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### **The Role of Local Open Source Communities**

The Role of Local Open Source Communities in the Development of Open Source Projects

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Department of Computer Science and Engineering  
Göteborg, Sweden January 2016

# The Role of Local Open Source Communities in the Development of Open Source Projects

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**Abstract—** in this paper we are going to investigate the role of local open source communities (LOSCs) in the development of open source projects (OSPs). We are going to look into the importance of the LOSCs, the motivation to join them and their impacts on OSP. Our interest in this topic originated from the fact that there is a lack of studies regarding this topic. To have a clear understanding of the problem, we have decided to adopt the case study strategy as our research methodology. In the research we have conducted seven interviews with members within different LOSCs. The results we obtained have proven the importance of LOSCs and the role it plays in the development of OSP.

## I. INTRODUCTION

In general the open source software is software that has its code open for public. By being open for public the developers with the right skills will most likely contribute towards improving it [1]. People, who participate in the OSPs, whether by using it or developing it, are referred to as OSP stakeholders [1]. The open source community mainly consists of stakeholders who contribute to OSPs [1]. In open source development the developers sometimes benefit from their work in some aspects such as the recognition from their peers, the fame they get from contributing and the advantages of the tool they create [2].

Open source software organizations depend on ultra-distribution in the development of projects, where contributions to OSPs are done by programmers from different destinations as the source code for these OSPs is available for the public to read, change or modify. Examples of famous OSPs include Mozilla Firefox and Linux Ubuntu [7, 14]. Even though open source organizations depend on ultra-distribution, it was observed that many organizations depend on the efforts of local communities that meet face to face to work on OSPs. We argue that this trend is significant as we will come to present throughout different sections of this paper, where we will refer to it as “LOSC”.

We have come across several local open source development communities in Gothenburg who operate locally. We found out that these local communities work on Open Source projects in local/regional areas. These local communities have different purposes, some of them are educational, some promotional, some social and some beneficial. Examples of open source communities which

operate locally are Linux User Groups (LUG) and Ubuntu’s LoCo teams [25, 26].

To lead to our purpose of the study we first wanted to give a clear idea as to what the open source is and what the open source communities are. Also, who the developers of these communities are, why they develop and how they benefit from their contributions. By explaining that we move to the purpose of our study which is to understand through an empirical inquiry why does the LOSC exist and how it can contribute to the open source community. Finally, what challenges and benefits they face or bring to the open source community.

From the purpose of our study we have come up with three research questions.

### *Research Questions:*

- A. *What interaction patterns are established between LOSCs and other stakeholders in OSPs?*
- B. *What is the role of LOSCs in the development of the project?*
- C. *What are the challenges/benefits that such communities face/bring when developing OSPs?*

The study will be based upon several interviews from different LOSCs that are situated locally in Gothenburg and others that are located around the globe. The data will be thoroughly analyzed, and used as foundation of our conclusions.

In this paper, we will present several studies that have been made in the same field as our topic. We then explain our research methodology and the choice of the research strategy for our study. Afterwards, we will present the data we collected from the conducted interviews in the result sections. We then discuss our findings from different aspects and compare them to our literature findings in the discussion section, along with the presentation of research limitations and future work. Finally, we end the paper with the conclusions we reached from the study.

## II. BACKGROUND AND RELATED WORK

In this section we are going to cover all sorts of aspects that are related to the open source communities. We will start by

defining the meaning of the open source as a whole. When gathering our literature, we noticed that there was a lack of papers that specifically address the topic of locally distributed communities and teams, and their role in the development of OSPs. Most of the literature we came across only covered open source communities on a global scale, without focusing on the specific roles that local communities have in the development of OSPs.

#### A. Open source software

Open source is a revolutionary process of producing software and provides the software for public so any developer with the right skills can contribute and improve the software [1, 2]. By being publicly presented to all the developers, the source code of the software will inevitably be improved because the collaboration will help fix the bugs within the software [1]. The open source software has become widely spread in the recent years [7]. Since the fact that everyone can modify and create new software based on existing open source software, this helped the open source grow [7]. A very good example is the Linux open source software which was initiated by Linus Torvalds. He created it based on the Minix open source software structure and with the help of the open source community the Linux project was developed [7]. Products like Linux that are created based on open source software are licensed as open source [8]. Some use different licensing to use for commercial purposes [8].

The development for open source is voluntary, the developer does not necessarily make monetary profits [8]. There are reasons for doing what they do and we will come to discuss them later on in the motivation section.

The open source products are cheap to make compared to the commercial products [8]. It is more reliable and cheaper to maintain due to the fact that the open source developers are there to fix it and improve it, compared to the commercial products [8]. That has lead big industries like Google, yahoo and Facebook to build their infrastructure using open source technologies [12].

#### B. Open source community

In general, the open source community is a community of people that contribute to the OSPs [1]. Not everyone who is part of the open source community would write open source code, some do not have the skill for it, instead they contribute in other ways such as translating, documenting as well as support and training [1, 9]. The ones who write the open source code are the ones who have the hobby of programing and they spend a lot of time on the computer [1]. There have been some observations made to understand how the communities work [3]. It has been noticed that within the communities there has been a lot of information, support and shared innovation spread among the developers [3]. Working in such communities where support, innovations and discussions are available encourage the developers to participate instead of working and innovating in isolation [3]. As mentioned before the open source does not necessarily provide compensation. Therefor the developers who are involved do not contribute for the financial compensation but rather for the intellectual achievement [3].

#### C. Local communities in social science

According to social science “A local community is a group of interacting people sharing an environment. In human communities, intent, belief, resources, preferences, needs, risks, and a number of other conditions may be present and common, affecting the identity of the participants and their degree of cohesiveness”[23]. A local community is where a group of people living in a common location, interact, share the same interests and contribute to each other’s social or material values within a shared geographical location [23].

#### D. Local open source community (LOSC)

In open source, there are many communities that are distributed locally city wise or country wise. These communities have objectives and characteristics which their members follow while working on OSPs. Examples of these communities along with their main objectives, characteristics and distribution will be presented below.

A Linux user group (LUG) is a group of developers who gather within a location and provide support, advocacy, education and a social environment for Linux developers whether they were experienced or novice [15]. Furthermore, they meet face to face or via IRC to exchange information and work on various Linux projects by developing, making configurations and fixing bugs [15]. There are different characteristics a LUG can have such as a need for a website, a meeting locations and a meeting time [15]. Also, LUGs are commonly known to be distributed city wise [26].

Another example is Ubuntu’s LoCo teams which stand for Ubuntu’s Local Community teams. They are to some extent similar to LUGs, there is a LoCo team in almost every country and sometimes more than one, like in the United States where they have it state wise [16]. The users expertise in LoCos range from Linux experts to entirely new users [22]. LoCo teams get together to achieve objectives that include advocating Ubuntu, providing support, organizing release parties and more [22]. In order to join a LoCo team and socialize with other Ubuntu users, one has to look for a LoCo in their area, if not existent, they are allowed to start a new one with other users in the area if they are available [25].

The final example is Mozilla’s Community Sites (MCS). Within MCS there are some which are locally distributed; these are commonly known as local MCS [24]. Commonly, MCS are distributed country wise [27]. Local MCS, work in a hierarchal manner and engage in various tasks such as; localizations, promotion, quality assurance, documentation and extension development [24, 28]. The number of members varies between different communities, and communication mechanism varies from IRC chat to mailing. However, it is mandatory for local Mozilla communities to have their own specific website for information and communication mechanism [24, 28].

We refer to such initiatives as Local Open Source Communities (LOSCs). The goal of this paper is to investigate LOSCs by looking into their role in open source development, what challenges and benefits they bring or face and what interaction patterns they have with OSPs stakeholders.

### III. METHODOLOGY

In this research, we decided to use a case study as our research strategy. A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and context are not clearly evident [19]. We are aiming to study in depth the purpose of the LOSCs and their role in OSPs. Therefore we chose to use a case study as a research strategy, because it suits our research the best. We wanted to know the reasons behind the local communities' existence. Also we needed to find and investigate the challenges they faced and the benefits they obtained and the challenges and the benefits they brought up from their experience with the OSPs. With a case study, we can collect qualitative data from different developers within the local communities.

#### A. Choice of research strategy

As mentioned before, we needed to conduct an in depth research and collect qualitative data. We found that the case study is the best as a research strategy since it provided us with in depth qualitative data which we collect from the interviews we conduct. A survey approach could have been beneficial if we were to collect opinions and generalize our findings regarding the local communities. However, that was not the case for this research as we need a deeper understanding which can only be obtained through a case study that includes interviewing subjects affiliated with our topic. We could not conduct an experiment since we did not have any treatment which we wanted to apply or factors which we wanted to control to see the behaviors [20]. Action research and design research were not required since we did not have a product which we wanted to test and improve.

#### B. Data collection procedures

Since we adopted the approach of collecting a qualitative data, our aim was to have around ten different interviews. There will be two interviews at each local community. We will interview two developers in case the subject lacked the knowledge or was biased with the answers (s) he provided to our questions. Biased answers could influence our result. We aim to interview five different local communities. That variation helps provide different perspectives regarding the purpose of the local communities. Since the size of the sample is very small and there is no population information available, we are adopting the maximum variation sampling for both the developers and the local communities [21]. The method of data collection which we chose was the "direct method" which involves conducting interviews and the direct involvement of people [21]. We will discuss with the developers regarding what information relates to them and whether or not they allow it to be revealed and we will respect their decision regarding that. We will sign NDA contracts if available. This step has been made to insure that we get the most reliable data. We will conduct a pilot test to estimate how much time it would take to answer our questions and whether our questions were clear enough to the interviewees to provide a good answer. During

the interviews, different open questions will be used followed by specific ones, which follows the "funnel model"[21]. With that design of the data collection procedure we could achieve more solid results.

#### C. The interview questions

To not miss any details which could help answer our research questions, the questions were derived from analyzing the list of our research questions we had. The interviewees understanding of LOSC should be achieved before the interviews in order to prevent any misinterpretations. This is the list of questions we have prepared for our interviewees:

- 1) *From your experience, how do local community branches contribute to OSPs?*
- 2) *What is the difference between local branch projects and the global community projects for OSPs?*
- 3) *Why do people join LOSCs? What motivates them?*
- 4) *What are the relationships between the local community members? Is it different from the public open source communities?*
- 5) *As stakeholders, how do these local communities impact the open source society?*
- 6) *As stakeholders, how does the local community impact the industries?*
- 7) *What kind of challenges could a local community introduce to the OSPs?*
- 8) *How can a local community benefit open source organizations?*
- 9) *What benefits does the local community obtain from the OSPs?*
- 10) *What challenges does the local community face by dealing with the OSPs?*

We have conducted a pilot test to estimate how much time it would take to answer our questions and whether our questions were clear enough to the interviewee to provide a good answer. The time it took to finish the interview was around 30-45 minutes.

#### D. Method for analyzing the data

In our study, we have interviewed two developers each from four different LOSCs we got lots of data from different angles. The data we got from the interviews are mostly qualitative data. When relying primarily on qualitative data, triangulation is the best technique to use [21]. Triangulation is a data analyzing technique that means studying an object from different angles and thus it provides a broader result [21]. Triangulation is also important in order to increase the precision of our research [21]. In our study, we decided that analyzing the data using data source triangulation would be the best. Data source triangulation is a type of triangulation where the data is collected by using more than one data source or by collecting the same data at different occasions [21]. Since we have interview data from five different LOSCs, we can use data source triangulation to get a broader result.

We started with summarizing the interview data. We then sorted, organized and categorized the answers depending on

which research question it is related to and who answered what. This made it easier to later analyze the data. With the sorted data, we used triangulation by analyzing what each developer answered comparing the answers in order to come up with a general result.

### E. Validity threats

Although we have lots of data, there could be some threats to its validity. A validity threat is the threat to the construct validity. Construct validity reflect how well the operational measures that are studied really represent what the researcher have in mind and what is investigated according to the research questions [21]. The interviewed person may have interpreted our interview questions in a different way than we did. In order to reduce this as much as possible, we had many discussions about the interview questions and we also pilot- tested them to make sure they are interpreted the same way by both the interviewer and the interviewees.

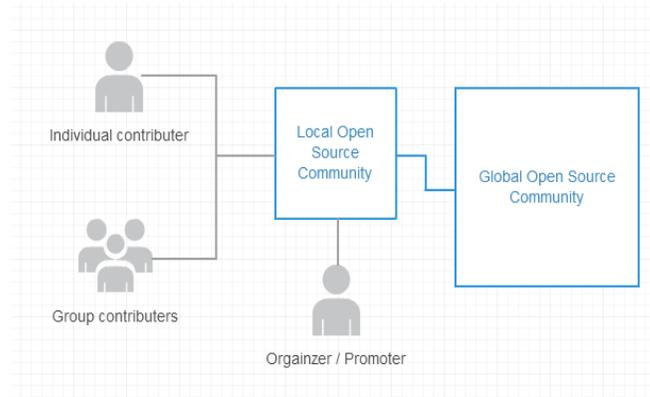
There is also the threat to the external validity. External validity is to what extent findings can be generalized and to what extents other people outside the investigated case have an interest in the findings [21]. In order to minimize this, we tried to interview as many different open source communities as possible. With data from three developers each from four different LOSCs, we should be able to get a generalized result.

One more validity threat is the threat to the reliability of the study. The reliability of the paper means to what extent specific researchers affect the data and the analysis [21]. Should another researcher conduct the same study, they should, hypothetically, get the same result. In order to reduce the reliability threat, we have discussed about all things we have done and made sure we have the same opinions so there is no bias.

## IV. RESULTS

Our results section will be divided into four sub sections each of which will be related to one of the research questions. The third research question will be covered in sub sections three and four. We are going to quote and explain the answers for each question asked to our interview subjects.

We have conducted ten interviews, three interviews with organizers of LOSCs, four interviews with developers within the LOSC and three interviews with a team within a LOSC. The interviewees were part of different LOSCs that are part of several open source organizations. The organizations are Linux, Meteor, Mozilla, Ubuntu and Google (buzz project). We have explained the concept of LOSC and how it originated to the interviewees to help remove any misconception about the term. Each type of LOSC members had a different point of view which we will come to present now. The figure below indicates the different type of LOSC members:



### A. First RQ: LOSC & OSP stakeholders' relationship

To answer our first research question regarding the interaction patterns established between local community members and other stakeholders, we are going to make use of the three points of views which we obtained from our interviews.

#### 1) As stakeholders, the interaction between LOSC and open source community.

First we will present the results for the interaction between the LOSC and the open source community. From an organizer of a LOSC's point of view it was said that "They participate in the discussion mainly on the mailing lists and they take part in international gathering with other communities from time to time." So as local community members they participate in discussions and they participate in other events that support the open source community.

As a LOSC members' point of view it was said that "our products are presented to the open source society but other than that we don't have an impact". So basically they contribute with what they make within the LOSCs to the open source community.

As for the group working in a LOSC we did not get any specific answer as how they contribute. They agreed with the other LOSC members by saying "When we started working with meteor we have created many different packages for the meteor and released it for the public." That answer is a typical for an open source contributor.

#### To summarize:

The answers we obtained from all three different points of views suggested the same regarding the interaction with other open source community members. All of the LOSC members can contribute with their products to the open source community. Plus in the LOSC organizer's point of view meeting other community members in different events is a way to interact.

#### 2) As stakeholders the interaction between different LOSC members.

In the LOSC organizers' perspective it was said that "In general members of OS communities do not mix community work with their daily work, even if they work in the open

source field.” Also another LOSC organizer said “I think it is easier to socialize with people from the same area who has similarities in language/thinking. Socialization with the people you are working with helps a lot in the result of your work.” The first organizer emphasized on not mixing their work with the community work, maybe that means that within the LOSC’s work they try to keep it on the subject and not drift. The other organizer suggested that socializing is an important aspect and it makes the development more efficient.

While analyzing the LOSC members’ point of view it was said that “I don’t think it differs very much other than maybe speaking the same language and meeting in person locally and socialize more” and “people in local communities are closer since they have more stuff in common.” And “You could be more effective”. We basically received the same answer; socializing was the main aspect and collaborating with others leads to more efficiency in working.

The LOSC groups’ point of views were a bit different than the others, one group said “Well with my teammates, we are friends. We all share the view of creating our own big company and make profit, we met at the start as different developers and worked on simple projects within the community but afterwards we started working together on our own app.” And another said “There’s not much difference, you could meet some interesting people and work on interesting things.” Those responses are different, while socializing may have been a factor, making profit is a new factor. Joining to meet interesting people to work on profit related things is an important aspect. The first group explained their idea which they were working on regarding how to make benefits with working with meteor framework. And according to them it was mentioned that their group were assembled at the start because of that idea.

#### *To summarize:*

The answers we obtained from LOSC organizers’ point of view and the LOSC members’ point of view suggested the same regarding the interaction with other LOSC members. All of the interviewees agreed that the interaction between the different members is a sort of socializing aspect which can help them cooperate and become more productive when developing OSPs. The LOSC groups’ point of view was a bit different. While they agreed on the socializing aspects, they added a new beneficial aspect. The developers which can work together on making a product which they can benefit financially from in the future were one of their main goals.

### *3) As stakeholders the interaction between LOSC members and industries.*

The organizers’ point of view were a moral point of view it was said that “Open Source community focus more on issues like freedom of the software and copyright licenses and less into changing industries. The main reason this happens is due to the fact that the goal of the industries is to maximize profits in comparison with the goal of OS communities that focus on other issues.” The other organizer did not find any relation and said “there is a difference between cooperation and open source market.”

The LOSC members’ point of view seemed different than the organizer. They mentioned that the industries could hire individuals who have a lot of contribution “could maybe hire people from these communities, for instance” also “working with open source is always a good thing; it helps being noticed by the industries.”

The LOSC groups’ point of view was similar to the community members’ point of view. It was said that “a group of three developers I know have worked on a project and they have managed to contribute to some extend towards that project. The meteor organization have noticed their contribution and offered them a job at San Francisco” that is a basically the same as the LOSC members’ point of view.

#### *To summarize:*

The answers we obtained regarding the interactions between the LOSC members and the industries suggested the same in the point of view of the LOSC members and the LOSC groups. They both pointed out that the interaction between the two is based on financial benefits. Working on communities may help them to be noticed by the industries. The organizers’ point of view on the other hand suggested that there is no interaction since the industries and the open source communities do not share the same goals since the open source communities’ goal is moral while the industries’ goals are beneficial.

#### *The answer to the first research question:*

What interaction patterns are established between LOSCs and other stakeholders in OSPs?

We have considered three different stake holders, the open source community members as the first stakeholders, the other LOSC members as the second stakeholders and the industries as the third stakeholders. The results we got were different in each case, the interaction between the LOSC members and the open source community members are means of contribution. The contribution could be towards the discussion boards and support and code contributions from packages and other means of code contributions.

The interaction between the different members within the LOSC is a sort of socializing aspect which can help them cooperate and become more productive when developing OSPs. Also another sort of interaction is a type of beneficial interaction. Meeting people in the LOSC who share your views and goals and think in ways that could lead to financial benefits could be a reason which brings people together in the LOSC.

The third interaction pattern was between the LOSC members and the industries. The only interaction we found is a beneficial type. Working within those LOSCs could improve the chances of getting hired by the industries, that could be done by the code contribution towards different projects or meeting others within those LOSCs who could make connections for you with those industries.

### *B. Second RQ: LOSC role in development of OSP*

There are different roles that a LOSC plays in OSP. From our interviews we found different aspects that LOSC can engage in when dealing with OSP. These roles are not limited,

as they differ from one community to another and one place to another. In this section we will provide answers to our second research question from the findings we reached from our interviews.

From LOSC organizers' perspective, LOSC promote and inspire people to use free open source technologies, as the LOSC localizes the content of open source and promoting materials on a more practical level. These LOSCs work on collaborative projects and the result product gives benefits to both the LOSC itself and the society as a whole. Furthermore, LOSC focuses more on issues like freedom of software and copyright license when working with projects more than they think of industrial changes and how they could sell products and make profit. They also focus on open source platform promoting and localization, which is beneficial to open source organizations that for example own an OSP. Their role in OSP development isn't limited to promoting, of course, various members have different roles and tasks in the LOSC itself as some of them promote and others do code contributions to OSP.

Even though LOSCs differ in their style of working on OSPs from one place to another, it is commonly known amongst these LOSCs that their members share the fact that they do not mix their daily work with their work on these projects even if some of their work is in the open source field. As they contribute to these OSPs, LOSCs use the materials and know-how of the global open source communities to show the importance of open source software in the LOSCs.

LOSC stakeholders usually partake in discussions via emails and they organize and take part in international gatherings to work with other LOSCs from time to time on large OSPs. This gives a bigger chance at solving problems when developing OSP if they pop up as more developers will be at the same place and could offer help. Also, this provides bigger motivation when a bigger group of individuals work together, which increase the chances of project success.

According to a LOSC organizer, in order to maintain an OSP un-abandoned, it is his job to motivate developers to show up at meetups to work together and find motivation. So in this sense, it is his job to keep the project alive, and possibly get more and more developers contributing to it. The developers mostly contribute to such projects for fun and to feel part of something big, when releasing the project to the people. This doesn't disclose the fact that some projects end up being marketed for profits as the LOSC members sometimes choose to go commercial with their project by changing its license. This is because OSP can be highly beneficial and could bring large incomes if promoted properly. Another aspect is that some companies use an open source platform or tool, and to keep the OSP which they are using alive, they pay developers to join LOSC in order to contribute to these OSP and keeping the projects alive.

One of our interview subjects from Google buzz project was an OSP advertiser/promoter. According to him, LOSC role is to advertise and to promote the OSPs which they are contributing to. From his experience, the roles that LOSC members play in the development of OSP are not limited to

code, advertising, promoting and marketing are also big roles that could make the OSP highly beneficial. For instance, members of LOSC present the project they are working with at meetups or share it online on forums and such, to either attract other developers to join in the contribution to the OSP to make it bigger and better, or to attract investors who plan to sell the project in the future. Another interview with a LOSC member from Linux suggested the same thing, where he said that the development and success of the LOSC help the movement of Linux to grow. Also, LOSC members -primarily organizers- help in structuring the OSP which the LOSC is working on in order to avoid issues in the future and to increase the chances of project success.

One of the developers we interviewed said "When we started working with meteor we have created many different packages for the meteor and released it for the public. I would say at this point we as local community members have contributed to the open source future projects". He and his team have contributed to the OSP called "Meteor" which is an open source platform for web development. They as a team from a LOSC played a role in the development of this OSP and after they released the product to the people, they are still contributing by adding new packages, fixing bugs when faced with some and constantly coming up with new ideas and features to the main OSP. Some of his fellow LOSC members were seeking jobs, which is why they took part in the development of the OSP. This plays a big role in the expansion and spreading of OSP, as many start to contribute to them and see it as an opportunity to gain reputation which attracts job offers.

We could see the differences in the perspectives on what roles a LOSC could have in the development of an OSP. According to advertisers, promoting and marketing the project making it beneficial and profitable is what a LOSC does when taking part in an OSP. On the other hand, the developers' point of view was that LOSC help in keeping projects alive by constantly contributing to them and adding new additions to them, specially the OSPs which are useful, needed, and used by many people. From organizers perspective, LOSC help attract developers and keeping projects alive, and if the LOSC stopped having meetups, then the developers would start to lose motivation to work on the project and might lead them to abandoning the project they are working with, which would result in the project's end.

#### *The answer to the second research question:*

What is the role of LOSCs in the development of the project?

LOSC plays a role in the development of OSP. From our findings we find that the role differs depending on what the LOSC member is interested in. It could be a developer contributing with code, an organizer managing meetups to work on OSP or an advertiser/promoter to advertise the project. If it is a developer, the contribution would be contributing with code to the project, finding and fixing bugs, updating, adding new designs to the OSP and such. An organizer's role would be mainly organizing local meetups for LOSC members so they

could meet and work on an OSP, making sure people contribute to the OSP so it doesn't get abandoned, promoting the project to get possible investors and attracting new developers to work on the OSP. As for the advertiser/promoter, his role is marketing and selling the product of the OSP, this could be done through sending emails, presenting the product and sharing the tool/platform online for people to see.

### *C. Third RQ: Benefits the LOSC bring and obtain when dealing with OSP*

In this part we will present the benefits that are brought from the LOSC and obtained by it. We will also present the motivation which motivates the people to join the LOSC.

#### *1) Benefit for joining LOSCs (motivation)*

There are many benefits for joining LOSCs. It ranges from being a part of something greater to humanitarian reasons and enjoyment. We gathered seven data points regarding this topic, one of the biggest reason is altruism. Helping others by working with OSPs is a factor which leads many enthusiastic developers to join this cause. Several of our data point's word wise indicates reason for altruism and it's benefit is, to support a cause which helps the greater good which would make oneself feel better. Humanitarian and altruism reasons and thoughts is something us humans think about and it is part of our nature and in a sense this practice would be a way to satisfy our nature to help.

Social factor and benefits lead many to join, it helps developers to grow and work in an environment which one can get an indication on how the industry works without having any severe risk such as a work related office or environment. Other benefits include idea sharing within the LOSC being able to see ideas and create them is a cherished attribute within open source communities. This leads to improve one's business relationships and goal orientation.

The last and probably the biggest motivation was experience and for future work criterion. Being part of open source development leads to many future works. This is truly beneficial for individuals in OSPs. Many work with open source to get some recognition for future purposes. It could be through the open source product itself or popularity from code repositories. Several interviews clearly stated they received many jobs offer due to their contribution and recognition from OSPs which they have worked on. This leads to be the biggest beneficial factor of joining LOSCs and OSPs.

#### *2) How do LOSCs benefit from open source organizations*

##### *a) LOSC organizers' point of view:*

Within our pool of data points there were two interviewees working as organizers. These two individuals had the same view which differed from the other interviewees. Both believed benefits occurred through promoting their global open source community and product which would attract several developers which would join the LOSC or for the LOSC to headhunt. The specific approach would benefit with workforce and workflow for the specific project and empower the structure of LOSC. This factor is an easy approach which LOSCs do, since this

will attract people with same interest in regards not only programming could be social norms language.

##### *b) LOSC groups' point of view:*

One of the interviewees represented the group's point of view. The interviewee discussed factors which revolved around the LOSC group itself rather than the interviewee himself. The LOSC group benefits varied from altruism to future criterion but the majority of the benefits were social factors. Working as a team with individuals whom shared the same interest, native tongue, social norms motivated the group itself with structure, work pace and made it more enjoyable.

##### *c) LOSC members' point of view:*

The LOSC members benefit view differs from the organizers' point of view. We can say the LOSC members see the tree while the organizers see the forest. LOSC members focus on their contribution to the OSP and want to be recognized by it. Their beneficial factor is to be recon with their work for future work activities, most of the interviewees gave examples how they received job offers from their work at the LOSC. This indeed is a benefit which the LOSC members benefits from.

#### *3) Benefits LOSCs obtain from the OSPs.*

These beneficial factors focus on how the LOSCs gain from an OSP itself rather than from the open source global community.

##### *a) Organizers' point of view:*

The benefit from the organizers' view differs from the previous section. Previously they stated that the benefit from the community itself would resolve promoting and localization as beneficial factors. In this specific field they stated being part of a product which helps out humanity or the greater good was the main beneficial factor. Since most of the organizers' task revolves around promoting and organizing the LOSC, they have less time on the development process. According to our interviewees, the sensation of altruism nature is something which would be considered as the main benefit of an organizers' point of view.

It was also mentioned by the an organizer that sometimes the LOSC does the same work as that of a regional office of a big company or organization as it provides support, solutions and education for its members.

##### *b) LOSC member point of view:*

The view of the LOSC members did not differ from the previous section. Previously stated future work criterion was the biggest beneficiary factor. According to our interviewees working on projects would give them recognition and it could be used as criteria for future work. Some interviewees stated altruism factors as helping society and social factors working with people with similar interest and native tongue was other small benefits.

##### *c) LOSC group point of view:*

There are lots of similarities between this matter and the previous one, but in this field a lot revolved around the wellbeing of the product itself. Since many join LOSC to work

on something which is greater than oneself, the group believes that the benefit is the product itself. OSP revolves around the idea of being free; helping the society, altruism factor was mentioned as a benefit of working on project. There were factors such as, future work criterion, gaining experience on how development environment works.

*The answer to first part of the third research question:*

What are the benefits that LOSC bring/obtain when dealing with OSPs?

The benefits we noticed in the organizers' point of view were promotional benefits and the altruistic benefits. The LOSC members' point of view and the LOSC groups' point of view were different from the organizers'. Their benefits were extrinsic and social. On the other hand, the benefits they brought to the OSPs included workforce, code contributions and structural stability.

*D. Third RQ: Challenges which the LOSC bring/face when dealing with OSPs*

We are going to present the challenges faced in all three different point of views:

*1) Organizer point of view:*

The main challenges were economical funding, result and tool changes. The organizers focus a lot on promoting; they create gatherings and other forms of promotional channels. This leads to an economical cost and since open source usually works freely this is a challenge many organizers face. Then there is the aspect of gathering and promoting. Another challenge is if the result was not efficient enough, how the local community should appeal to the society for recruiting and information sharing. Another challenge that the Ubuntu organizer mentioned was that the LOSC scene is dying since many developers are working directly within the global open source communities instead of joining LOSC as he sees it. Lastly tool changes are a challenge which is sometimes met. The challenge revolves around how to introduce the new tool to the LOSC. This could lead to structure challenges and efficiency problems with project development.

*2) LOSC group point of view:*

The challenges which the group faces are quite more general. The biggest challenge is meeting up with the team since time and place is an issue and since most of the members do their work on their spare time and individuals have different schedules based on their life choices.

*3) LOSC member point of view:*

The challenge which LOSC members face is adaption, whenever there is a new tool introduced or structural changes. Majority of the members in a LOSC are developers, and whenever there is a new tool introduced many try to reject this idea but when they really have to use the tool, the adaption process slows down the development process and some at the start maybe too stubborn to learn it and that leads to slowing down not only the process but also the workforce. Another

issue is structural changes, according to some of our interviewees when a structural change occurs the members of the community tend to get the shorter stick. They have to adapt, learn and understand the changes which sometimes lower the morality of the members.

*The answer to the second part of the third research question:*

What are the challenges that LOSC bring/face when dealing with OSPs?

The challenges the organizers' faced when dealing with LOSC are mostly financial challenges. The outcome of their gathering is also a challenge. Another challenge is tool introduction. Where convincing the LOSC to use it is an issue. The groups within the LOSC faced a different type of challenges; setting up meeting was a challenge to them. Other challenges the LOSC members faced was the adaption Of/with a new tool or structure of the OSPs. The challenges that the LOSCs could bring to OSPs includes bad overall structure, project forking, neglecting and abandoning.

## V. DISCUSSION

In our discussion section we are going to discuss the finding, compare them to the existing literature and clear out what is new. We will discuss the importance of the LOSC, the motivations for joining them, their impact on the OSPs, the challenges and benefits they face or bring, then end the discussion section with explaining our research limitations and the future work.

*A. The importance of LOSC*

We have found out a couple of important aspects which we had to bring into the discussion regarding the importance of the LOSCs.

*1) The collaborative work:*

The collaborative work which the LOSCs provide is important. It is true that tools that are provided for the open source developers to help them become more collaborative. Tools like the discussion boards for example help them get more support. Another example, tools like GitHub helps them organize their contributions. Those tools are available for the open source developers, but talking face to face and work in a team together in the same place is more collaborative and more efficient. That is an extra aspect the LOSC provides. Socializing could also be considered as an aspect which improves the work efficiency and it was provided by the LOSC.

*2) Meeting people with the same views:*

Within a LOSC you could meet people who share the same views and goals as you. Maybe those people you meet could be your future teammates who work with you on something you both are interested in. We found out such relationships within the groups in the LOSCs. Such relations are a bit hard to run into in the open source communities since your interactions are mainly in the cyber world.

### 3) Interaction with industries:

While there have been many cases mentioned before regarding the interaction between the open source community and the industries. Many of them are related to being noticed through the code contribution where contributors try to earn respect and good reputation in the software community [10]. Within the local communities the members could meet other members who work within industries. Those members could be considered a mean of interacting with the industries so the LOSC could improve the chances of being noticed by the industries. This is also a property provided by LOSCs.

### 4) Promoting Open source:

On a different point of view, the LOSC could be considered as a mean to inspire people to use the free open source technologies. The meetings and socializing aspects along with the support provided by the experts within the LOSC could assist in inspiring people to use and contribute to the open source. The LOSC can also be used as a way to promote different OSPs and different open source tools. We have seen firsthand the attempts that were made to promote the meteor framework. The local event was supported by the meteor organization itself and the organizers and the developers were LOSC developers.

### B. Why people join LOSC

Open source community's work force is based upon volunteers. Majority of these volunteers work for free and on their spare time but what is the golden factor which makes them join.

There were several factors in the literature findings such as Motivation to learn and create Social motivators, Flow motivators and Altruism motivators, those motivators helped the global open source community developers to contribute to OSPs [9]. Other motivations such as Intrinsic Motivation and Extrinsic Motivation also helped [4, 6, 13]. From our interviewees we had factors such as social reasons, future work criterion, enjoyment, self-improvement, and humanitarian. If we would compare these factors from both sides we can clearly see all of them match each other, even though the wording is different. This is because literature uses more academic terminology while the interviewees' uses more common terminology.

If we would categorize and match word wise from both parties, it would be categorized as following:

Literature	Interviewees
Motivation to learn and create	Self-improvement
Social motivators	Social reasons
Flow motivators	Self-improvement and enjoyment
Altruism motivators	Humanitarian
Intrinsic Motivation	Enjoyment and social reasons
Extrinsic Motivation	Future work criterion

The result is not shocking since the world of academia studied this behavior before. Open source are volunteered based, why people join may differ but all the result direct to human nature and the nature of open source. Our nature revolves around learning, expressing oneself, helping each other and be part of something. This is something Open source and LOSC offers. The factors and reason why people join LOSC has evolved since the time of free software foundation (1984), where the general idea was, all the developed/contributed code would be free for the general population. Later on the idea expanded to humanitarian reasons creating products which will help the general population, and current time with the heavily competitive market many chooses open source as a practicing ground for improvement and whereas some companies been gaining profits. With these changes many people have seen the attributes of open source which allures them into joining, to be able to quench their thirst of their nature.

Since several studies have been made on open source community we wanted to focus on LOSCs, as in geographical specific location. Lately, many have been joining LOSC to grow as a developer, many join locally so they could learn and grow with a fellow human being who shares the same native tongue. This is one of the biggest reasons why some would join LOSCs instead of just working from home in a global open source community.

It is the organizer's work to sometimes create such communities an organizer mentioned. The steps they follow to attract the developers include finding a friendly meet up place where they gather and socialize with other developers with the same interest they have. Also the organizer usually form a mailing list or some mean of communication in order to get a hold of developers who show an interest in open source project they are currently working on, thus getting new developers into the LOSC.

### C. LOSC and OSP

Open source community members have been known for their contributions to OSP in different ways and for a variety of different reasons. LOSC is similar to a large extent to the global open source community in terms of dealing with OSP. LOSC role in the development of OSP is as we found in our results, is not limited to only code contributions as the members did other things like advertising OSPs. From our findings, we found that the contribution of the LOSC members depends on what role they have as members in the LOSC. For instance, the developers do code contributions, designs, bug fixing and mostly technical related things. As for the promoter/organizer, the contribution features planning, organizing and advertising.

In literature, the open source community showed similarities to our findings to some extent as it suggested that in open source communities in general, OSPs are usually conducted by developers located on different locations, and there is no design or schedule to deliver the project [18]. OSPs begins with a developer/organizer setting the vision or the goal of the project and creating the architecture design for the project and preparing the project before opening up to the

public [2, 14, 17]. Also, on the contribution of the members, it was suggested in the literature that members of open source communities contribute to OSP by efforts which included adding new features, improving old ones, updating, maintenance work and advertising OSP [7].

From the findings of our results and our literature study, we can clearly see the common properties that both LOSC and open source communities in general share in terms of working with OSP. However, there were also some differences which we noticed that are considered beneficial to OSP, an example of this is that LOSC members do localization process as well. This is useful to OSP as it attracts more developers from the area where the LOSC is located to join in the open source development thus contributing to OSP. An example of a localization process can be considered when thinking of the Ubuntu LOSC in Gothenburg, where they consider local specific requirements.

Even though it came to our understanding from the findings of our study that what LOSC do is quite similar to what a global open source community does, there are still some aspects that make these LOSC different in their own way. Some of the LOSC members contribute to OSP as a branch of a larger community. For instance, the Ubuntu community in the city of Gothenburg is a branch of the Ubuntu global community thus making it a LOSC in Gothenburg, as explained by one of our interviewees who is a member of the Gothenburg Ubuntu team. These teams are usually made of members from the same city and they can engage in separate OSPs other than the ones which they work on as members of the open source community. This also leads to differences in terms of how beneficial LOSC contributions to OSP are in comparison to global open source contribution, such as going commercial on their own version of the OSP and making a business out of it. This of course means that the OSP license is no longer open source, which restricts the OSP contributions only to the members of the LOSC which own that project, as mentioned by one of our interviewees who had done this personally with a tool which was open source at first before he and his team decided to make profit out of it.

#### *D. Common challenges associated with LOSC*

While working with open source or any kind of work in general anomalies might emerge in forms of challenges; the nature of the challenge differs when comparing literature and our gathered data points. According to the gathered challenges from the literature the three biggest challenges are; low level activity and performance, lack of documentation and support roles, at last, the forking of projects and high-end users' product development [11]. Another very common challenge that many would face is the lack of focus on documentation and support, the need of a decent user interface and backward compatibility which is found in different OSPs [11]. From our interviews we gathered three different challenges from different views. First view was organizers' point of view where the concerned revolved around promotion, tool introduction of and for the LOSC. Second, local groups' view is the issue of time and date. Third, LOSC members' view, organizational and structure changes.

If we would compare these two fields, we would be able to see the difference between the gathered challenges. The challenges in the literature are more biased towards the global open source community rather than the LOSC. While the open source development projects are much more flexible than the commercial projects since mainly there is no deadline to keep [5]. Within the global open source communities, developers who contribute to the projects are not paid to develop therefore they usually work on what interests them within the project [2]. That leads to issues in some cases since the organizer has no right to force a developer to work on different sections within the project such as testing or restructuring or documenting [2, 17]. That means the projects cannot be organized and cannot be directed towards a goal [2, 17]. On the other hand the challenges from the interview give us a different aspect of challenges within the LOSC. The challenges themselves came from different hierarchal positions within a LOSC. As previously displayed, the challenges include promotion, time & date and structural changes. Even though the challenges from literature and the interviews differ, the challenges from literature still apply to the LOSC since it is a branch of the global (main) community. However the challenges from the data do not necessarily apply to the ones from the literature findings.

#### *E. Research Limitations*

There are many research limitations which could be a cause for some flaws in our research implications, results and conclusions. In this section we present what we think could be a limitation or a disadvantage to our research, which could affect our conclusion and findings of the study in a way, in order to avoid them in future researches.

##### *1) Biased opinions:*

The opinions of our interview subjects could be inaccurate and their opinions might not represent all LOSC but only the ones which they are members of. Also, our addressed questions could have had some flaws, or they could've been misinterpreted by the subjects which could also lead to false implications from the study. If another person was to ask the questions again to the subjects, they could have different answers. Also, the same questions asked in a different manner could also change the answer. Furthermore, there are several questions which were left unanswered by some subjects that lead to the lack of certainty in some of the results. These are validity threats which we took into consideration when working with our research methodology.

##### *2) Data misinterpretation:*

A limitation to our findings could be the way we understood and analyzed the data we gathered from interviews. This is why it is important to pick a proper method for data analysis as the research's conclusion could be affected by how well the subjects' answers are interpreted. Even though we are confident with how we analyzed the data, but since some of the answers we got from our subjects were unclear, there could still

be a chance that we misinterpreted a point or two, as some of the subjects talked in a vague general manner.

On the other hand, another misinterpretation could be made by the subjects about the topic they are being interviewed about. This is something which we came across in some of the interviews, specifically when we mentioned the word “local” in association with open source communities as some of the subjects considered all open source communities on a global and local scale to be similar and that there shouldn’t be called LOSC in specific. Even though we tried to avoid this issue by explaining the topic, titles and interview questions clearly and with examples for the subjects, it doesn’t mean that the subjects had the proper interpretation of the topic and questions, thus the answers they gave might be based on a misinterpretation of the questions.

### 3) *The interviewees*

It quickly came to our understanding that finding subjects to interview from a LOSC was not as easy as we thought. We have contacted many people who are members of a LOSC in different cities and countries but only a few were willing to give us an interview. The number of subjects we interviewed had a high impact on our findings, as the more subjects we interview the higher becomes our chance of reaching a concrete conclusion/implication.

Also, the role of the LOSC member that we interviewed could be a limitation. For instance, it could be better if the subject is an organizer/leader in the LOSC for best results in some questions, while in others it could be better if the subject was a normal developer. We tried to keep it balanced, as we avoided having many subjects that share the same role.

### *F. Future work*

In order to improve our research findings if we were to do some further research, there are a couple of things which we would consider. Primarily, we would like to talk to more people and have more interviews. It would increase the validity of our findings to have more opinions from more members of different LOSC in different areas around the world. Having more than one method to analyze the data gathered from interviews could also help in improving the results. We would also like to dig deeper into the literature and introduce new aspects to discover. It would also be useful if we could get in touch with LOSC members who have worked with famous OSP and interview them to see how it is like being a part of something big and famous which would also make our result look more solid.

Our choice of research strategy would be the same if we were to conduct a future research which involves interviews as we think it fits well. However, it might be good to take into consideration the idea of doing surveys instead of interviews, as they tend to take less time to answer which increases the chance of having participants. If we were to extend the period which the research took place in, we would aim to attend LOSC meetups where members of different LOSC gather to socialize and work together in some OSP. This way we get to meet many LOSC members, which increase our chance of

getting more interviews with members who have different roles and level of experience, thus helping us reach better results and overall improvement of the study.

In terms of how we our team would work, we think that including more people to help with the research could highly improve it as it brings more perspectives and new ideas and insights. However, if continuing with the same team, we would still introduce new aspects to the study, such so that it covers more of the phenomena we are investigating. An example would be having more research questions, on both broad and detailed levels. We would also consider splitting the task of finding different LOSC members in such way so that we cover different areas from around the world, which would help us reach more solid results and cover broader perspectives.

## VI. CONCLUSION

We started this paper with the aim of understanding the role of the LOSCs in the development of OSPs. In order to achieve this we have chosen the case study strategy as our research methodology. To investigate our topic properly, we first initiated a literature study where we specify some literature findings implicated by other researchers in the field which we think relates to our topic to an extent. We then conducted ten interviews with members of several LOSCs, who had different roles working in LOSCs. From our results we concluded that both LOSCs and OSPs have impacts on each other. Some impacts are beneficial such as code contributions, project localization and promoting. Others represented challenges such as the financial challenges and project abandoning.

We have also discussed motivations as to why people join the LOSCs. Some of which included the need of being part of something big, helping humanity by offering free software and socializing with people who share the same interests. We finally present our research limitations and our future plans if we were to deepen our study in future researches.

## REFERENCES

- [1] Bonaccorsi, A., & Rossi, C. (2003). Why open source software can succeed. *Research policy*, 32(7), 1243-1258.
- [2] Godfrey, Michael W., and Qiang Tu. "Evolution in open source software: A case study." *Software Maintenance*, 2000. Proceedings. International Conference on. IEEE, 2000.
- [3] Dahlander, L., & Magnusson, M. G. (2005). Relationships between open source software companies and communities: Observations from Nordic firms. *Research policy*, 34(4), 481-493.
- [4] Wang, F. R., He, D., & Chen, J. (2005, August). Motivations of individuals and firms participating in open source community. In *Machine Learning and Cybernetics*, 2005. Proceedings of 2005 International Conference on (Vol. 1, pp. 309-314). IEEE.
- [5] Wang, Y., & Guo, D. (2007). EMOS/1: An Evolution Metrics Model for Open Source Software. Unpublished Paper.
- [6] Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological bulletin*, 125(6), 627.

- [7] den Besten, M., Dalle, J. M., & Galia, F. (2008). The allocation of collaborative efforts in open-source software. *Information Economics and Policy*, 20(4), 316-322.
- [8] Ghapanchi, A. H., & Aurum, A. (2012). The impact of project capabilities on project performance: Case of open source software projects. *International Journal of Project Management*, 30(4), 407-417.
- [9] Baytiyeh, H., & Pfaffman, J. (2010). Open source software: A community of altruists. *Computers in Human Behavior*, 26(6), 1345-1354.
- [10] Feller, J. (2005). *Perspectives on free and open source software*. MIT Press.
- [11] Lerner, J., & Triole, J. (2000). The simple economics of open source (No. w7600). National Bureau of Economic Research.
- [12] DeKoenigsberg, G. (2008, April). How successful open source projects work, and how and why to introduce students to the open source world. In *Software Engineering Education and Training*, 2008. CSEET'08. IEEE 21st Conference on (pp. 274-276). IEEE.
- [13] Lakhani, K., & Wolf, R. G. (2003). Why hackers do what they do: Understanding motivation and effort in free/open source software projects.
- [14] Dick, S., & Sadia, A. (2006, July). Fuzzy clustering of open-source software quality data: A case study of Mozilla. In *Neural Networks, 2006. IJCNN'06. International Joint Conference on* (pp. 4089-4096). IEEE.
- [15] Moen, R. (2004). *Linux user group HOWTO*.
- [16] Ubuntu LoCo Teams List | Ubuntu LoCo Team Portal. (n.d.). Retrieved December 13, 2015, from <http://loco.ubuntu.com/teams/>
- [17] Raymond, E. (1999). The cathedral and the bazaar. *Knowledge, Technology & Policy*, 12(3), 23-49.
- [18] Mockus, A., Fielding, R. T., & Herbsleb, J. D. (2002). Two case studies of open source software development: Apache and Mozilla. *ACM Transactions on Software Engineering and Methodology (TOSEM)*, 11(3), 309-346.
- [19] Yin, R. K. (2013). *Case study research: Design and methods*. Sage publications.
- [20] Creswell, John W. *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications, 2013.
- [21] Runeson, P, Höst, M (2009) Guidelines for conducting and reporting case study research in software engineering, *Empirical Software Engineering*, vol 14, pp. 131-164.
- [22] Bacon, Jono. *The art of community: Building the new age of participation*. " O'Reilly Media, Inc.", 2012.
- [23] Beck, U. (1992). *Risk society: Towards a new modernity* (Vol. 17). Sage.
- [24] Mozilla Community Sites. (n.d.). Retrieved December 13, 2015, from <https://wiki.mozilla.org/MCS>
- [25] Ubuntu Wiki. (n.d.). Retrieved December 13, 2015, from <https://wiki.ubuntu.com/LoCoFAQ>
- [26] UK Linux User Groups. (n.d.). Retrieved December 13, 2015, from <https://lug.org.uk/uklugs>
- [27] Contacts, Spaces and Communities - Communities. (n.d.). Retrieved December 13, 2015, from <https://www.mozilla.org/en-US/contact/communities/>
- [28] MCS/Planning. (n.d.). Retrieved December 13, 2015, from <https://wiki.mozilla.org/MCS/Planning>