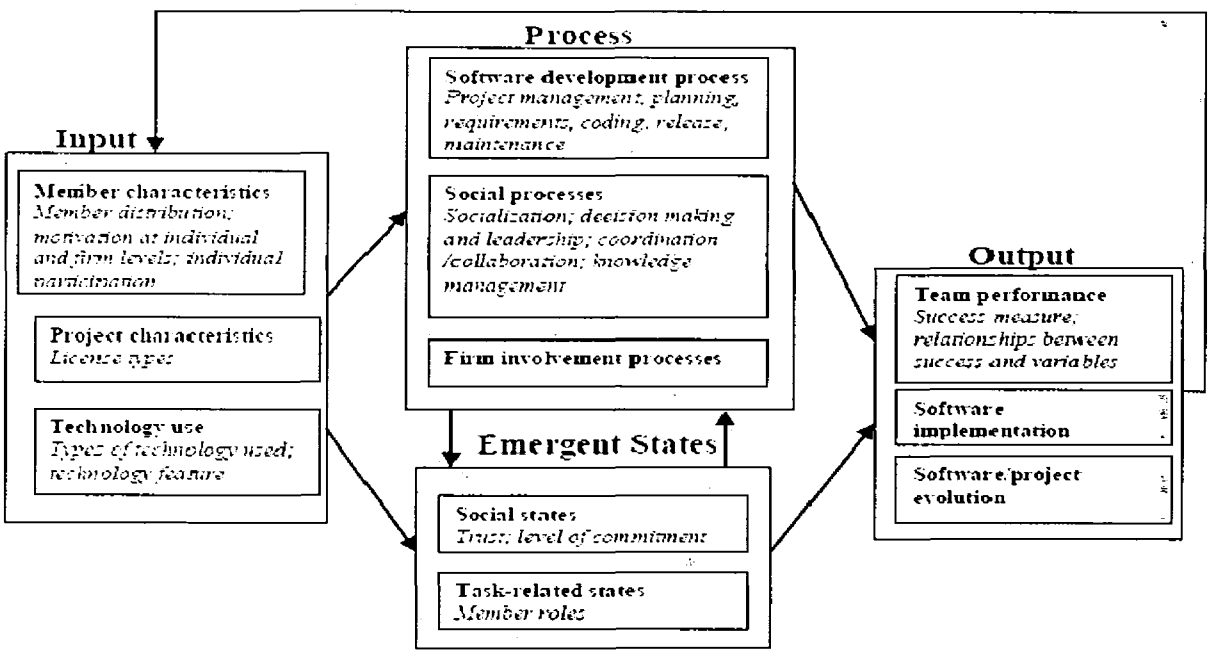


Fig.1 relationship construct from the studies of FLOSS [1,21]

This is a model which presents the hierarchy of open source software and proprietary software after their release. Modification in any software is made after its release is called maintenance. The person who does modification is called maintainer. User-developer is that which use the software and develop it as well [5].

Above mentioned model provides the scenario of any software which was released under any type of software i.e. open source software license and proprietary software license. If software is released under proprietary software then, the maintainer of that software is eliciting feedback on the performance and feature from the user and user-developer. In the light of feedback, maintainer modifies the software and again releases its new version. The feedback which maintainer get from user help him for remaining up to date according to market needs and in increasing the revenue by selling the software. If maintainer does not follow the feedback then his software remains outdated and competitor cover the market which becomes cause of lower down his revenue. The whole process of maintaining proprietary software is shown is figure2 [5].

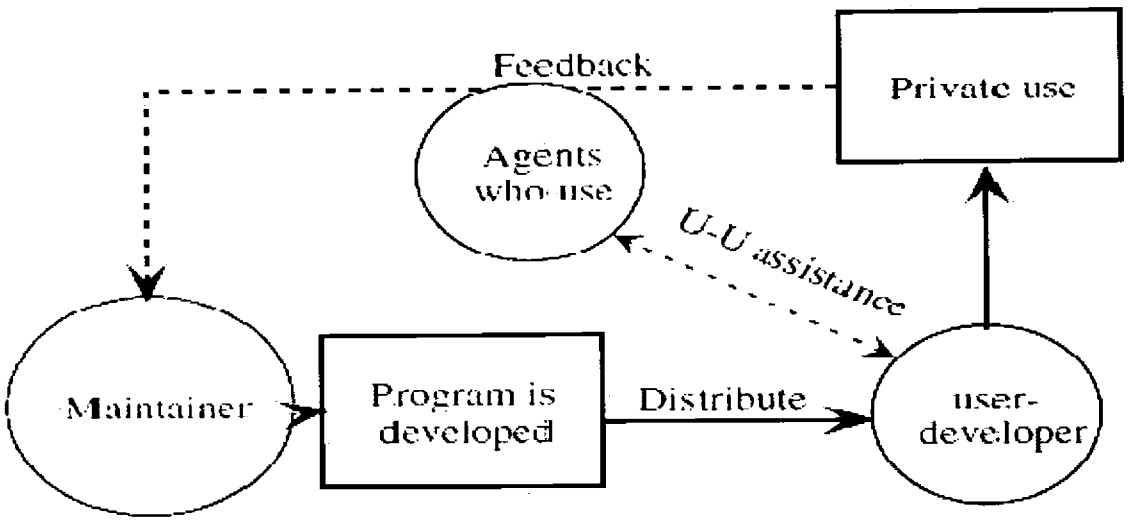


Fig 2. Describe the maintaining process of proprietary software [5]

The maintained process of software which is released under open source software license named GPL is that modifications are suggested by the users in it. Then recommended modifications are developed. After the modifications, modified version is distributed along with its source code to the user-developer. Then the user-developer sent their feedback to the maintainer and this process remains going in such patterns [5].

The maintenance process of that open source software which is released under GPL is given below in figure3

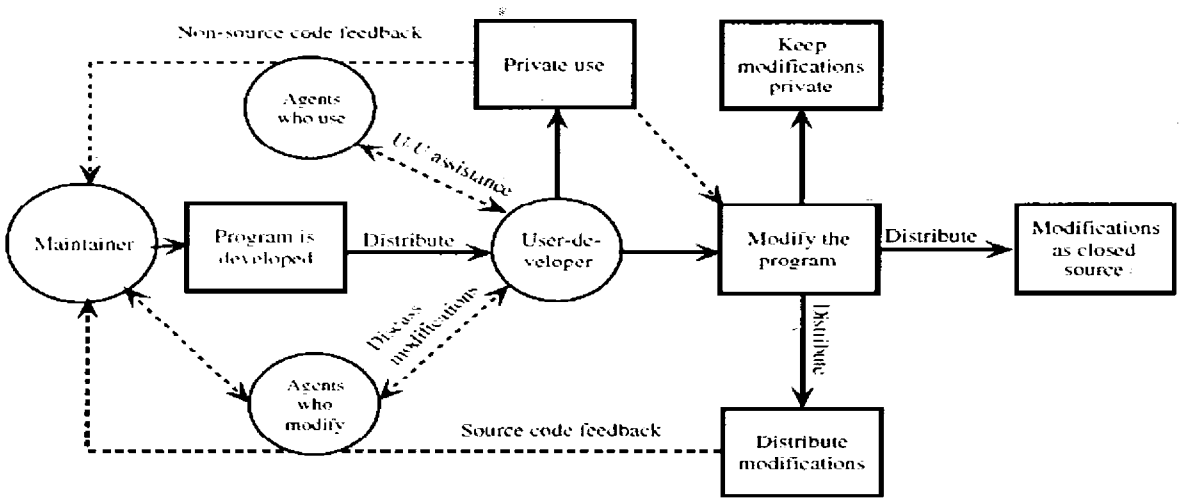


Fig 3. Describe the maintaining process of GPL [5]

The maintained process of software which is released under open source software license named BSD is that modifications are suggested by the users in it. Then recommended modifications are developed. After the modifications, modified version is distributed along with its source code to the user-developer. Then the user-developer sent their feedback to the maintainer. But this open source software license gives relaxation to the community .i.e. maintainer, user-developer to make the modified version proprietary or open source. [5].

The maintaining process of that open source software which is released under BSD is given below in figure4

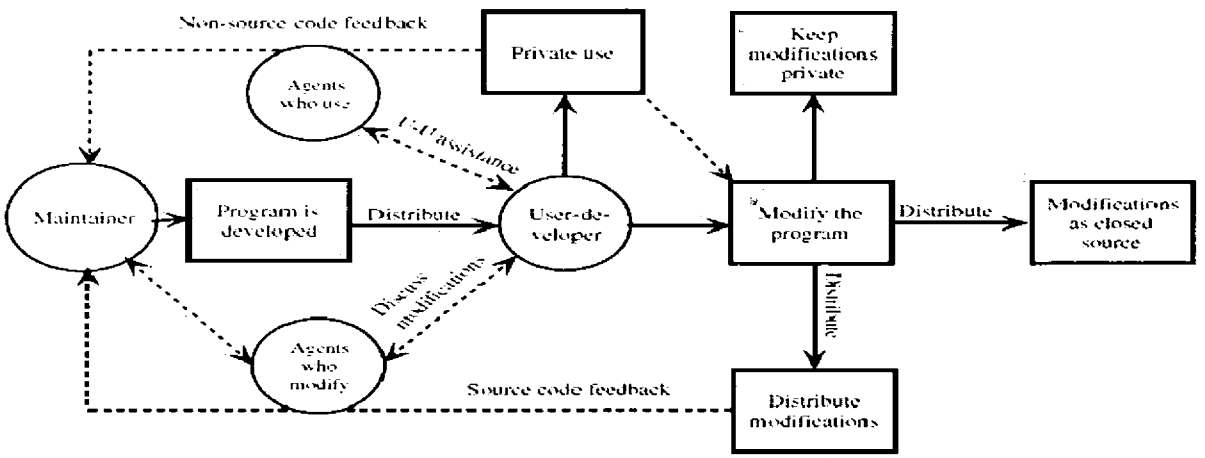


Fig 4. Describe the maintaining process of BSD [5]

This is the pictorial representation of relaxation of BSD in figure 5. It announces that any software which is released under BSD can change its license after modification .i.e. if community wants to keep in BSD or other open source software or make it proprietary[5].

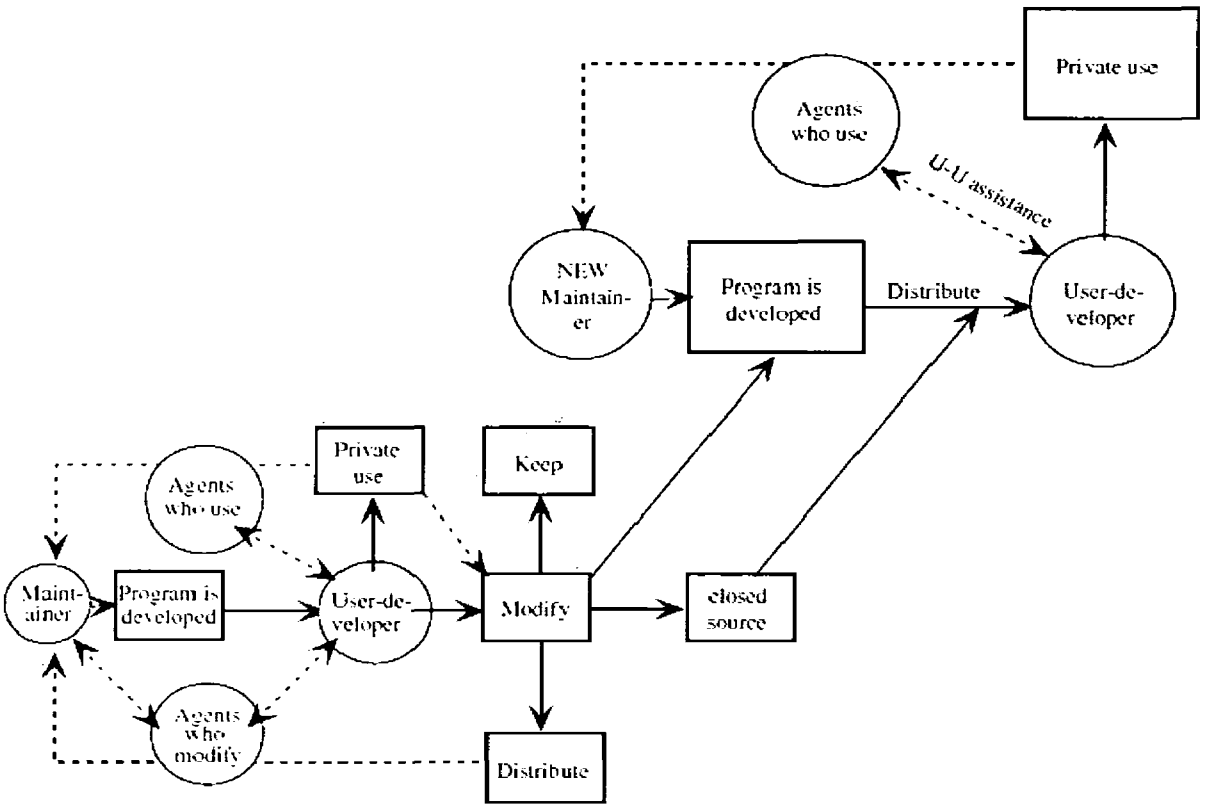


Fig 5. Describe the relaxation of BSD [5]

2.3. Motivation:

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].

2.3.1. Motivation for Participation in OSSD:

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].

2.3.2. 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 which is shown in figure 6[14].

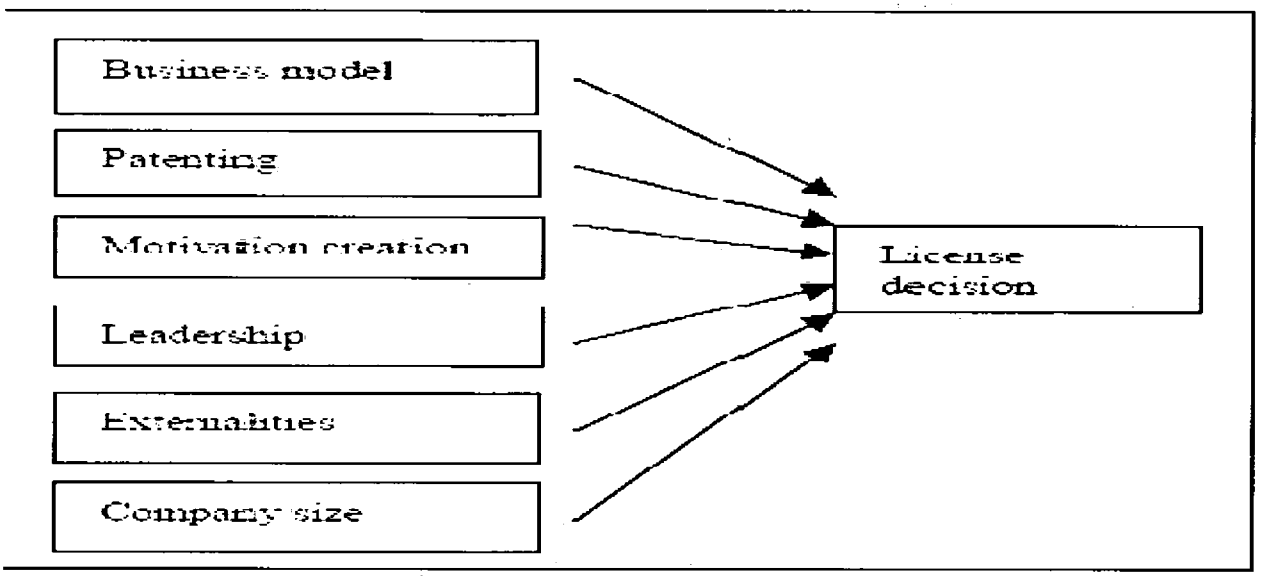


Fig 6. Proposed framework for license selection in commercial perspective

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].

Table 1. Open source software licenses

License	Type	Free Distribution	Derivative works	Bundling	Patenting
MIT, BSD	All permissive	Yes	No restrictions	No restrictions	Not stated anyhow
Apache	All permissive	Yes	Apache name cannot be used for marketing	Apache name cannot be used for marketing	Free licensing required
MPL	Restrictive	Yes	GPL	No restrictions	Free licensing required
LGPL	Restrictive	Yes	GPL or LGPL	No restrictions	Free licensing required
GPL	Restrictive and viral	Yes	GPL	Only GPL	Free licensing required
Commercial	All restrictive	No	Not allowed	Restricted	Restricted

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].

Chapter # 3 Research Methodology

3.1. Introduction:

This chapter describes our research methodology and investigates the new trends in the field of open source software license selection. This chapter consists of following order.

3.2. 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]. In this framework, I consider myself as a researcher, research circumstances and research methodology. As shown in figure 7.

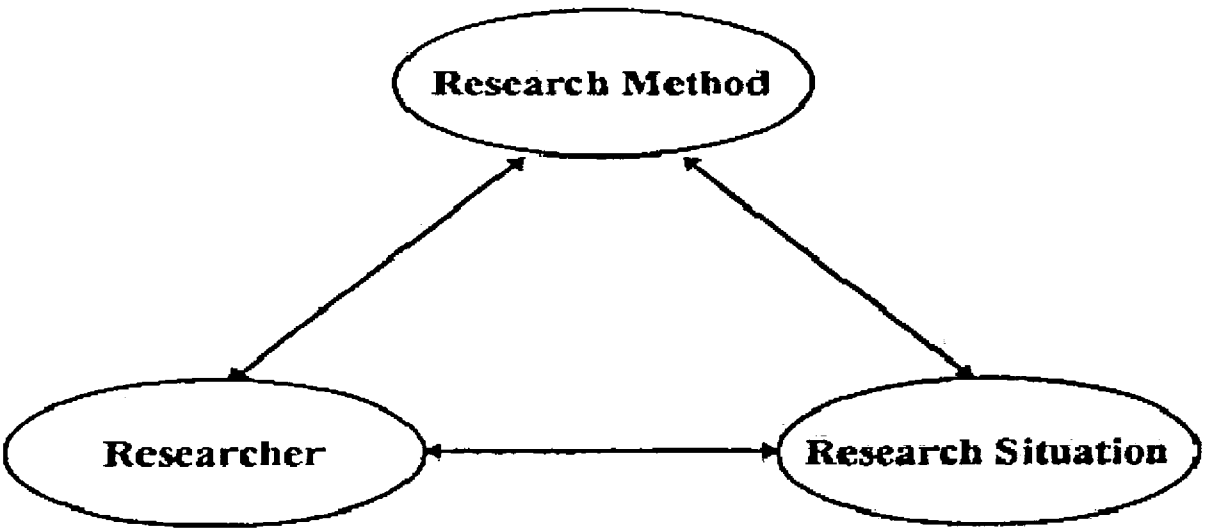


Figure 7. framework of selection of research method [24]

3.2.1. Researcher:

The first degree of researcher is in information technology from the Islamia University Bahawalpur. Then he continued his studies and took in Master of Science (Software Engineering). The duration among in both degrees will be at least three and half years. The researcher is going to explore the very important knowledge area.

3.2.2. Situation of Research:

If anybody wants to understand the complete situation of research then, it is necessary to understand all the aspects of situation of research which are research area, admittance to population/sample, theory to support research and requirement for master's degree assessment.

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.

Any research which is related to the motivational factors for participation in the open source software development activity and motivational factors of selection of open source software license in any perspective is considerable.

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.

The constraints of this research are the researcher's financial status, time duration of degree.

3.2.3. Research Method:

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 taxonomy of the research methodology is described in the table 2

jects	Modes of traditional approaches (observations)							Modes of newer approaches (interpretations)		
	Theorem proof	*Lab experiment*	*Field experiment*	*Case study*	*Survey*	*Futures research*	*Simulation*	*Subjective/ argumentative*	*Descriptive/ interpretative*	*Action Research*
iety	No	No	Possibly	Possibly	Yes	Yes	Possibly	Yes	Yes	Possibly
ganisation/ roup	No	Possibly (small groups)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ividual	No	Yes	Yes	Possibly	Possibly	Possibly	Yes	Yes	Yes	Possibly
hnology	Yes	Yes	Yes	No	Possibly	Yes	Yes	Possibly	Possibly	No
thodology	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
eory building	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
testing	Yes	Yes	Yes	Yes	Possibly	No	Possibly	No	Possibly	Yes
extension	Possibly	Possibly	Possibly	Possibly	Possibly	No	No	No	Possibly	Possibly

Table. 2. Taxonomy of the research methodology [27]

The pictorial representation of approach is describes in figure 8

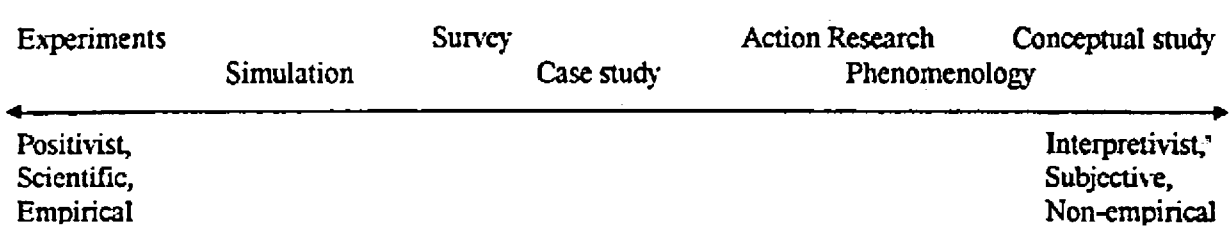


Figure. 8 pictorial representation of continuum approach [30]

3.2.3.1. Conceptual study:

This method is on the right side of figure 8. It provides the subjective opinion about the area of research. This research method contains only thinking process but no experiment. It is opinion based methodology. There is no method of observation and measurement in it therefore it is hard to test hypothesis. It provides opportunity to critically analyze data and finds new dimensions. The subjective nature and necessity to link the conceptual environment to real environment is the major weakness of this research methodology.

3.2.3.2. Proof of Theorem:

This research method is on the left side of the figure 8. Its level of control is the supreme. Its measurement is accurate. The accuracy of results is its strength. The inability to present organizational, cultural and contextual issues in form of equation is its major weakness.

3.2.3.3. Experiment:

This method provides the exact relationship between two variables into a controlled environment. Quantitative techniques provide statement. In this technique behavior of dependent variable is observed after manipulating the independent variable.

3.2.3.4. Field experiment:

This research method is hybrid of subjective and objective elements. It has less degree of control. In this method, research is conducted in organization's own setting on human instead of laboratory. In this method, the effect of independent variable on dependent variable is observed. Its weakness is that the level of control on environment cannot be attained.

3.2.3.5. Case study:

In this method, a phenomenon is investigated with its normal setting depending on evidence from various sources .i.e. observation, archival record, interview and questionnaire. Such questions are answered through this method .i.e. why this decision was taken? How was it implemented? What types of results were achieved?

The boundaries of this method are not defined and no mechanism of controlled environment is existed. This method is implemented in real world, therefore various and difficult types of situation can be studied. Its weakness is the lack of control and high cost.

3.2.3.6. Phenomenology:

It is defined as "It is the methodological study of consciousness in order to understand the essence of experience". It is a method of obtaining meaning of structure, which provides supposition and sense about the subject and author. It tells us about thing rather than their functionality. Its strength is that it provides understanding about the situation. It is not suitable if anybody wants to use statistical inference.

3.2.3.7. Action research:

This method solves practical problem and increase knowledge simultaneously. In this approach link between theory and practice is exist. It takes its problem from the practitioner's perceptions in a specific context. It specifies the research according to the local circumstances. The data gather in this approach from action, which is imposed by the actor. It is a realistic approach in which terms and conditions are taken from real world. It is difficult to take control on all circumstances of this research method.

3.2.3.8. Survey:

This research method elicits data regarding a situation through questioning from a representative sample of a population. It is a method which is used at majority level in the world of research in software engineering. It is conducted through several methods .i.e. telephone survey, mail survey and interview. The results of this method may be qualitative or quantitative. It is based on the context in which question asked [31]. The researcher first focuses on developing the sample, which provides the picture and views of the population. The strength of the survey is that it provides the state of the real-world. It describes the belief, impression, opinion and attitude of the human [33]. "They can therefore provide a reasonably accurate description of real word situations from a variety of viewpoints". It verifies either the population thinks or exists. Its data is used to test hypothesis or explore new area of interests.

If any researcher conducts survey through interview then, it provides detailed study, but it is very costly and its sample size become too short. It also becomes bias due to the human nature. If researcher conducts survey through e-mail then population of survey becomes very large and the views of a large population can be elicited [25, 29]. It is cost-efficient [29]. Its disadvantages are following, no guarantee the respondent is targeted sample, and non-response seriously biased the results [25]. It is assumed that the views of non-respondent may be different from the views of respondent.

3.3. My Research Methodology:

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].

3.4. Research Design:

The design of this research for exploration of motivation factors of selection of open source software license contains on following sub parts: research strategy, unit of analysis, data collection and data analysis.

3.4.1. Research strategy:

To adopt the research strategy, researcher needs to intent the inquiry and research question(s). Literature reported that there are three types of investigation techniques which are explanatory, exploratory and descriptive [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 investigation techniques provide guideline in adoption of appropriate research methodology as shown in table 3 [34].

Table 3.Research approaches [34]

	Experiment	Simulation	Survey	Case study	Action Research	Phenom. Study	Conceptual Study
Exploratory	No	Yes	Maybe	Yes	Yes	Yes	Yes
Descriptive	No	No	Yes	Yes	Yes	Yes	No
Explanatory	Yes	No	Maybe	Maybe	No	Maybe	No

The research strategy depends on the questions which may be of these types "what, why, how, who and where" [30,33]. Yin provided instruction about archival analysis, survey, experiment, case study which are given below in table 4.

Table 4.Relevant questions for different research scenarios [30]

Strategy	Form of research question	Requires control over behavioural events?	Focuses on contemporary events?
Experiment	how, why	yes	yes
Survey	who, what, where, how many, how much	no	yes
Archival analysis	who, what, where, how many, how much	no	Yes/no
History	how, why	no	no
Case study	how, why	no	yes

3.4.2. 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.

3.4.3. 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.

3.4.4. 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.

Chapter #4 Results & Analysis

4.1. Introduction:

This chapter presents the results on the basis of survey responses of this research. The objective to perform this research activity is to investigate the economic and social motivational factors which influence in the selection of open source software license. The selection of open source software license, their motivational factors with respect to economic and social perspective of international open source software development community and national (Pakistani) open source software development community, the priority of motivation factors, the relationship among different motivational factors and future plans of open source software practitioners in adoption of open source software license are explored.

This chapter relates to web survey, analysis on collected data and results is partitioned into five subparts including this one. Section 4.2 presents setting of research, section 4.3 and 4.4 describes data analysis and results and section 4.5 describes the verification of previous knowledge.

4.2. Research Setting:

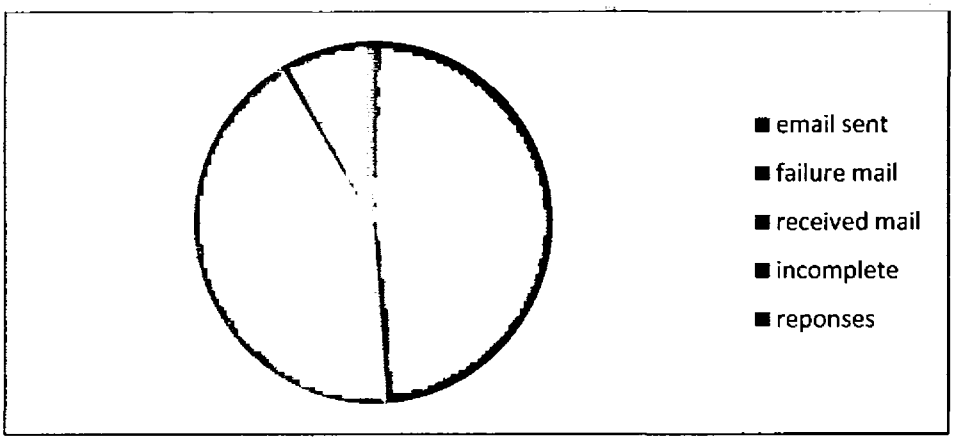
This section presents setting of our web survey. The sample selecting process for this web survey, design of instrument of research i.e. questionnaire and process of data gathering is presented.

4.2.1. 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.

This is the overall response rate of our survey which is shown in pie chart no 1.



Pie chart 1. Overall response rate

4.2.2. Research instrument:

Literature suggested that research instrument should be tested before its distribution [26, 29, 36]. My research instrument was tested by the Professors of Faculty of Basic and Applied Sciences, Department of Computer science and Software Engineering of The International Islamic University Islamabad. After the approval of my Supervisor Mr.Shahbaz Ahmed Khan Ghayyur and Mr. Zulqarnain Hashmi, this survey was distributed among 10 BS level students of our university. They were asked to comment on this survey in following manners

- Instructions Clarity
- Questions Clarity
- Time Completion for Survey
- Questions layout
- Any other factor

They provided their feedback which led some changes in order of questions and their wording before distribution.

4.2.3. Data collection:

The research collected data through email survey. It was intended to float the questionnaire in the first week of June 2011, but due to final exam of BS the program was post pond, because the feedback of BS student was not elicited. After eliciting feedback from BS student and made recommended changes, the final questionnaire was floated in the last week of June 2011. After two months, we did further work on the attained responses.

4.3 Data analysis and Results:

This section presents the analysis of our survey and shows the results. 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, which are given in chapter 2. 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

4.3.1. 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. Which are represented in following table 5, figure 8 and pie chart no 2.

Table 5. Local and international responses

Local OSSD community	International OSSD community
34	81

Total no of responses from local OSSD community = 34

Mean of responses from local OSSD community = 115/34=3.38

Total no of responses from international OSSD community=81

Mean of responses from international OSSD community = 115/81=1.42

This is graphical representation of mean of responses in graph 1

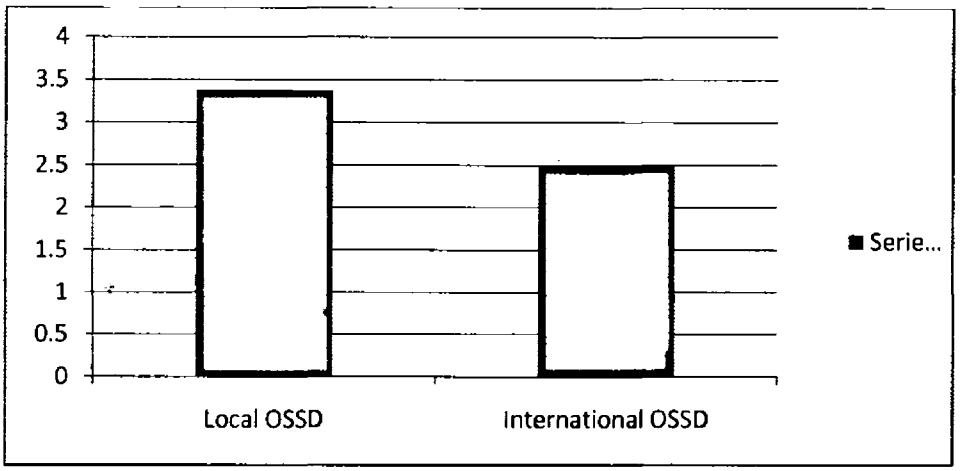
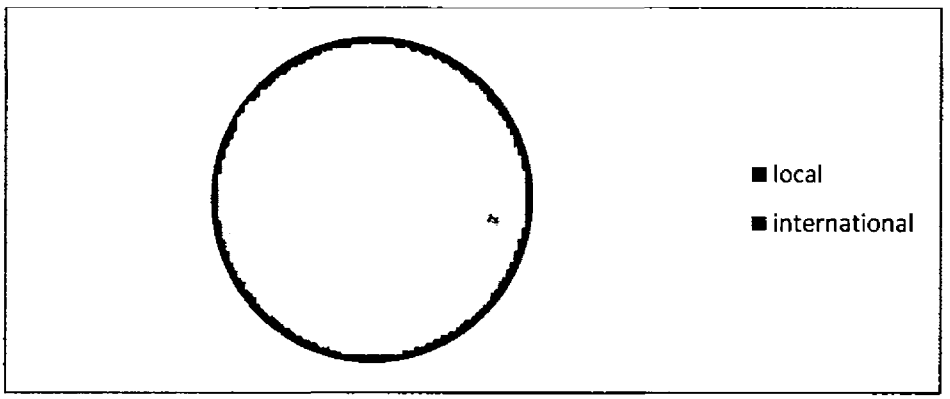
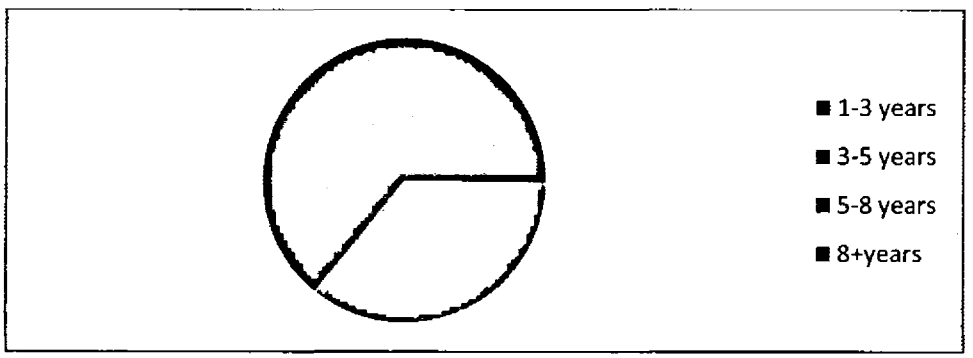


Fig 8.Graphical representation of mean of responses



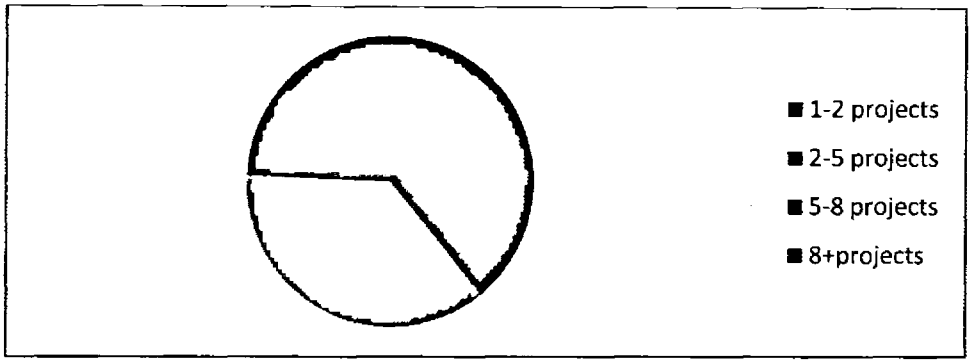
Pie Chart 2. Responses from local and international community

The respondents had different range of experience in open source software development which are given below, in respondent there were, 11 were those who had 1-3 years experience, 18 were of those who had 3-5 years experience, 41 were those who had 5-8 years experience and 45 were those which had more than 8 years experience. The above statistics are describing in the pie chart no 3.



Pie chart 3.Participant's Experience

The respondents had participated in different range of open source software, among them 9 had participated in 1-2 open source software projects, 36 had participated in 2-5 open source software projects, 42 had participated in 5-8 open source software projects, 28 had more 8 open source software projects. The above mentioned statistics are describing in chart no 4



Pie chart 4.Participant's participation in open source software projects

4.3.2. Priority Ranking:

This section describes the priority of both economic and social factors. The priority is presented in table 5 firstly; in which factors are given from up to down and ranking is present from left to right. In priority five levels is exist which are critical importance, high importance, medium importance, low importance and no importance. While no answer are those who are incomplete responses; therefore, we discarded them as shown in table 6.

Table6. Priority table of economic and social factors

Factor	Critical importance	Highly importance	Medium importance	Low importance	No importance	No
Protection of own work	59	34	22			8
Using other's work	26	50	30	8	1	8
Last experience	32	42	22	18		8
Related community	31	55	17	11	1	8
Good reputation	53	44	16		2	8
Ego satisfaction	84	21	6		2	8
Extent own work	84	21	6	2	2	8
Fight against market domination	52	42	17	3	1	8
Helping the community	49	42	23		1	8
Time utilization	44	55	13	1	2	8
Return on investment	45	48	15	3	8	8
Immediate pay off	44	48	21		2	8
Donation for skilled people	42	45	21	4	3	8
Better future	87	15	10	1	2	8

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 9, 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.

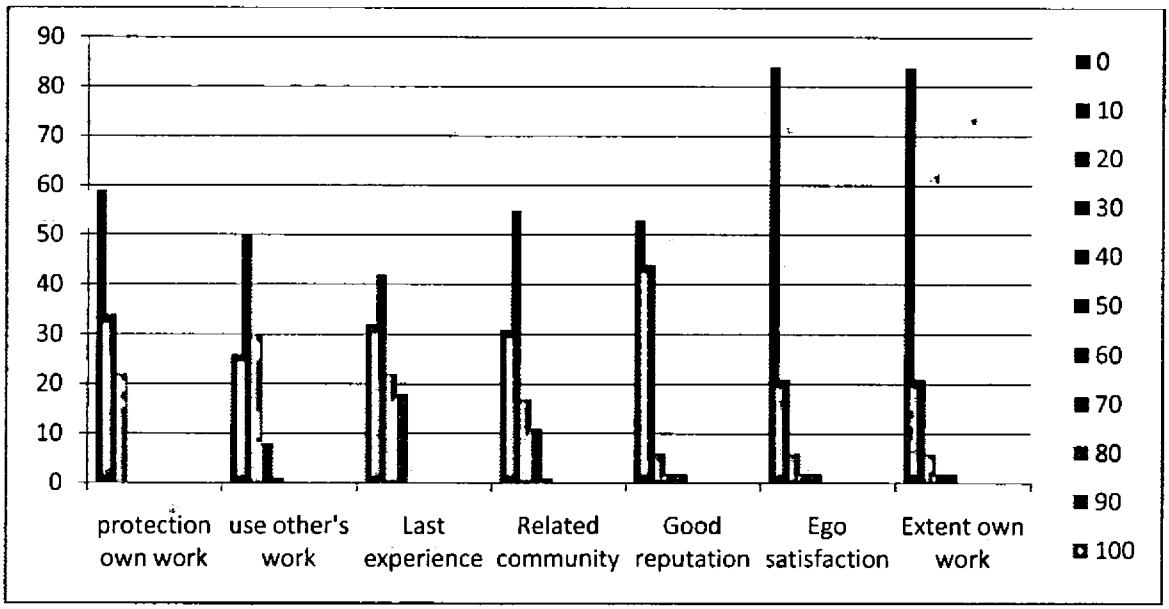


Fig 9. Graphical representation of 1-6 factors

This is graphical representation of 7-13 factors in figure10.

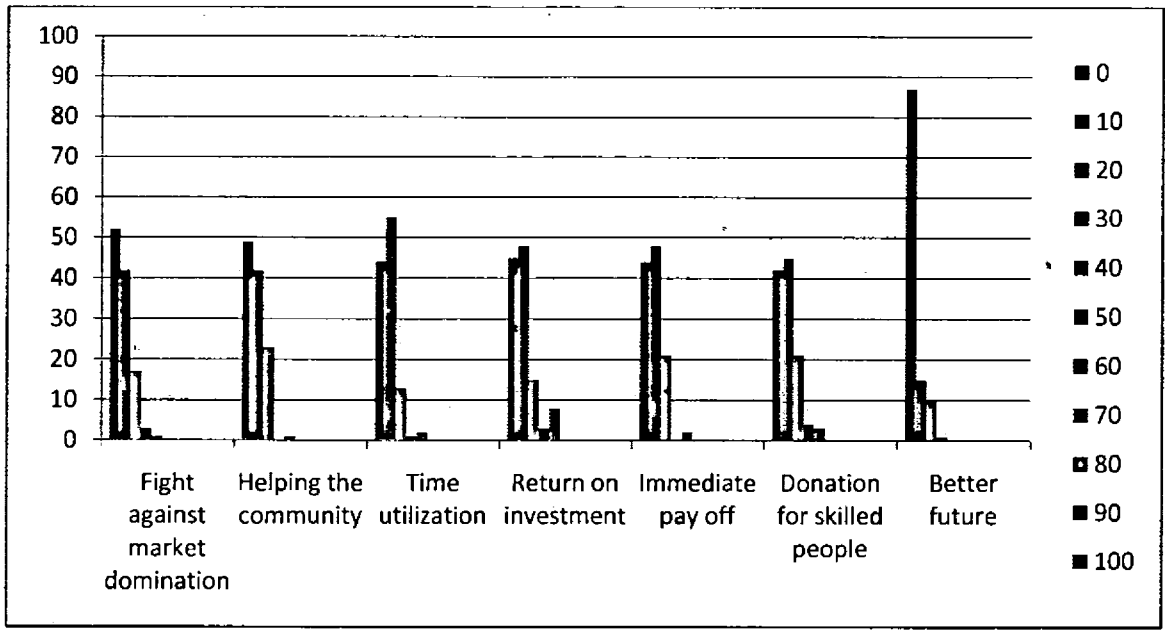


Fig. 10 Graphical representation of 7-13 factors

4.3.3. 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.

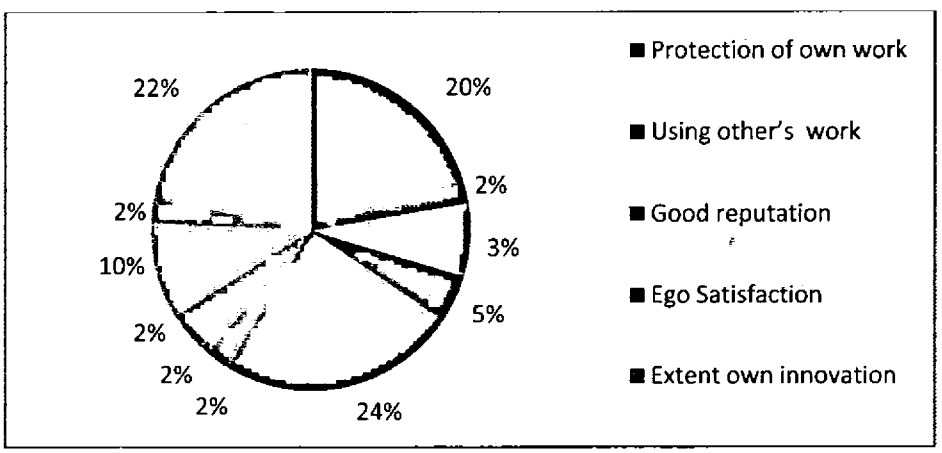
4.3.3.1. Comparative Scale for Local OSSD Community:

This section analyzes that which factor comparatively more influences to personnel to choose specific open source software license in local OSSD community. The frequency of responses in tabular form is in table 6. In this table factors are from up to down and their respective number of responses are along with them as shown in table 7.

Comparative scale of local OSSD community table 7

Factors	Responses
Protection of own work	1
Using other's work	1
Good reputation	2
Ego Satisfaction	2
Extent own innovation	11
Fight against market domination	1
Helping the community	1
Return on investment	1
Immediate Pay off	4
Donation for skilled people	1
Better future	9

From the above mentioned responses in table 7 draw pie chart which shows more detail about the responses because it also shows percentage of each response as shown in pie chart no 5.



Pie Chart 5. Comparative scale of local OSSD community more influential factors

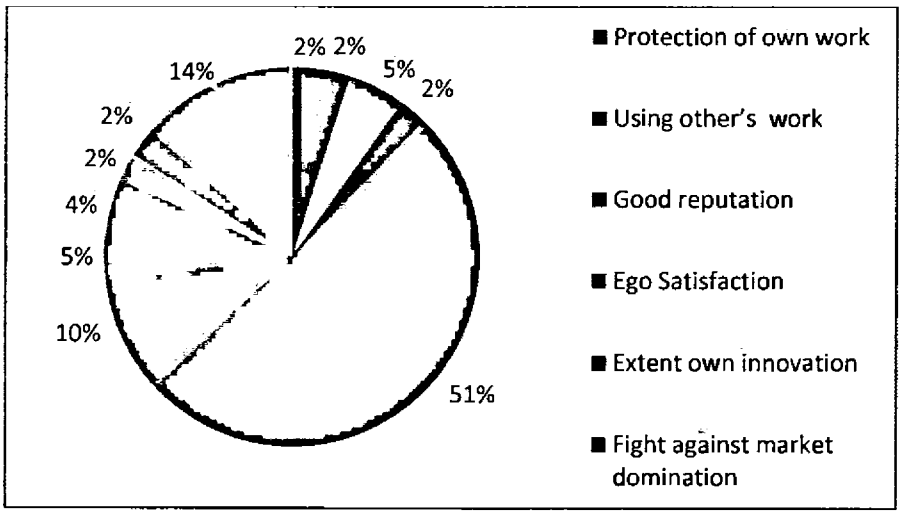
4.3.3.2. Comparative Scale for International OSSD Community:

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 in tabular form is in table 8. In this table factors are from up to down and their respective number of responses are along with them as shown in table 8.

Table 8. Comparative scale of international OSSD community

factors	Responses
Protection of own work	2
Using other's work	2
Good reputation	4
Ego Satisfaction	2
Extent own innovation	41
Fight against market domination	8
Helping the community	4
Return on investment	3
Immediate Pay off	2
Donation for skilled people	2
Better future	11

From the above mentioned responses in table 8 draw pie chart which shows more detail about the responses because it also shows percentage of each response as shown in pie chart no 6.



Pie Chart 6. Comparative scale of international OSSD community more influential factors

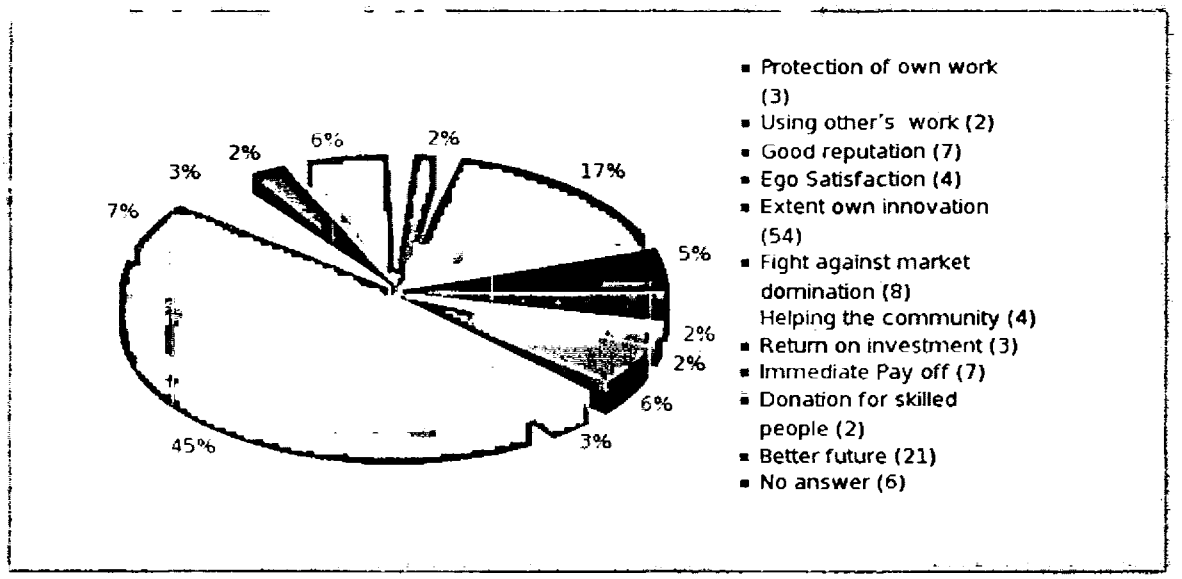
4.3.3.3. International and Local OSSD community comparative analysis:

The frequency of responses in tabular form is in 8. In this table factors are from up to down and their respective number of responses are along with them as shown in table 9.

Table 9.Comparative scale table 9

Factors	Responses
Protection of own work	3
Using other's work	2
Good reputation	7
Ego Satisfaction	4
Extent own innovation	54
Fight against market domination	8
Helping the community	4
Return on investment	3
Immediate Pay off	7
Donation for skilled people	2
Better future	21

From the above mentioned responses in table 8 draw pie chart which shows more detail about the responses because it also shows percentage of each response as shown in pie chart no 7.



Pie Cart 7. Comparative scale of more influential factors

4.4. 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 we discuss covariance and its types.

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)}]

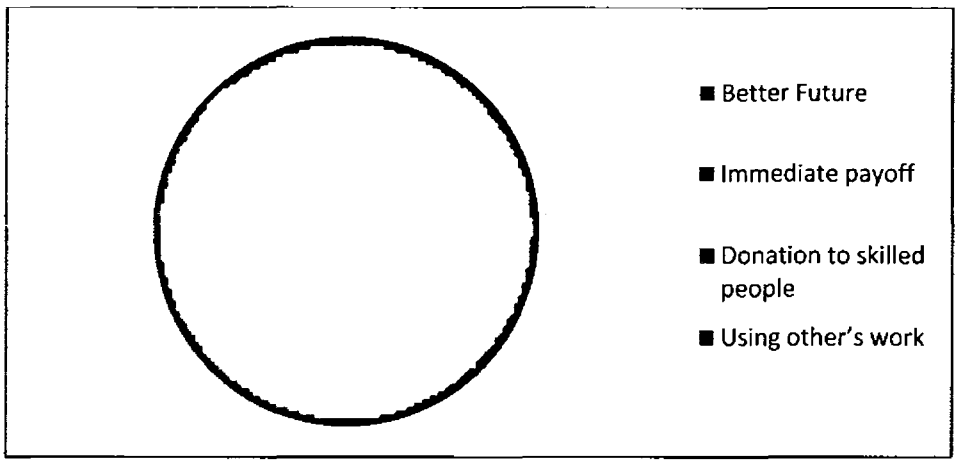
The covariance of A1 and A2 is calculated as, take their difference from their mean value and multiplies their difference. If the result of covariance is positive then it states that both variables are varied in same direction and when result is negative then it shows that both variables are varied in 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.

4.4.1. Motivation Factors for Local OSSD for OSS License Selection:

These are the response frequency in economic perspective from the local OSSD community as shown in table 10 and in pie chart 8. In the table 9 X1 denotes the better future, X2 represents the immediate pay off, X3 shows donation to skilled people and X4 indicates the using other's work.

Table 10. Economic perspective responses from local OSSD community

X1	X2	X3	X4
26	8	0	
28	8	0	0

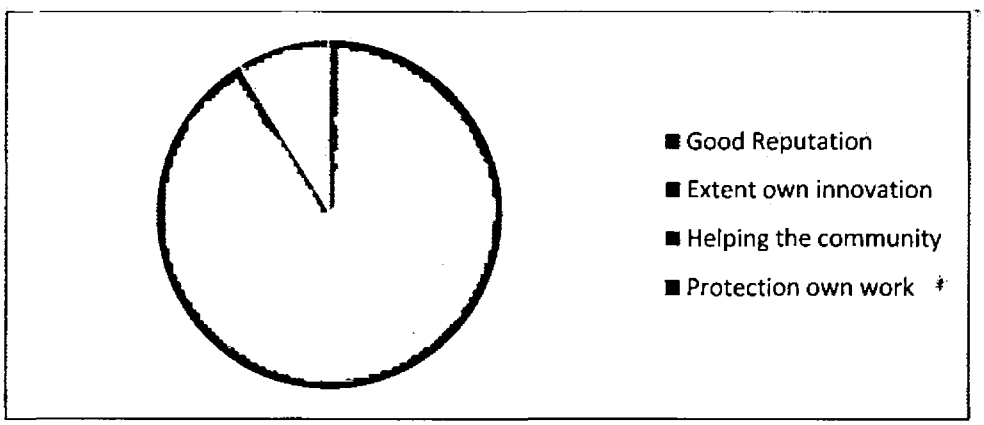


Pie Chart 8. Economic perspective responses from local OSSD community

These are the response frequency in social perspective from the local OSSD community as shown in table 11 and in pie chart 9. In the table 10 X1 denotes the good reputation, X2 represents the extension in innovation, X3 shows helping the community and X4 indicates the protection own work.

Table 11. Social perspective responses from local OSSD community

X1	X2	X3	X4
9	22	3	0



Pie Chart 9. Social perspective responses from local OSSD community

For investigation of motivation factors of local OSSDC we apply "Z test", which is implemented below, in this "Z test" we set level of significance $\alpha = 0.05$. We have $1- \alpha = 1-0.05 = .095$, get the value of Z from the value table as $Z_{.95} = 1.645$

Null Hypothesis Ho: The extension in innovation of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: The extension in innovation of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -3.28.
Since the value of Z=-3.28 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1
The cause of selection of open source software license is freely extension in innovation of individual skills.

Null Hypothesis Ho: Good reputation of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: Good reputation of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -16.78

Since the value of Z=-16.78 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.
Null Hypothesis Ho: The expectation of better future of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: The expectation of better future of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -1.28
Since the value of Z=-1.28 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.

Covariance analysis of extension own innovation and good reputation in Local OSSD:

We data for our test from table 7 where X1 indicates extension in own innovation of an individual, X2 shows good reputation of an individual and X3 represents own better future.

Cov(X1, X2) = E(X1X2)-E(X1)(X2)

E(X1X2) = 118.5

E(X1)E(X2) = 17.5*6

= 105

Cov(X1, X2) = 118.5-105

Cov(X1,X2) = 13.5

The above result shows that extension own innovation and own good reputation has linear relation open source software license selection.

Covariance between extension in innovation and Better future:

Cov(X1,X3) = E(X1X3)-E(X1)(X3)

E(X1X3) = 373

E(X1)E(X3) = 17.5*19

= 332.5

Cov(X1,X3) = 373-332.5

Cov(X1,X3) = 40.5

The above result shows that extension own innovation and own better future has linear relation for open source software license selection.

Covariance between Better future and good reputation:

Cov(X2,X3) = E(X2X3)-E(X2)(X3)

E(X2X3) = 141

E(X2)E(X3) = 6*19

= 114

Cov(X2,X3) = 141-114

Cov(X2,X3) = 27

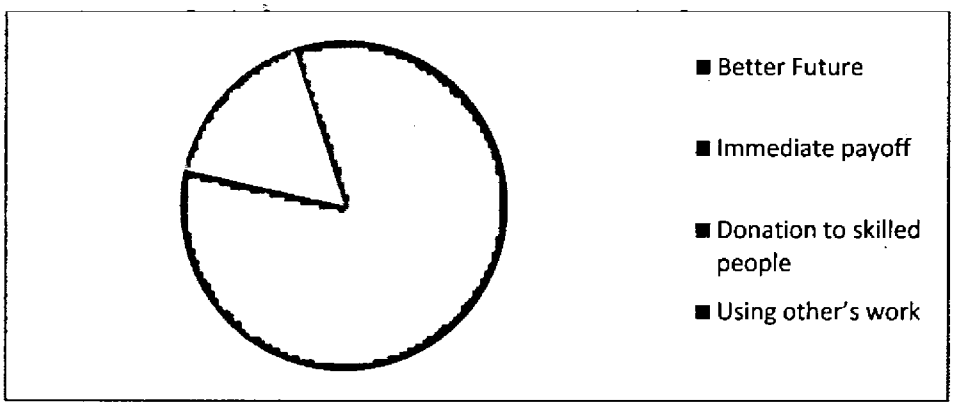
The above result shows that own better future and own good reputation has linear relation for open source software license selection.

4.4.2. Motivation Factors for International OSSD for OSS License Selection:

These are the response frequency in economic perspective from the international OSSD community as shown in table 12 and in pie chart 10. In the table 12 X1 denotes the better future, X2 represents the immediate payoff, X3 shows the donation to skilled people and X4 indicates the using other's work.

Table 12. Economic perspective responses from international OSSD community

X1	X2	X3	X4
61	6	14	
56	6	13	4

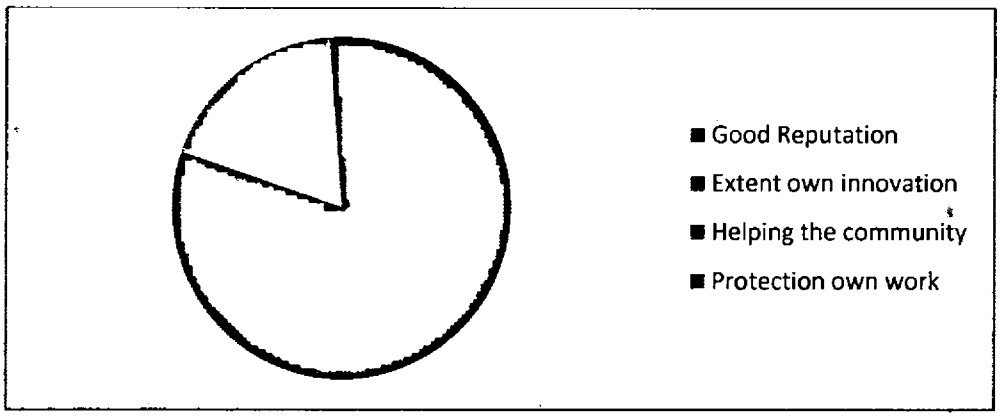


Pie Chart 10. Economic perspective responses from international OSSD community

These are the response frequency in social perspective from the international OSSD community as shown in table 13 and in pie chart 11. In the table 13 X1 denotes the good reputation, X2 represents the extension in innovation, X3 shows helping the community and X4 indicates the protection own work.

Table 13. Social perspective responses from international OSSD community

X1	X2	X3	X4
14	51	15	1



Pie Chart. Social perspective responses from international OSSD community

For investigation of motivation factors of local OSSDC we apply "Z test", which is implemented below. in this "Z test" we set 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

Null Hypothesis Ho: The extension in innovation of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: The extension in innovation of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -5.36

Since the value of Z=-5.36 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1

The cause of selection of open source software license is freely extension in innovation of individual skills.

Null Hypothesis Ho: Good reputation of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: Good reputation of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -43.51

Since the value of Z=-43.51 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.

Null Hypothesis Ho: The expectation of better future of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: The expectation of better future of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -4.47

Since the value of Z=-4.47 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.

Covariance analysis of extension own innovation and good reputation:

We data for our test from table 7 where X1 indicates extension in own innovation of an individual, X2 shows good reputation of an individual and X3 represents own better future.

$Cov(X1, X2) = E(X1X2)-E(X1)(X2)$

$= 439$

$E(X1)E(X2) = 46*9$

$= 414$

$Cov(X1, X2) = E(X1X2)-E(X1)(X2)$

$Cov(X1,X2) = 25$

The above result shows that extension own innovation and own good reputation has linear relation for open source software license selection.

Covariance between extension in innovation and Better future:

$Cov(X1,X3) = E(X1X3)-E(X1)(X3)$

$E(X1X3) = 1635.5$

$E(X1)E(X3) = 46*33.5$

$= 1541$

$Cov(X1,X3) = E(X1X3)-E(X1)(X3)$

Cov(X1,X3) = 94.5

The above result shows that extension own innovation and own better future has linear relation for open source software license selection.

Covariance between Better future and good reputation:

Cov(X2,X3) = E(X2X3)-E(X2)(X3)

E(X2X3) = 414

E(X2)E(X3) = 9*33.5

= 301.5

Cov(X2,X3) = E(X2X3)-E(X2)(X2)

Cov(X2,X3) = 112.5

The above result shows that own better future and own good reputation has linear relation for open source software license selection.

4.4.3. Motivation Factors for Local and International OSSD for OSS License Selection:

There are three more the 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. In this table 14 X1 indicates extension in own innovation of an individual, X2 shows good reputation of an individual and X3 represents helping the community, X4 shows protection of own work, X5 indicates own better future X6 represents immediate payoff, X7 indicates donation to skilled people and X8 denoted using other's work as shown in table 14.

Table 14. Table of economic and social factor

X1	X2	X3	X4	X5	X6	X7	X8
54	7	18	1	21	14	13	4
82	14	4	3	84	7	2	2

In order to investigate the motivation factors for selection of open source software license with respect to economic and social perspective from international and local open source software development community, we applied statistical analysis test named "Z test" on the data given in table13, in this "Z test" we set level of significance $\alpha = 0.05$. We have $1- \alpha= 1-0.05= .095$, get the value of Z from the value table as $Z .95= 1.645$. We have established hypothesis for applying this test.

Null Hypothesis Ho: The extension in innovation of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: The extension in innovation of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -12.60.

Since the value of Z=-12.60 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1

The cause of selection of open source software license is freely extension in innovation of individual skills.

Null Hypothesis Ho: Good reputation of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: Good reputation of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -173

Since the value of Z=-173 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.

Null Hypothesis Ho: Helping the community is a cause of selection of open source software license.

Alternative Hypothesis H1: Helping the community of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -58.43

Since the value of Z=-18.43 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.

Null Hypothesis Ho: Protecting own idea of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: Protecting own idea of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -123.91

Since the value of Z=-123.91 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.

Null Hypothesis Ho: The expectation of better future of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: The expectation of better future of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -4.52

Since the value of Z=-4.52 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.

Null Hypothesis Ho: Immediate payoff of an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: Immediate payoff of an individual is not cause of selection of open source software license.

For this test we got the value of Z= -78.23

Since the value of Z=-78.23 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.

Null Hypothesis Ho: Donation to skilled people to an individual is a cause of selection of open source software license.

Alternative Hypothesis H1: Donation to skilled people to an individual is not cause of selection of open source software license.

For this test we got the value of Z= -85

Since the value of Z=-85 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.

Null Hypothesis Ho: Using the other work is a cause of selection of open source software license.

Alternative Hypothesis H1: Using the other work is not cause of selection of open source software license.

For this test we got the value of Z= -300

Since the value of Z=-300 which is less than 1.645 so we accept the null hypothesis Ho and reject the alternative hypothesis H1.

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

4.4.4. Covariance between Factors:

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

4.4.4.1. Covariance between Social Factors:

This section presents covariance between social factors which is given below.

Covariance Analysis of Extension Own Innovation and Good Reputation:

This section gets data for test from table 13 where X1 indicates extension in own innovation of an individual, X2 shows good reputation of an individual and X3 represents helping the community, X4 shows protection of own work.

Cov(X1, X2) = E(X1X2)-E(X1)(X2)

E(X1X2) = 682

E(X1)E(X2) = 68*9

= 612

Cov(X1, X2) = E(X1X2)-E(X1)(X2)

Cov(X1,X2) = 70

The above result shows that extension own innovation and own good reputation has linear relation for open source software license selection.

Covariance Analysis of Extension Own Innovation and Helping the Community:

Cov(X1, X3) = E(X1X3)-E(X1)(X3)

E(X1X3) = 846

E(X1)E(X2) = 68*11

= 748

Cov(X1, X3) = 846-748

Cov(X1,X3) = 98

The above result shows that extension own innovation and helping the community has linear relation for open source software license selection.

Covariance Analysis of Extension Own Innovation and Protection of Own Idea:

Cov(X1, X4) = E(X1X4)-E(X1)(X4)

E(X1X4) = 122

E(X1)E(X2) = 68*2

= 136

Cov(X1, X4) = 122-136

Cov(X1,X4) = -14

The above result shows that extension own innovation and protection of own idea has nonlinear relation for open source software license selection.

Covariance Analysis of Good Reputation and Helping the Community:

Cov(X2, X3) = E(X2X3)-E(X2)(X3)

E(X2X3) = 140

E(X2)E(X3) =10.5*11

= 115.5

Cov(X2, X3) = 140-115.5

Cov(X2,X3) = 24.5

The above result shows that own good reputation and helping the community has linear relation for open source software license selection.

Covariance Analysis of Good Reputation and Protection of Own Idea:

Cov(X2, X4) = E(X2X4)-E(X2)(X4)

E(X2X4) = 17.5

E(X2)E(X4) = 10.5*2

= 21

Cov(X2, X4) = 17.5-21

Cov(X2,X4) = -3.5

The above result shows that own good reputation and protection of own idea has nonlinear relation for open source software license selection.

Covariance Analysis of Helping the Community and Protection Own Idea:

Cov(X3, X4) = E(X3X4)-E(X3)(X4)

E(X3X4) = 15

E(X1)E(X2) = 11*2

= 22

Cov(X3, X4) = 15-22

Cov(X3,X4) = -7

The above result shows that helping the community and protection of own idea has nonlinear relation for open source software license selection.

4.4.4.2. Covariance between Economic Factors:

This section presents covariance between economic factors. Data for test from table 13 where X5 indicates own better future and X6 shows immediate pay off, X7 indicates donation to skilled people and X8 denoted using other's work which is given below.

Covariance between Better Future and Immediate Payoff:

Cov(X5,X6) = E(X5X6)-E(X5)(X6)

E(X5X6) = 661.5

E(X5)E(X6) = 52.5*10.5

= 551.25

Cov(X5,X6) = 611.5-551.25

Cov(X5,X6) = 110.25

The above result shows that own better future and immediate payoff has linear relation for open source software license selection.

Covariance between Better Future and Donation to Skilled People:

Cov(X5,X7) = E(X5X7)-E(X5)(X7)

E(X5X7) = 667

E(X5)E(X6) = 52.5*7.5

= 393.75

Cov(X5,X7) = 667-393.25

Cov(X5,X7) = 273.25

The above result shows that own better future and donation to skilled people has linear relation for open source software license selection.

Covariance between Better Future and Using other's Work:

Cov(X5,X8) = E(X5X8)-E(X5)(X8)

E(X5X8) = 189

E(X5)E(X8) = 52.5*3

= 157.5

Cov(X5,X8) = 189-157.5

Cov(X5,X6) = 31.5

The above result shows that own better future and using other's work have linear relation for open source software license selection.

Covariance between Immediate Payoff and Donation to Skilled People:

Cov(X6,X7) = E(X6X7)-E(X6)(X7)

E(X6X7) = 98

E(X6)E(X7) = 10.5*7.5

= 78.75

Cov(X6,X7) = 98-78.75

Cov(X5,X6) = 19.25

The above result shows that own immediate payoff and donation to skilled people has linear relation for open source software license selection.

Covariance between Immediate Payoff and Using Other's Work:

Cov(X6,X8) = E(X6X8)-E(X6)(X8)

E(X6X8) = 35

E(X6)E(X8) = 10.5*3

= 31.5

Cov(X6,X8) = 35-31.5

Cov(X6, X8) = 3.5

The above result shows that immediate payoff and using other's work has linear relation for open source software license selection.

Covariance between Donation to Skilled People and Using Other's Work:

Cov(X7,X8) = E(X7X8)-E(X7)(X8)

E(X7X8) = 28

E(X7)E(X8) = 7.5*2

= 15

Cov(X7,X8) = 28-15

Cov(X5,X6) = 13

The above result shows that donation to skilled people and using other's work has linear relation for open source software license selection.

4.4.4.3. Covariance between Economic and Social Factors:

This section presents combine covariance of economic and social factors.

Covariance between Extent Own Innovation and Better Future:

Cov(X1,X5) = E(X1X2)-E(X1)(X5)

E(X1X5) = 4011

E(X1)E(X5) = 68*52.5

= 3570

Cov(X1,X5) = 4011-3570

Cov(X1,X2) = 441

The above result shows that better future and extension in innovation has linear relation for open source software license selection.

Covariance between Extension Own Innovation and Immediate Payoff:

Cov(X1,X6) = E(X1X6)-E(X1)(X6)

E(X1X6) = 778

E(X1)E(X6) = 68*10.5

= 714

Cov(X1,X6) = 778-714

Cov(X1,X6) = 64

The above result shows that extension own innovation and immediate payoff has linear relation for open source software license selection.

Covariance between Extent Own Innovation and Donation to Skilled People:

Cov(X1,X7) = E(X1X7)-E(X1)(X7)

E(X1X7) = 587

E(X1)E(X7) = 68*7.5

= 510

Cov(X1,X7) = 587-510

Cov(X1,X2) = 77

The above result shows that extension in own innovation and donation to skilled people has linear relation for open source software license selection.

Covariance between Extent Own Innovation and Using Other's Work:

Cov(X1,X8) = E(X1X8)-E(X1)(X8)

E(X1X8) = 218

E(X1)E(X8) =68*3

= 204

Cov(X1,X8) = 218-204

Cov(X1,X8) = 14

The above result shows that extent own innovation and using other's work has linear relation for open source software license selection.

Covariance between Good Reputation and Better Future:

Cov(X2,X5) = E(X2X5)-E(X2)(X5)

E(X2X5) = 630

E(X2)E(X5) = 9*52.5

= 472.5

Cov(X2,X5) = 630-472.5

Cov(X2,X5) = 157.5

The above result shows that own better future and own good reputation has linear relation for open source software license selection.

Covariance between Good Reputation and Immediate Payoff:

Cov(X2,X6) = E(X2X6)-E(X2)(X6)

E(X2X6) = 122.5

E(X2)E(X6) = 14*7

= 98

Cov(X2,X6) = 122.5-98

Cov(X2,X6) = 24.5

The above result shows that own good reputation and immediate payoff has linear relation for open source software license selection.

Covariance between Good Reputation and Donation to Skilled People:

Cov(X2,X7) = E(X2X7)-E(X2)(X7)

E(X2X7) = 148

E(X2)E(X7) = 10.5*7.5

= 78.75

Cov(X2,X7) = 148-78.5

Cov(X2,X7) = 69.25

The above result shows that own good reputation and donation to skilled people has linear relation for open source software license selection.

Covariance between Good Reputation and Using Other's Work:

Cov(X2,X8) = E(X2X8)-E(X2)(X8)

E(X2X8) = 35

E(X2)E(X8) = 10.5*3

= 31.5

Cov(X2,X8) = 35-31.5

Cov(X2,X8) = 3.5

The above result shows that own good reputation and using other's work have linear relation for open source software license selection.

Covariance between Helping the Community and Better Future:

Cov(X3,X5) = E(X3X5)-E(X3)(X5)

E(X3X5) = 795

E(X3)E(X5) = 11*52.5

= 577.5

Cov(X3,X5)= 795-577.5

Cov(X3,X5) = 217.5

The above result shows that helping the community and own better future has linear relation for open source software license selection.

Covariance between Helping the Community and Immediate Payoff:

Cov(X3,X6) = E(X3X6)-E(X3)(X6)

E(X3X6) = 140

E(X3)E(X6) = 10.5*11

= 115.5

Cov(X3,X6) = 140-155.5

Cov(X3,X6) = 24.5

The above result shows that helping the community and immediate payoff has linear relation for open source software license selection.

Covariance between Helping the Community and Donation to Skilled People:

Cov(X3,X7) = E(X3X7)-E(X3)(X7)

E(X3X7) = 121

E(X3)E(X7) = 11*7.5

= 82.5

Cov(X3,X7) = 121-82.5

Cov(X3,X7) = 38.5

The above result shows that helping the community and donation to skilled people has linear relation for open source software license selection.

Covariance between Helping the Community and Using Other's Work:

Cov(X3,X8) = E(X3X8)-E(X3)(X8)

E(X3X8) = 40

E(X3)E(X8) = 11*3

= 33

Cov(X3,X8) = 40-33

Cov(X31,X8) = 7

The above result shows that helping the community and using other's work have linear relation for open source software license selection.

Covariance between Protection Own Work and Better Future:

Cov(X4,X5) = E(X4X5)-E(X4)(X5)

E(X4X5) = 72.5

E(X4)E(X5) = 52.5*2

= 105

Cov(X4,X5) = 72.5-105

Cov(X4,X5) = -22.5

The above result shows that protection own work and better future has nonlinear relation for open source software license selection.

Covariance between Protection Own Work and Immediate Payoff:

Cov(X4,X6) = E(X4X6)-E(X4)(X6)

E(X4X6) = 17.5

E(X4)E(X6) = 10.5*2

= 21

Cov(X4,X6) = 17.5-21

Cov(X4,X6) = -3.5

The above result shows that protection own work and immediate payoff has nonlinear relation for open source software license selection.

Covariance between Protection Own Work and Donation to Skilled People:

Cov(X4,X6) = E(X4X7)-E(X4)(X7)

E(X4X7) = 9.5

E(X4)E(X7) = 7.5*2

= 15

Cov(X4,X7) = 9.5-15

Cov(X4,X7) = -5.5

The above result shows that protecting own work and donation to skilled people has nonlinear relation for open source software license selection.

Covariance between Protection Own Work and Using Other's Work:

Cov(X4,X8) = E(X4X8)-E(X4)(X8)

E(X4X8) = 5

E(X4)E(X8) = 2*3

= 6

Cov(X4,X8) = 5-6

Cov(X4,X8) = -1

The above result shows that protection of own work and using other's work has nonlinear relation for open source software license selection.

4.5. Verification of previous knowledge:

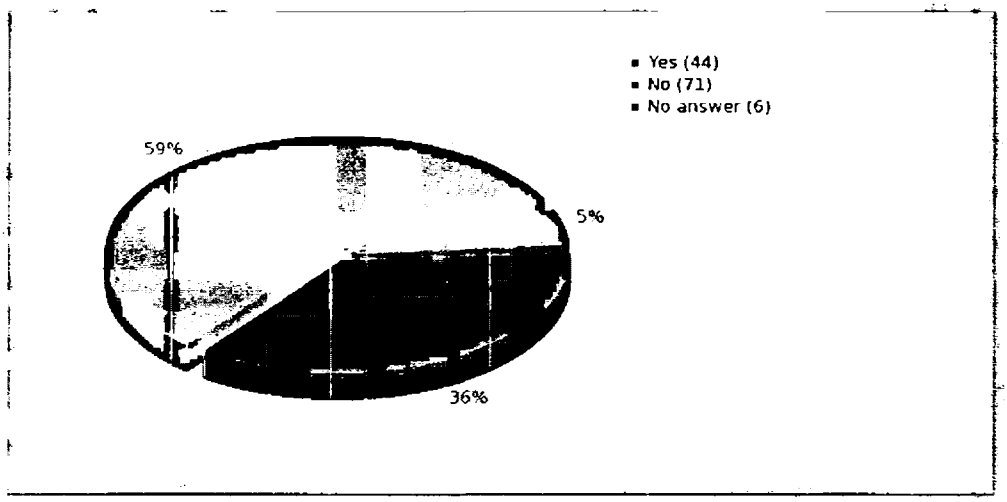
This section verified literature reported knowledge, table 15 summarized all knowledge.

Table 15. Verify reported literature knowledge

Questions	Yes	No
Q 13	44	71
Q 17	72	43
Q 21	98	17
Q 23	100	15
Q 30	7	108
Q 31	106	9
Q 32	104	11
Q 33	2	113

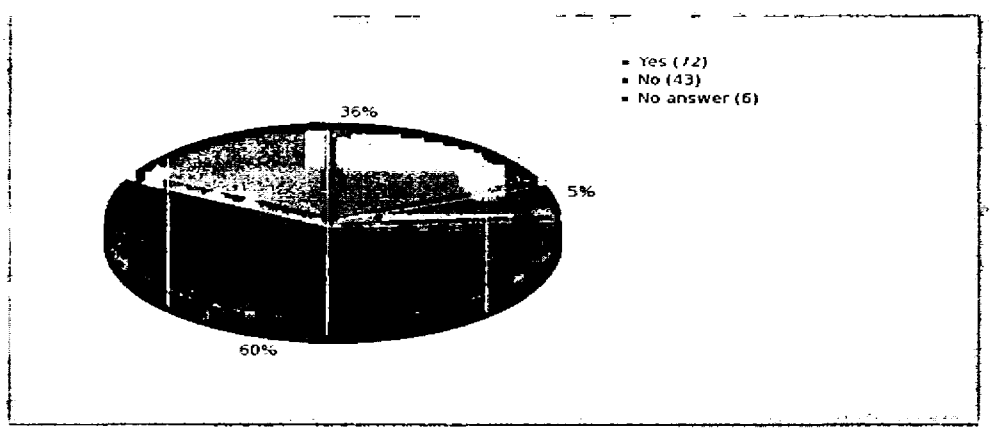
In this table, Survey questions are on left side and their responses are adjacently available with them. It is verified that mostly project managers do not know terms and condition of their adopted open source software license, 44 project managers are those who know terms and

conditions of open source software license while 71 project manager don't know as shown in pie chart no 12.



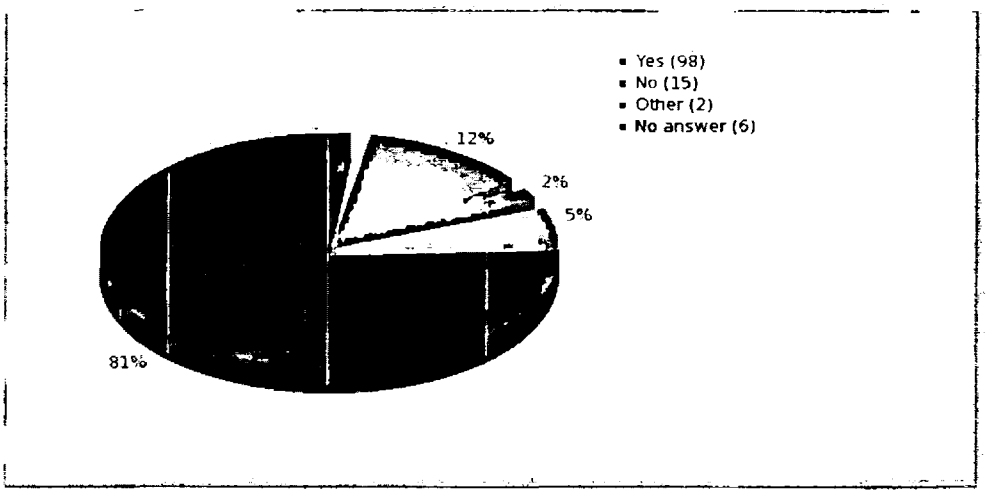
Pie Chart 12. OSSL term and condition knowledge

It is verified that project managers took guideline about open source software license from their open source software community, 72 project managers respond that they took help in adoption of license from their open source software community while 43 project managers don't take help from their relevant open source software community as shown in pie chart no 13



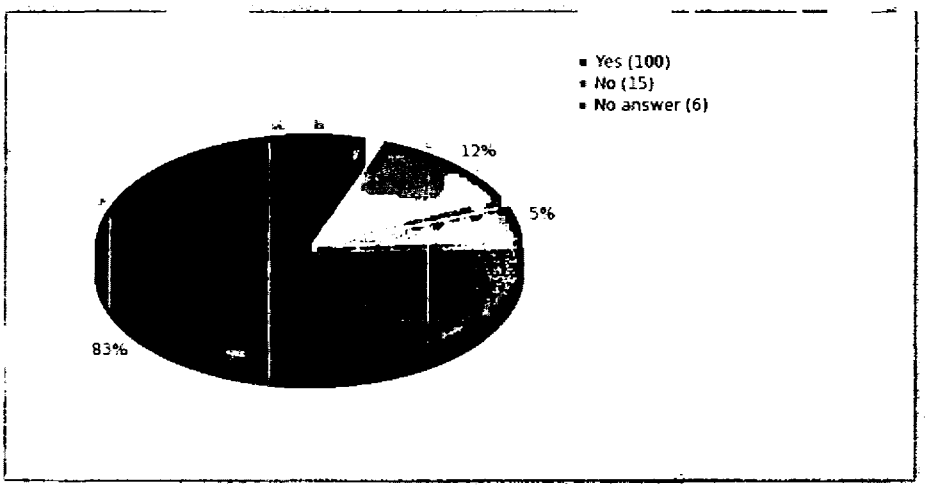
Pie Chart 13. Project manager taking help from OSSD community

. It has been validated that open source software development community helps the project managers in choosing an appropriate open source software license. 98 responses tell that open source software development community helps the project manager in selection of open source software license while 17 responses are in negation as shown in the pie chart no 14.



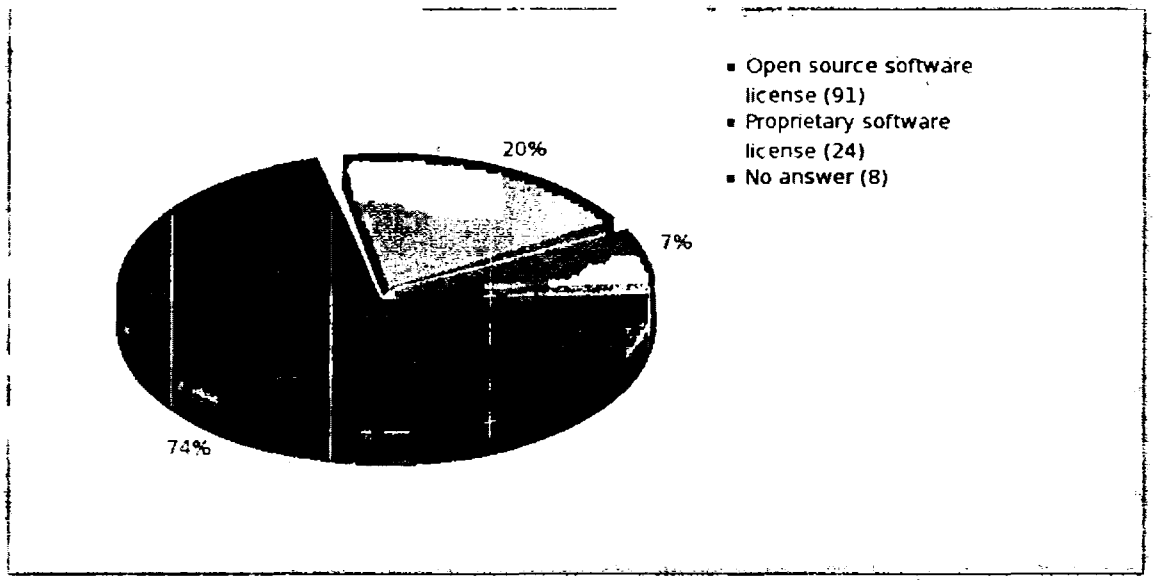
Pie Chart 14. Decision making personnel in OSSD community

It is also verified that open source software license is adopted in comparison with proprietary software license due to their return on investment. 100 responses are in its favor and 15 are in its negation as shown in pie chart no 15.



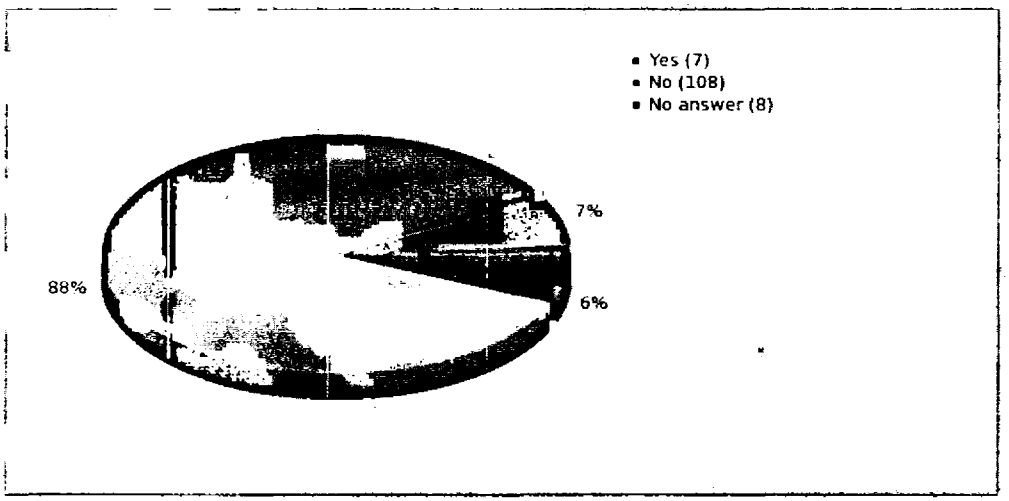
Pie Chart 15. OSSL selection on ROI

Due to such precious economic and social benefits mostly personals of open source software development community want to choose open source software license for their future open source projects as shown in pie chart16.



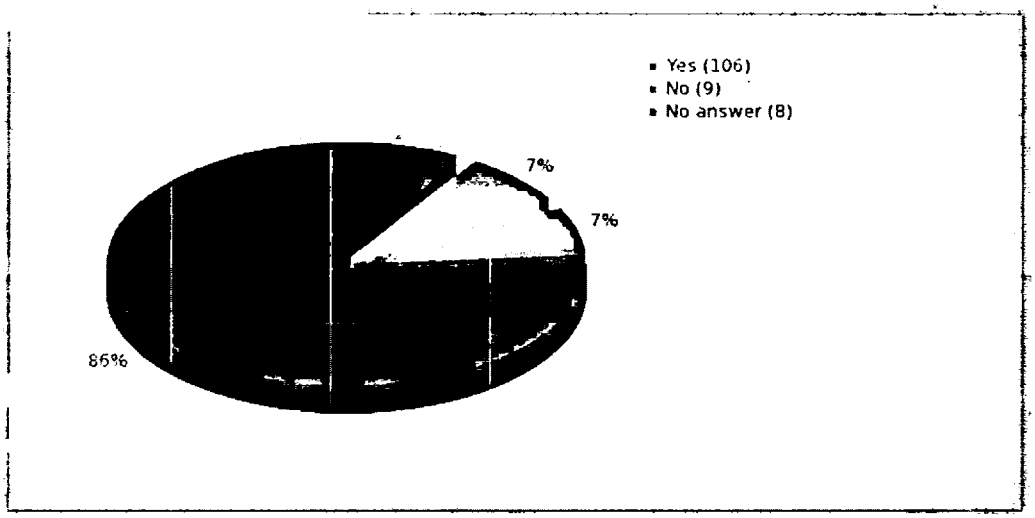
Pie Chart 16. Expected future OSSL selection

Here are some interesting facts which are given below; mostly open source software development community members are unaware about any standards and any certifications for open source software development. The mostly respondent response in favor of standard and certifications of open source software development which are represent in following pie chart17.



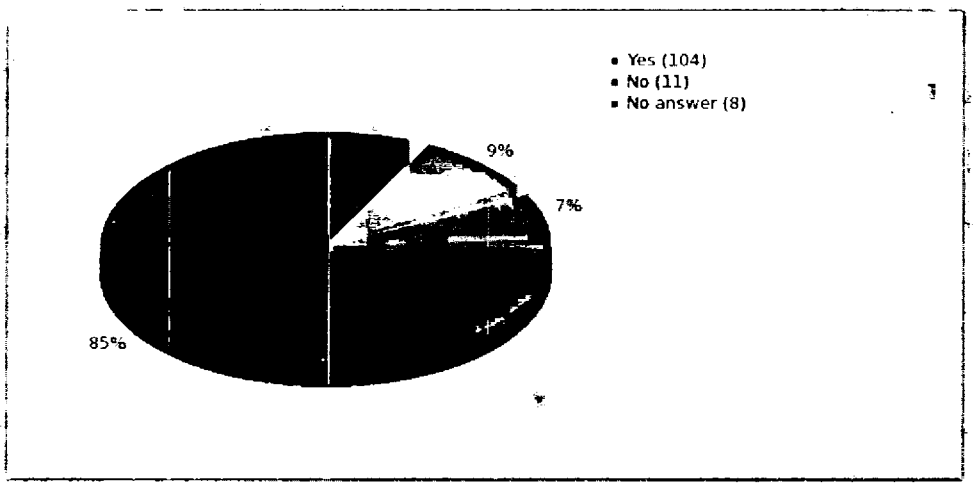
Pie Chart 17. Standard and certification knowledge

Open source software development community wants to standardized the open source software development processes as shown in pie chart 18



Pie Chart 18. Need of standard for OSSD

It is come to know that open source software community want such certifications which may be beneficial for open source development as shown in pie chart 19.



Pie Chart 19. Need of certification for OSSD

Chapter # 5 Conclusion

5.1. Introduction

This chapter presents the finding and conclusion of this research. Section 5.2 describes conclusion of our research. Research contribution is presented in section 5.3; Discussion of limitation of research in section 5.4. Future work is presented.

5.2. 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.

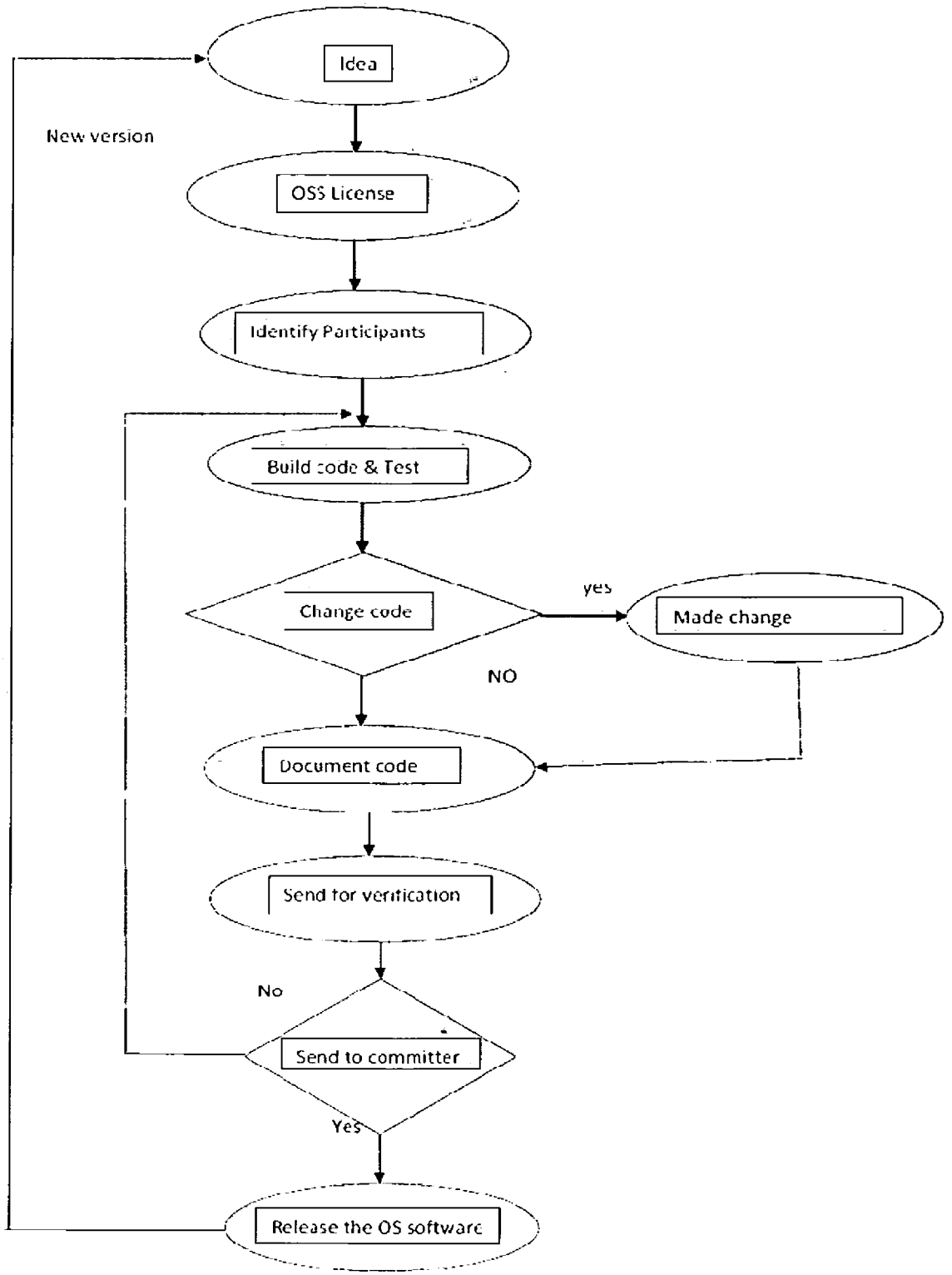
5.3. Limitation of Study:

The reason of criticism on this research survey may be that there may be so many other perspectives on which selection of OSS license can be make then why choose just these two perspectives. On the other hand, don't consideration those firms which are participation in OSSD

activities and just focus the personals for this survey. Therefore, the described results are derived from the perception of personnel's.

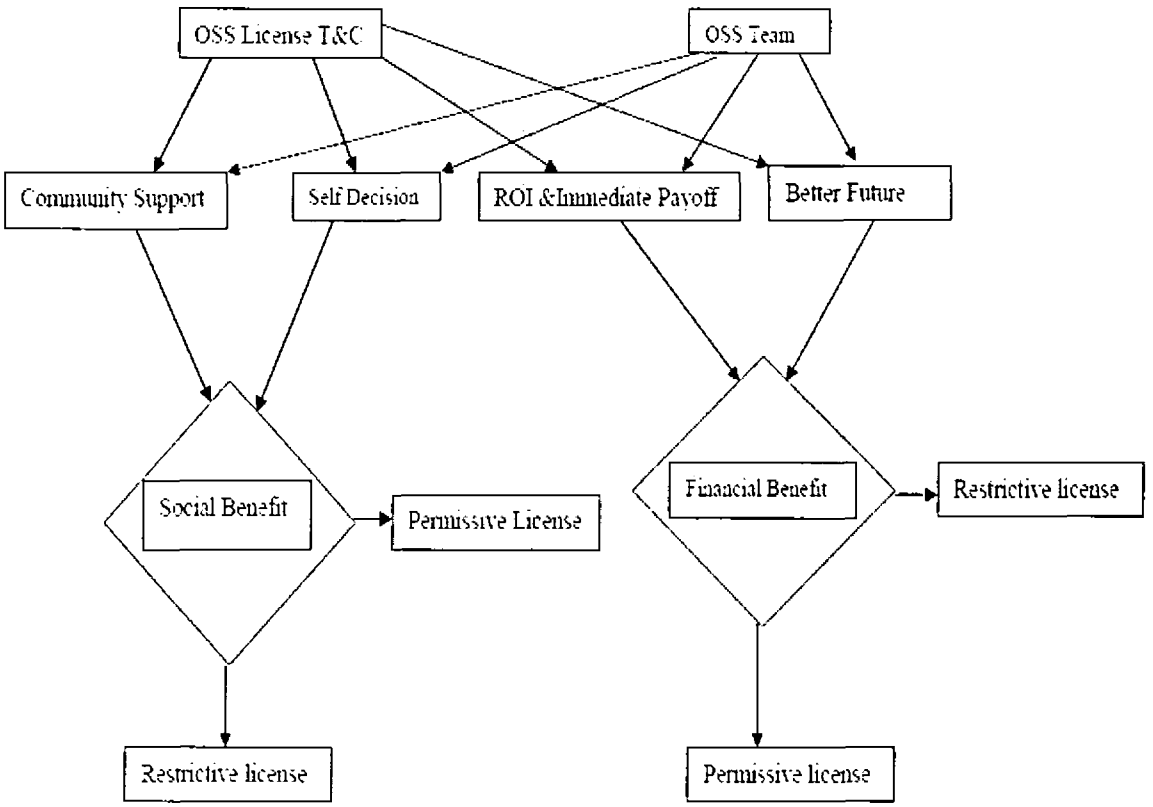
5.4. Future Work:

It has been come to know from this survey that there is need of open source software development process. Therefore, we proposed open source software development process shown in figure 9. According to open source software development process, when an idea comes to any person's mind and he want to develop software on that idea. First of all he has to adopt open source software license because it is essential to keep software open source [1]. If he doesn't adopt OSS license then he has to choose proprietary license for his project. After adopting OSSL, he will find volunteer for developing his OSS project. Participants build code and test it, if it is need to make changes in code then make changes and then document the code, otherwise document the code after testing. The changes send to committer for acceptance and verification [12]. If he verifies and include in the project and this cycle remains continue in this sequence. After completion of desired project the version of project is released. If there is any need to modification from the end users feedback then the whole process is restarted from its beginning.



Proposed OSSD process fig. 9

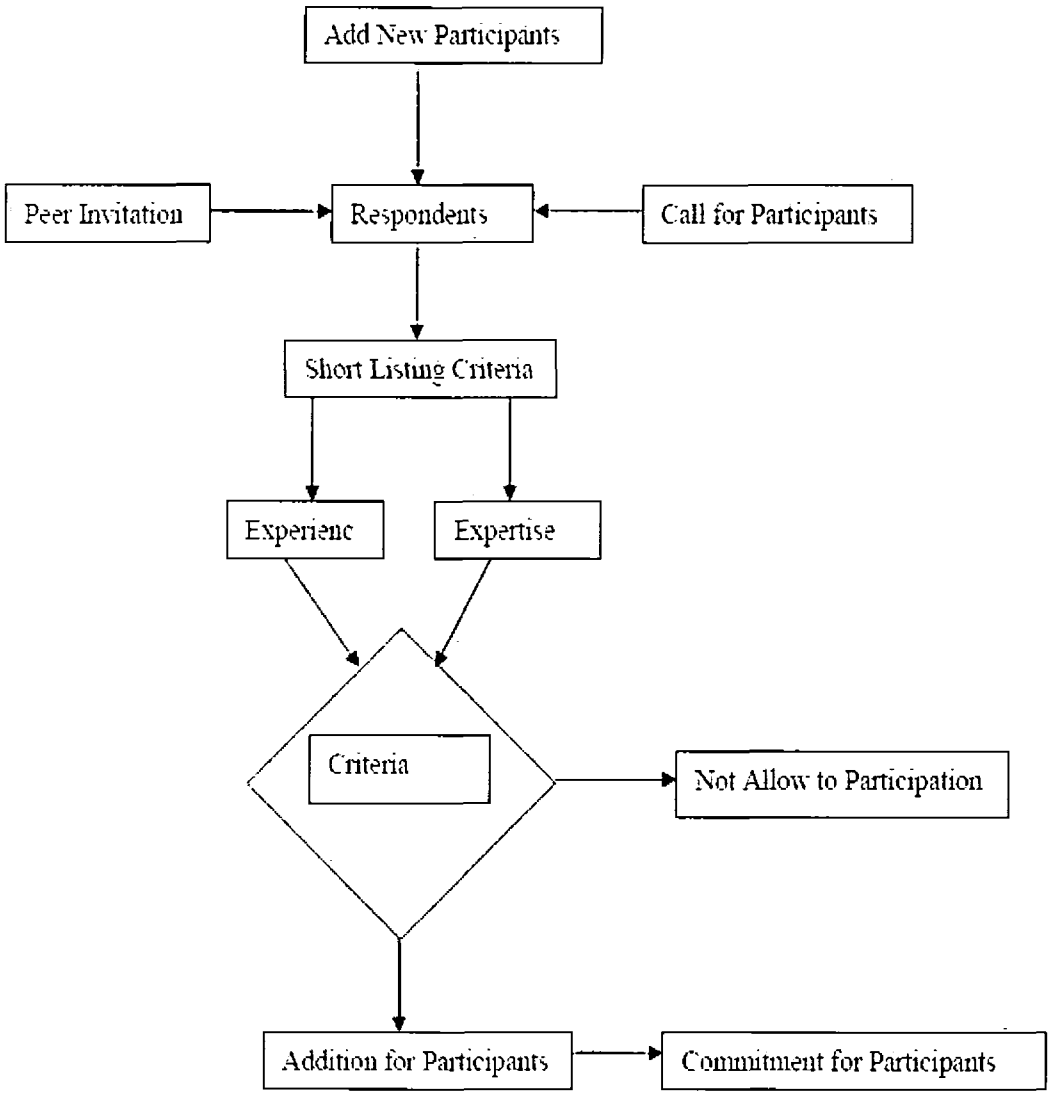
This is the detailed picture of each step in the proposed process. This is the most important part of OSSD; because it decides that project remain OSS or proprietary. This section explores the OSS license selection for proposed OSS process. The terms and conditions of OSSL and OSSD team influence the economic and social factors which may be influenced for OSSL selection which are community support, self decision, ROI & immediate payoff and better future. From above factors if social factors influence more, then the selection authority chooses the restrictive OSSL otherwise he selects the permissive license and vice versa as shown in fig 10.



OSSL selection fig no 10

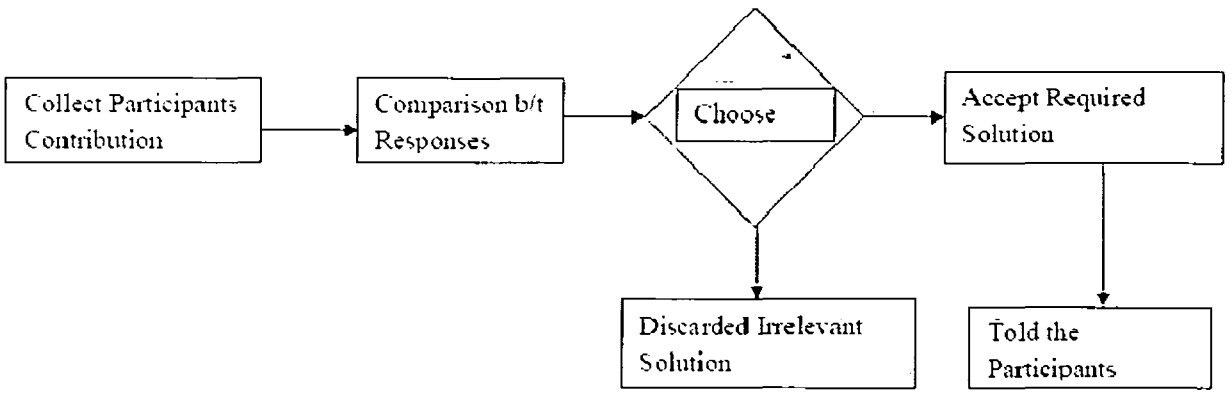
In this section of proposed OSSD process, the project manager/initiator invites participants by peer invitation and by sending mail of call for participation to mailing lists of running projects of OSSDC. After this, short listing criteria apply to the participants. After short listing, the selected participants add in the participants list and after this they signed their commitment for that particular OSS project. Except this, reject those respondents which can't meet shot listing criteria. In this proposed OSS model, if any volunteer wants to take part in OSS project during

the development then the whole process of identifying participants follow again for him as shown fig no 11



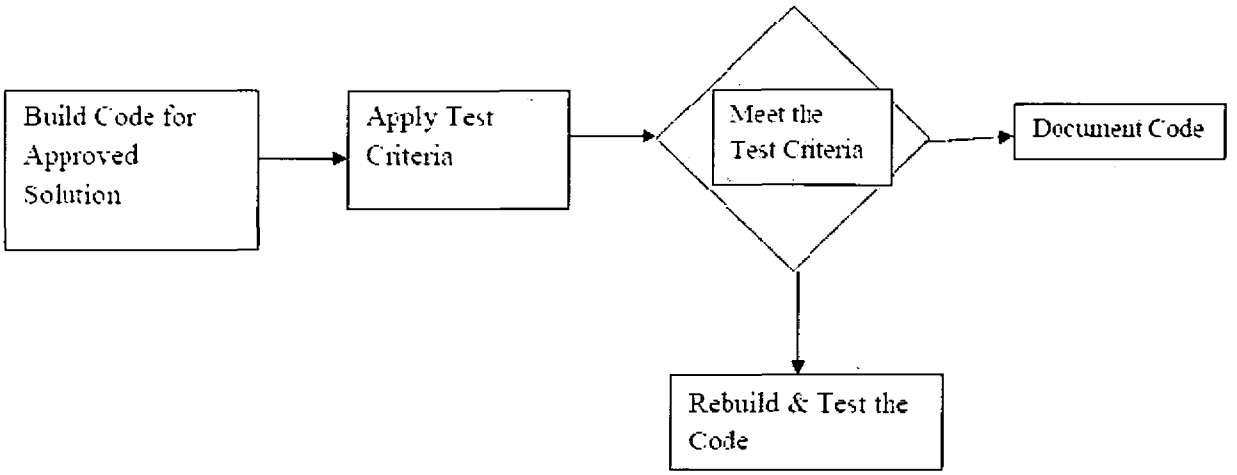
Finding participants fig no 11

In this step of proposed OSSD process, committer collects the contribution of participants, does comparison between all the proposed solutions of participants and evaluates them. After evaluation, he chooses the best proposed solution and discards remaining solutions and told all the participants as shown in fig no 12.



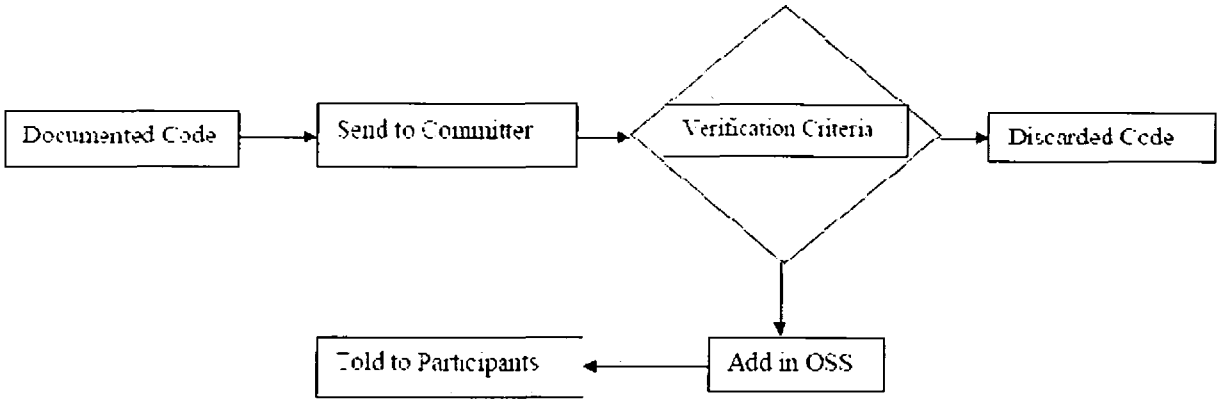
Identification of solution in OSSD fig no 12

In this section of proposed OSSD process, OSSD team builds the code for committer approved solution, test criterions apply on the build code, if code meets the test then document the code otherwise rebuild and test the code as shown in fig no 13.



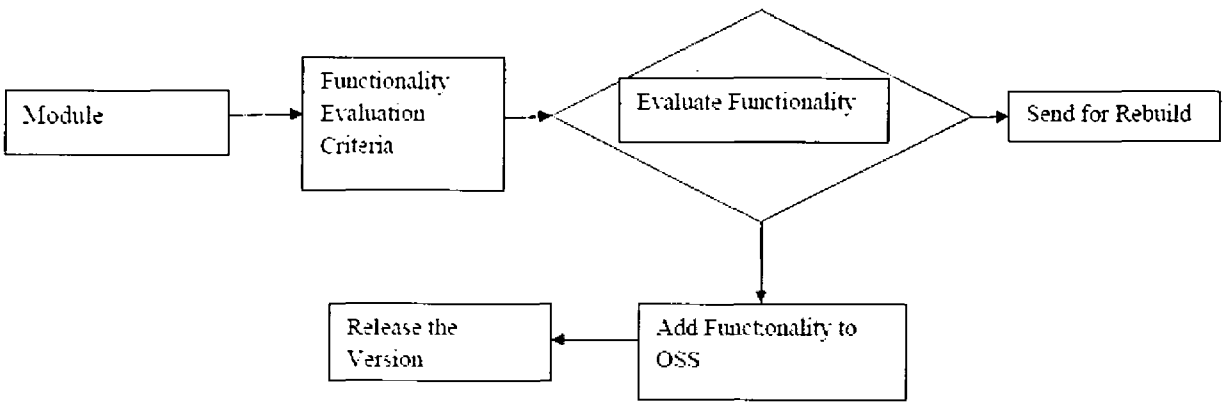
Build and test code fig no 13

In the proposed OSSD process, after document the code contributions send to committer where he verifies the code by applying own verification criteria. If code meets the verification criteria then choose best functionality code among them and add that in the OSS, discard the remaining code except that and committer tells the participants as shown in fig no 14



Verification for Code fig no 14

In this proposed OSSD process, the committer the build modules arrive to committer, on which functionality evaluation criterion apply. If the any module meets required functionality then chooses that module, adds in OSS, releases the version and discards the rest modules as shown in fig no 15.



Release of OSS fig no 15

References:

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Appendix:

A survey for motivation factors in selection of open source software license: social and economic perspective:

This survey is designed for elicitation of motivational factors which influence a person in making choices on selection/adoption of open source software license from a variety available for selection. This survey is designed to bring into focus motivation factors (old or new) for OSS license selection. The research will enlighten the open source community on drivers behind license selection and will also make a person better aware of various influences while making choice on license adoption.

The data provided by you will remain confidential and will only be used for analysis in my graduate research. I shall look forward your contribution in accumulating and compiling this much needed knowledge and am thanking you in advance for devoting precious time and effort out of your busy schedule.

Kindly, click on the following link or copy and paste the URL in the address bar for the survey.

URL:

The results of this survey and analysis of issues will be shared with you once my research is complete.

Regarding,

M.Abdul Qadoos Bilal

Personal information: (To be kept confidential)

Nor part or whole of this section will be made public and is for cataloging and record keeping as evidence of my research only.

Fill in the following this information will be kept confidential

1. **Your good name?**
   .....(if you want to share)
2. **Type in your email address.**
   .....**(results of survey will be shared via this E-mail)**
3. **Your employment type?**

- o Self Employed
- o Salaried
- o Freelancer

4. **Your Last academic degree.**

- o Diploma
- o Bachelor's degree
- o Master's degree
- o Doctoral degree

- None of these

5. Have you received any formal training in Open Source Software Development?

- Yes (academic education)
- Yes(industry certification)
- Yes(Other source)
- No
- If yes please specify(during academic education or special certification)

6. Please specify your experience in open source software?

- 1-3 years
- 3-5 years
- 5-8 years
- 8+ years

Influence of Participant in selection of OSSL

7. What are approximate number open source software initiatives you have been involved in?

- 1- 2
- 2-5
- 5-10
- Other…….

8. What is/was your current status in the recent open source software project?

- Project Manager
- Senior Manager
- Developer
- Other ----------

9. What was your level of participation in Open Source Software Development?

No of Projects	Level (Dedicated full-time/ Part time)
Example: Three project	Example: Dedicated full time

10. What is/was your level of participation in the recent open source software?

- Dedicated full-time
- Part time

11. What is/are name(s) of open source software license(s) and open source software project(s) you were involved with?

Name of Projects	License (Mandatory)
Example: Free Mind	Example: GPL

12. Which body took decision in the selection of current open source software license(s)?

- You
- Other……(refer to question no 8)

13. Do you have good knowledge of the term(s) and condition(s) of OSS license(s)?

Good Knowledge (At least one time you have studied terms and conditions)

- Yes
- No

14. Which of the following influenced you or your peers in selection of OSS license?

Note: (restrictive licenses provide protection of ideas while permissive license allows the usage of

other's work)
Please choose only one of following:
- o Protection of work
- o Use of other's work

15. As per your experience who takes decision about the selection of open source software license?
- o Project Manager
- o Senior Manager
- o Developer
- o Specify .....

16. What is about your last experience with open source project?
- o Successful
- o Failure
- o Ongoing

17. Has your previous experience(s) affected your recent decision in selection of open source software license(s)?
- o Yes
- o No

18. With project involving you, which body was more influential in selection of OSS license?
- o Project Manager
- o Senior Manager
- o Developer
- o Specify .....

19. Would you like to change your current open source software license?
- o Yes
- o No
- o _____ issues

Social motivation factors:

20. From where do you take help or inspiration while making decision about the adoption of your first OSS license?
Please choose only one of following:
- o OSSD Community
- o Documentation of OSSL
- o Other Resources (Blogs / experience reports / Reviews)

21. Has the OSS community influenced you in any manner in choice of current OSS license?
Please choose only one of following:
- o Yes
- o No
- o Specify.....(Briefly Specify who helped you and how)

22. How much do you agree with following given statements about adoption of open source software license(s)?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The aspiration of helping the community forces us to choose a particular open source software license.	o	o	o	o	o

The ambition to fight against market domination of proprietary software gives strength to the choice of this open source software.	o	o	o	o	o
The desire of maximum time utilization might select an open source software license.	o	o	o	o	o

Economic motivation factors:

23. Do you take into consideration about return on investment of proprietary software before making choice about adoption of OSS license?

Please choose only one of following:

- o Yes
- o No

24. Which of following compelled you the most in selection of OSS license(s)?

Please choose one of following:

- o Better Future
- o Immediate Pay off
- o Donation for skilled people

25. How much do you agree with the following statements about adoption of open source software license(s)?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The hope of better future becomes a cause of taking decision carefully about the open source software license.	o	o	o	o	o
The choice of open source software license might be affect due to the announcement of economic benefits from any organization.	o	o	o	o	o
The eagerness of attaining immediate pay off or monetary benefits forces in select of open source software license.	o	o	o	o	o

Comparative scale of motivation factors:

26. Which factor comparatively more influences you in selection of OSSL?

Specify only one.

- o Protection of own work
- o Using other's work
- o last experience
- o Related Community
- o Good reputation
- o Ego Satisfaction
- o Extent own innovation
- o Fight against market domination
- o Helping the community
- o Time utilization
- o Return on investment
- o Immediate Pay off
- o Donation for skilled people

- Better future

Maximum numbers of motivation factors in selection of OSSL:

27. How many factors at most consider while selecting the OSSL?
Please specify as much you consider and also give the priority by given scale.
1=Critical important, 2= highly important, 3= medium important, 4=low important, 5=no important

	1	2	3	4	5
Protection of own work					
Using other's work					
Last experience					
Related community					
Good reputation					
Ego satisfaction					
Extent own work					
Fight against market domination					
Helping the community					
Time utilization					
Return on investment					
Immediate pay off					
Donation for skilled people					
Better future					

Relationship Between motivational factors:

28. Which of the following motivates you for associating yourself with open source software community?
    - o Better Future
    - o Immediate payoff
    - o Donation to skilled people
    - o Using other's work

29. Which of the following motivates you for associating yourself with open source software community?
    - o Good Reputation
    - o Extent own innovation
    - o Helping the community
    - o Protection own work

Certification and Standardization in OSS Licensing:

30. Do you have knowledge about any existing standards or certifications regarding OSS Licenses?

Specify only one.

31. Yes
32. No
33. Specify if yes.....

31. Do you feel the need for standardization for creation of OSSL?

Specify only one.

- o Yes
- o No

32. Do you feel the need for certification in OSS license?

Specify only one.

- o Yes
- o No

33. Do you have knowledge of any existing OSSD process?

Specify only one.

- o Yes
- o No