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**ADDIS ABABA UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**  
**SCHOOL OF INFORMATION SCIENCE**

**Opportunities and Challenges of Crowdsourcing in Addis Ababa  
Software Companies**

**By: Mahlet Getachew**

**Advisor: Tibebe Beshah (PhD)**

**A Thesis Submitted to the School of Information Science of Addis Ababa University  
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# **Opportunities and Challenges of Crowdsourcing in Addis Ababa Software Companies**

**By: Mahlet Getachew**

**Approved By Board of Examiner:**

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Advisor

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Signature

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Date

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Examiner

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Signature

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Date

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Examiner

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Signature

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Date

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Chairperson of department

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Signature

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Date

# Declaration

I, Mahlet Getachew declare that this thesis is my own work and this work has not been submitted before for a degree at any other institution.

**Declared by:**

Name: Mahlet Getachew

Signature:.....

Date:.....

**Confirmed by Advisor:**

Name: Tibebe Beshah (PhD)

Signature:.....

Date:.....

# **Declaration**

**TO: Tsgereda Adege**

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## ABSTRACT

**Main Objective:** The main objective of this study was to investigate the opportunities and challenges of crowdsourcing in software companies from software developer (crowd worker) and company (requester) perspective.

**Methodology:** quantitative study was conducted on 82 software developers and 11 software companies' managers and qualitative study was conducted on conveniently selected 5 software company owners. Data collection was done by using questionnaire and semi-structured interview.

**Result:** crowdsourcing has opportunities to share knowledge, to get reward, to help others and crowdsourcing is highly flexible for software developers. Moreover, crowdsourcing has also opportunities for software companies to improve software quality, to get creative solutions, to save time and cost, to get resource and highly skillful worker which is not available in the company at any time, easy to adopt, complex tasks can be solved and intellectual property or copy right is protected in crowdsourcing.

Crowdsourcing has its own challenges such as lack of awareness of crowdsourcing, limited information about tasks and employer in crowdsourcing platforms, lack of time to participate, questions are not clearly describe in most crowdsourcing platforms, low internet access, privacy and creative works are unprotected for software developers and also crowdsourcing has challenges for software companies such as task decomposition, communication problem, planning and scheduling of tasks is very critical to complete tasks on time, majority result may not be relevant, difficult to control the qualities of the work, attractive payment or reward are required to retain skillful crowd, lack of legal and regulatory framework.

**Conclusion:** crowdsourcing are very useful tool for software companies but there is low awareness of crowdsourcing in software companies. Because of that crowdsourcing is not widely used in Addis Ababa software companies. The findings also highlight the opportunities and challenges of crowdsourcing in software companies.

**KEY TERMS:** crowdsourcing, requesters, crowd worker, platforms, software companies

# CHAPTER ONE

## 1. INTRODUCTION

### 1.1 Background of the study

Crowdsourcing is the process of finding solutions online by organizations from large group of people for their problems or tasks [1]. Before the term crowdsourcing coined, some organizations crowdsourced different tasks and peoples have tried to provide solution for the crowdsourced tasks before the internet age. For example in 1884, the Oxford English Dictionary asked a large group of readers to catalog words [2]. In 1936, the Japanese company presented a logo design competition for large and unknown group of people to redesign its logo. The company received about twenty- seven thousand submissions and the final winning logo was selected [3].

In Web 2.0 era, some crowdsourcing platforms came into view such as online t-shirt design, website Threadless and other crowdsourcing platforms have emerged [4] and the term ‘crowdsourcing’ was introduced for the first time by Jeff Howe and Mark Robinson in this Web 2.0 era on June 2006 [5]. Jeff Howe has defined the term crowdsourcing is as follows;

*“Crowdsourcing is the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call ”[5].*

The number of crowdsourcing platforms has also increased though for the purpose of different tasks and number of works performing online in various platforms. For example Mechanical Turk, Topcoder, Mob4Hire, uTest, Freelancer, AppStori, Guru, 99design, Innocentive, CloudCrowd, and CloudFlower and other platforms emerged.

Topcoder is one of the largest crowdsourcing platforms for software development tasks [6]. Nowadays, companies and individuals need more integrated and easy-to-use software, because of that software are significantly [7, 8]. With the intention that Topcoder and other related

crowdsourcing platforms are developed to satisfy these and other associated needs of organizations or individuals need [7].

Crowdsourcing is one of the solutions to decrease the complexity nature of works in software companies [7] and most of software tasks are complex [9]. Software systems have been applied in different domain areas such as cell phones, medical systems, biology etc. Furthermore, the growths of software ecosystems and software development activities have become familiar in almost all fields [7].

According to Stol et al. [6], the crowdsourcing definition in the context of software development is as following:

*“The accomplishment of specified software development tasks on behalf of an organization by a large and typically undefined group of external people with the requisite specialist knowledge through an open call.” [6].*

According to Mao et al. [10], in crowdsourcing, there are three main components in software development activities. These are requester, workers and platforms or brokers. These three components have different roles in crowdsourcing activities. The components are presented as follows:

**Requester or Crowdsourcer** - Is an organization or a company that requests for work (for software development tasks).

**Crowd Workers** - individuals or group of people who perform software development tasks in crowdsourcing platforms.

**Platforms or brokers** - is a system that creates link between requesters and crowd worker by providing an online market place.

According to Metha [11], any software development process involves different phases that include designing, coding, testing, documentation and deployment and there are three main types of tasks that are performed in crowdsourcing software development such as Routine tasks, Creative/Innovative tasks and complex tasks.

There are some platforms that Ethiopians participate to do works online as both crowd workers and requesters. For example “Translator town” is one of the platforms. In this platform, there are some experienced workers. If an individual post job or document to translate, the workers translate in different languages online [13] And there are some other platforms which Ethiopians participated. for example Topcoder [12] .

## 1.2 Statement of the problem

As software development cycles become very quick, while software complexity raises, many companies are looking for new knowledge outside their boundaries [7].Currently, numbers of organizations in different countries take crowdsourcing as a new model of businesses to accomplish tasks successfully [14]. In order to do that crowdsourcing has been adopted in wide different organization or industries including in software companies [6]. As to the level of the researcher’s knowledge there is no empirical research which has been done on crowdsourcing regarding how software developers and organizations practice crowdsourcing in Addis Ababa and in Ethiopia in general.

According to Cheung [15] study, Crowdsourcing is country dependent. The US workers take a job on Amazon mechanical trunk (one of the crowdsourcing platform) to just spend their extra time and to apply their skill. However, the Indians workers take jobs in crowdsourcing as primary sources of income. As the authors explained that crowdsourcing have different opportunities for Indians and US workers. Crowdsourcing has an opportunity for Indians worker as primary source of income, but not for US workers.

Globally, there are many crowdsourcing research have been done in different areas and also software developments tasks are more common in number of companies [7, 16] but the number of crowdsourcing research is very small in software development context [7].This problem also exists in Ethiopia. The number of software companies becomes increases [14]. But again to the researcher’s knowledge there is no formal research which has been done on crowdsourcing in software development area.

From the existing crowdsourcing research worldwide, number of crowdsourcing research focuses on crowdsourcing systems and applications in software companies. According to Leicht

et al.[7], most (60%) of crowdsourcing researches focus on system perspective. The remaining researches focus on the application of crowdsourcing in software development. Only one research exist which deals about crowdsourcing in software companies from crowd worker perspective till June 2015 and the research also focus only the motivation of crowd workers in crowdsourcing platforms [7], So that it can be said that there is small attention crowd workers or software developers perspective in software companies.

This study referred the Moe et al. [10] model. This model contains three main components of crowdsourcing which are requesters, platforms and workers and the model show the process of crowdsourcing. Based on this model and by considering the above issues, this research attempted to investigate the opportunities and challenges of crowdsourcing from software developer (crowd worker) and company (requester) perspective.

### **1.3 Research questions**

Generally, the study gives answer for the following two main research questions:

1. What are the opportunities and challenges of crowdsourcing for software developers as crowd workers in Addis Ababa software companies?
2. What are the opportunities and challenges of crowdsourcing for software companies as requesters in Addis Ababa software companies?

### **1.4 Objective of the Study**

#### **1.4.1 General objective**

The general objective of the study was to investigate the opportunities and challenges of crowdsourcing in Addis Ababa software companies from software developers and company perspective.

#### **1.4.2 Specific objectives**

The specific objectives of the research are to:

- Assess the awareness of crowdsourcing in software companies.
- Assess the current practices of crowdsourcing in software companies.
- Identify the opportunities of crowdsourcing for software developers as crowd workers.

- Identify the importance of crowdsourcing for software companies as requesters.
- Identify possible challenges of software developers (crowd workers) face while they are engaged in crowdsourcing to participate.
- Identify any possible challenges of software companies (requesters) while they are post tasks in crowdsourcing platform.

### **1.5 Significance of the Study**

The concept of crowdsourcing was applied in different countries and software companies. Europe and U.S. are well known in crowdsourcing [16]. However, overall crowdsourcing is a relatively new concept and practice [11]. Due to the different reasons software companies decide which tasks should be crowdsourced or not crowdsourced. Based on the companies' decisions, companies may get advantage or face challenges. So, this research identifies the benefits and challenges of crowdsourcing for the software companies or requesters early, as well as identifies the opportunities and possible challenges of crowdsourcing for software developers or crowd workers. Based on these it is expected that software companies and software developers can benefit from this research finding and recommendation to improve their products and software services. In addition, it provides insights for software companies' managers about crowdsourcing for different issues and also the study creates an opportunity for the business people to gain better awareness about crowdsourcing. Moreover, the study serves as a reference for other researchers who need to work further research in crowdsourcing and related issues.

### **1.6 Scope and Limitation of the Study**

This research deals with the opportunities and challenges of crowdsourcing with crowdsourcer (requester) and crowd worker perspective in the selected software companies in Addis Ababa. It did not consider the platforms side or platform operators and it did not include other software companies which were found in other cities of Ethiopia.

## 1.7 Organization of the Thesis

The thesis is organized in to five chapters. The first chapter included background of the study, statement of the problem, general and specific objectives of the study, research questions, and significance of the study, scope and limitation of the study. In the second chapter; theoretical and empirical literatures reviews were included. The third chapter; the research type, population of the study, sampling method, sample size, data collection instrument and method of data analysis were included. The fourth chapter; data presentation and discussion of the finding were presented. The fifth chapter; the conclusions and recommendations of the study were presented. Finally, the questionnaires and Interview questions were included in the appendices.

# CHAPTER TWO

## 2 LITERATURE REVIEW

### 2.1 Overview

The main purpose of this literature review is to familiarize the reader with the basic concept of crowdsourcing. In this chapter, the literature will be approached in order: first, about software and software industries will be discussed. Second, the definition and components of crowdsourcing will be presented. Third, crowdsourcing will be compared with related concept. Fourth, the practice of crowdsourcing in worldwide will be presented. Fifth, the practice of crowdsourcing in software companies will be presented and finally, in this chapter related works will be presented.

### 2.2 Software and Software Industries

Software is a unit of computer programs as well software is digital goods and its products which can be marketable [17]. Software has indefinable nature. However, software has become an essential component for almost all value chain in all fields and especially for business activities but the software service in developing countries is still in its infancy stage [18].

According to Vlahovic et al.[18], software industry with information communication technology is an important sector for international economies in the information age. Generally, it is an important sector for almost all type of economic development and for scientific research. North America software market is the largest software market in the world and there are highly skilled professionals in the industries such as programmers, software architects and software designers and almost all business in North America depends on software [19].

According to Hietala et al. [20], there are some challenges in software industries. One of the challenges is some main software products in software industries are difficult to use and manage. It is only easy for computer programmers, software architects, and software designers and for other related professionals. The other major challenge is wrong understanding of the problem

during the process of software development, change of rules during development and Software testing are some of the challenges in software industries.

According to Dawit [21], Previously many organization in Ethiopia focus on computer hardware. Ethiopia companies didn't give attention for software products. Organizations had assigned more budget for buying hardware rather than software. The majority of computer in organization use for typing rather than giving other services, however nowadays most IT companies are give attention for software products also, but there is no good quality software services in Ethiopia [22] .

Ethiopia trade and industries ministry database show that the number of software business organizations in Addis Ababa from in 2011 up to 2015. In 2011, there were 8 software business organizations in Addis Ababa. Among these eight software companies 2 of them were sole proprietor and 6 of them were private limited companies (PLC). But now (2015), there are 282 software business organizations in Addis Ababa. From these 282 software companies 183 of them were private limited companies (PLC), 99 are sole proprietors. We can understand from Ethiopia trade and industries ministry database that the growth of software business organizations was rapid.

### **2.3 Definition of Crowdsourcing and Components of Crowdsourcing**

The term crowdsourcing is a relatively new word [11].The word crowdsourcing was included as a word in Oxford English Dictionary for the first time in June 2013 edition [23]. The term crowdsourcing is the combinations of two words, these are crowd and outsourcing. Crowd , refer to large group of people [24]. Outsourcing , refers to “the act of obtaining services from an external source” [25]. Following this approach, authors such as Jeff Howe affirm that crowdsourcing “is a business practice that means literally to outsource an activity to the crowd” [5] . But, to adopt the etymological Significance as a definition is too biased [1]. So that, there are many books about crowdsourcing that were written by many authors [5] and there are several definitions of crowdsourcing [14, 26].

According to Estellés-Arolas et al. [26], the authors collected 40 definitions of crowdsourcing from 209 different type of documents such as from conference papers , journal papers, workshops, books ,technical reports and working paper to get common definition of crowdsourcing and finally they define crowdsourcing as follow;

"a type of participative online activity in which an individual, an institution, a non-profit organization, or a company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge and/or experience, always entails mutual benefit. The user will receive the satisfaction of a given type of need, be it economic, social recognition, self-esteem, or the development of individual skills, while the crowdsourcer will obtain and utilize to their advantage that what the user has brought to the venture, whose form will depend on the type of activity undertaken. " [26].

However, this definition was not accepted by others authors [27, 28]. Crowdsourcing define in different context such as in market context , in medicine, in engineering context and so on. Stol et al. [6] define crowdsourcing in the context of software development. So that in this paper the researcher use Stol & Fitzgerald's definition and this definition of crowdsourcing is as follow:

*"The accomplishment of specified software development tasks on behalf of an organization by a large and typically undefined group of external people with the requisite specialist knowledge through an open call."* [6]

According to Mao et al. [10], Crowdsourcing has three main components:

1. Requester (crowdsourcer)
2. platform
3. crowd worker

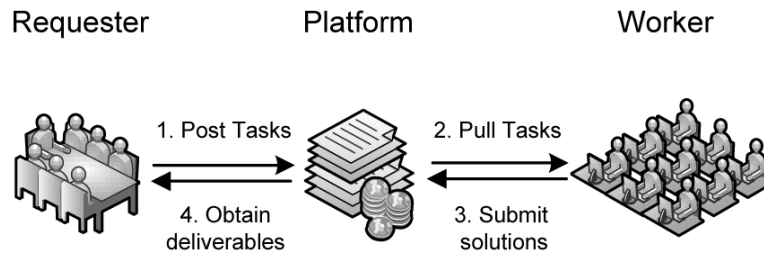


Figure 2.1 - Participants of crowdsourcing (source: Mao et al. [10])

## 1. The requester (crowdsourcer)

In crowdsourcing, companies or institutions that request for the task are called requester or Crowdsourcer [10].

The requesters outsource the tasks on crowdsourcing platform to the crowd workers and after the crowd worker completed the tasks the requesters might be pay or forward rewards for the crowd workers [29]. When requesters communicate with the crowd workers about the task or payment, the organization or the individuals have responsibility to keep private information of the crowd workers [30].

The requestor can be profitable organization or nonprofit organization [31]. For example international Business Machines (IBM) , some automobile, motorcycle, and engine manufacturing company like bayerische motoren werke (BMW), intelligent home appliances and other companies applies the concept of crowdsourcing to enhance their productivity [32]. as well as nonprofit organizations or individuals use crowdsourcing service for a number of reasons including to motivate new volunteers and to find sponsors that contribute or support for a given issue and promote about the organization's work to large group of peoples and also for other benefits [33] and number of organizations or individuals will apply crowdsourcing more in future [33, 34].

## 2. Platform

Platform defined as "a market place that are run and managed by platform operators" [29].According to Arshad et al. [29], platforms are connect the crowdsourcer and crowd to communicate each other or to exchange services as broker. Platform operators have receive tasks

from crowdsourcer and post the tasks with the descriptions such as about the tasks, about the payments of the tasks and the deadline for complete tasks also describe on platforms for unknown group of worker and the crowd worker after completed the tasks they submitted their tasks through the platform then the platform operators checked the validity of the work that done by crowd workers.

According to Brabham [35], the general functions of platforms operator in crowdsourcing system are transmitting or sending out tasks to perform, selecting the tasks, receiving the results of the tasks from crowd workers, checking and verifying the completed task that come from crowd worker and also that controlling other technical tasks.

Regarding to Morris et al. [36], platforms can be online or offline type of platforms. Amazon Mechanical Turk and Crowdfunder are good example of platform which are online and taskrabbit.com; communities sourcing are example of a platform which are offline.

According to Morris et al [36], Amazon Mechanical Turk begin as service in 2005 and human intelligence tasks are common in Amazon Mechanical Turk online crowdsourcing platform. Amazon mechanical Turk define as "an online labor market where requesters post jobs and workers choose which jobs to do for pay" [36].

In mechanical Turk, transcribing audio, identifying items in a photograph, or making sure a website doesn't have broken links to name are the most common tasks [37]. as well, Mechanical truck has benefits to get people easily, it is permanent, it works for different subject and it is important for doing research tasks [37].

On the other hand TakRabbit is an offline platform. it was founded by Leah Busque in February 2008 and it start for the first time in Boston and allows users to outsource small jobs and tasks to local contractors [38].

### **3 Crowd workers**

In context of crowdsourcing, crowd workers are any person who performs task on crowdsourcing platform to give a solution for crowdsourcer (requesters) [10]. When crowd workers have completed the given tasks, the crowdworker forward the completed tasks through platform and

they got paid for performed tasks through the platform after the platform operators check the validity and completeness of the work [29].

According to Gupta et al. [39], There are different types of tasks in crowdsourcing that are performed by crowd worker. Micro task is one of the common type crowdsourcing tasks. Micro task means as the word show that its small tasks and micro task might formulated by dividing large tasks or changes difficult tasks into easy small tasks and also Creative work, design, coding, surveys, open innovation and fundraising are some of the tasks in crowdsourcing that are performed by crowd workers .

Most crowd worker perform the crowdsourcing tasks at their home [16] and the crowd worker can participate part-time or fulltime. But knowledge and skills are important to participate, as well to solve the problem for crowdsourcer [35] and according to Engd et al. [40], the majority of crowd worker in crowdsourcing are well educated and 75 present of crowd workers have Bachelor, Master or Doctorate degree.

Regarding to Ford et al. [41], there are three kinds of good crowd workers in crowdsourcing platforms commonly. The first kinds of crowd workers are who have readiness to help organizations. The second kinds of crowd workers are who have a willingness to solve problems of the organizations. The third kinds of crowd workers are who have an ability to solve the problem of organizations.

In addition, crowd workers have participate in the platform for different reasons. According to Roth et al.[34] , there are reasons why crowd worker participate. The reasons that are mentioned in the study are to earn money, to develop creative skills, to network with other creative professionals, to build a portfolio for future employment, to socialize and make friends, to kill time, to contribute in a large project of common interest and to have fun are mention as the reason in the study.

## 2.4 Crowdsourcing and related concept

As mentioned on the above section, crowdsourcing has no common definition and there is disagreement on the definition of crowdsourcing among writers [26], Because of this the concept of crowdsourcing make some confusion with related concepts such as Open Innovation, User Innovation, Open Source and also Outsourcing [42].

Number of authors have tried to avoid the ambiguity between crowdsourcing and other related concepts of crowdsourcing. [4, 26, 42] open innovation, user innovation, open source and outsourcing are the most frequently confused words with the term crowdsourcing [42] in order to that the differences between these concepts (open Innovation, and user Innovation, open source and outsourcing ) and crowdsourcing discuss as follow:

### 2.4.1 Crowdsourcing and Outsourcing

The term outsourcing derived from the American terminology “outside resourcing”, the term itself tells us that getting resources from the external part or outside [43].

Outsourcing define as “the contractual service of transferring one or more businesses process to a third party provider, where the latter takes over the management, ongoing support and infrastructure of the entire application or process” [44] .

According to Yuan [4] crowdsourcing and outsourcing are different. Outsourcing is just a process of giving out tasks to some specific organization. But, crowdsourcing is not outsourcing tasks to some specific organizations. Crowdsourcing is an outsourcing (giving) task to undefined large group of people. The other difference is that organizations choose the highest quality solution or work for their task in crowdsourcing. But in outsourcing, organizations choose the best worker for their tasks not works. In both crowdsourcing and outsourcing, workers have payment for what they perform. But in crowdsourcing, the payment is based on the result of tasks and in outsourcing, the payment is based on the time that the worker taken a time for tasks [42].

### **2.4.2 Crowdsourcing and Open Innovation**

There was confusion between the concept of crowdsourcing and open innovation. But the concept of crowdsourcing and open innovation are different. Open innovation was introduced by Chesbrough in 2003. Open innovation defines as the follow:

“A paradigm that assumes that firms can and should external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Open Innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model” [45].

According to Schenk [42], Crowdsourcing and open innovation have some similarities. One of the similarities is both in crowdsourcing and open innovation requesters used outside peoples to accomplish tasks in other expiration requesters to get new products or services they use an external peoples. However the deference is in crowdsourcing the task is done by unknown people, experts or organizations in the form of open call, but in open innovation use preselect group of professional and most of the time number of participant in open innovation are smaller than the number of participants in crowdsourcing ,because the task release in crowdsourcing for large number of participant . The other difference between open innovation and crowdsourcing, open innovation are focusing on innovations tasks but crowdsourcing is not only for innovation task it also give solution for any existing problem that are posted on the crowdsourcing platform by organizations or individuals.

### **2.4.3 Crowdsourcing and user innovation**

According to Bakic et al. [46], user innovation refer to the work that are new and that can be done by only users not by producers but crowdsourcing is not only innovation tasks and also tasks in crowdsourcing can be done by any person.

### **2.4.4 Crowdsourcing and open source**

The term “open source” for the first time was introduced by a group of people in the free software movement [47].

Howe defines crowdsourcing as the “application of open Source principles to fields outside of software” [5]. From this definition number of authors raises different idea about the concept of crowdsourcing and outsourcing [6]. some authors believed that open source is the form of crowdsourcing others argue that open source are different from crowdsourcing. However, [48] identify the difference between crowdsourcing and open source. open source is self-organized and commonly used for product improvement but crowdsourcing is not only product improvement it also create new ideas . The other difference between crowdsourcing and open source is that in crowdsourcing might be payments or rewards for the participants who get the solution for the given problem. But in open source, there is no payment or reward for participants.

## **2.5 current practices of crowdsourcing**

Currently, crowdsourcing relatively recent field and organizations in many countries are not well understood the concept of crowdsourcing properly [49].

### **2.5.1 Crowdsourcing in worldwide**

Crowdsourcing is very important [6, 31]. Many countries applied crowdsourcing for their organization. The number of European and us participant in crowdsourcing platform was very large and they use from crowdsourcing very well [16].

According to Arshad et al. [29], in Malaysia, many companies crowdsource their tasks that are difficult for the companies on platforms. Most of these companies are private companies. Some of the companies are Giant, Watson and Mcdonalds and most of the time companies in Malaysia posts IT and IT related tasks on crowdsourcing platforms. However, Malaysia in crowdsourcing still in its infancy stage and there are some crowdsourcing challenges in Malaysia companies such as lack of credibility, lack of skilled/ experienced talents, lack of auto matching mechanism, weak payment mechanism, cyber psychological issue, competition from international platforms [29].

In south Africa, many companies diverting to online communities and number of companies practice crowdsourcing in South Africa for difficult tasks ,but one of the major challenges of crowdsourcing in south Africa is the payement for crowd worker is not attractive to participate in crowdsourcng platforms [49].

Regarding to Cheung [15] study, the motivation of participants of crowdsourcing is different from countries to countries especially between higher income and lower income participants. The motivation of participation of US participants and Indian participants on popular Amazon mechanical Turk platform and the largest number of participants on Amazon mechanical Turk platform are US participants and the second largest participants from India. The US workers take a job on Amazon mechanical trunk to just spend their extra time in productivity ways and to apply their skill. However, the Indians workers take jobs in crowdsourcing for primary sources of income. As the authors explained that the reason was the income of the two countries participants are different. The US workers have better income than Indians workers.

### **2.5.2 Crowdsourcing in Ethiopia**

Outsource a task is one of the activities in crowdsourcing and in Ethiopia, some organization outsource their work [50, 51]. Some of these companies are non-governmental organizations, private limited company (PLC), insurance and banks [50]. These companies outsource their non functional works such as security service, janitorial service, information technology service and also other service [51]. For examples Ethiopia commercial bank was one of the companies that outsource its tasks. This bank outsource some tasks to commercial nominees private limited company [50].

In Ethiopia, there are some crowdsourcing researches in agriculture and there are crowdsourcing platforms that Ethiopians participated. For example experts Ad.com, Translator town and so on, but there is no empirical study which deals about how crowdsourcing practices as the researcher's knowledge.

## **2.6 Crowdsourcing in Software Industries**

There are different fields that applied crowdsourcing [7] and some of them are art, business, political, scientific research, governance, health service and software development etc.

According to Leicht et al. [7], crowdsourcing are very acceptable and practicable in software industries as well crowdsourcing is recent concept in software industries like some other

industries. Before 2012, only one crowdsourcing research was available in software development context. Almost more than 85% of relevant researches were available after 2013 and over all there are few crowdsourcing researchers in the area of software development globally [52]. But there are many crowdsourcing platforms that are purposefully developed for software development and related tasks [6]. For example, topcoder, appstori, U Test, MathWorks, Mob4Hire and TestFlight are some of platform that developed for the purpose of Crowdsourcing Software development . TopCoder is the largest crowdsourcing platform for software development task and Top coder Founded by Jack Hughes in April, 2001. Topcoder has 939,000 members till February 2016 [53]. Most of the top coder communities are professionals in software designing, software developing and data science. In addition, TopCoder is the most successful crowdsourcing platform and it use crowdsourcing methods to drive software coding and development, creating contests where programmers compete for a financial award by designing algorithms that meet the company's specifications [6].

Globally, the importance and practice of crowdsourcing increasing in software industries [7]. In Ethiopian, organizations are volunteer to outsourcer information technology service included software development, hardware maintenance and other services [50]. This is good initial practices to adopt crowdsourcing because in crowdsourcing outsourcing the task is one of basic active.

## **2.7 Opportunity of crowdsourcing**

The opportunities of crowdsourcing mention by number of authors [6]. According to Leicht et al. [7], software complexity increases very much because many companies need new knowledge outside of their companies and crowdsourcing is important to give a solution by managing large team in software development.

According to Cheung [15], crowdsourcing has an advantage to get large number of worker then the number of worker in companies. The other advantage of crowdsourcing is crowds workers participates from different area in order to that the requester or organization get a workers who have different knowledge and experience and also organizations get a solution for what ask from crowd by lesser cost .

Regarding to Abhinav et al. [30], crowdsourcing has an opportunities for software companies. the cost is fair in crowdsourcing for software development tasks, the work is done in short period of time, skillful crowd workers are available, there are better quality services are available, different background of crowds bring creativity and innovation.

According to Ponti et al. [54] , sharing experience, express creativity, learning new knowledge and skill are some of the opportunities of crowdsourcing for crowd works. Mehta [11], identify the benefit of crowdsourcing for software companies and they explain the reason why organization use crowdsourcing in the software development area. The benefit of crowdsourcing in the context of software development that are mention in the paper was cost reduction, a faster time to market, higher quality and Creativity and open innovation .

## **2.8 challenges of crowdsourcing**

Most of existing researches are more focused on the opportunities of crowdsourcing software development then the challenges of crowdsourcing in software development context [6].

Regarding to Zogaj et al.[52], there are three management challenges of crowdsourcing these are managing the crowd, managing the process and managing techniques.

According to Abhinav et al. [30], explain the challenges of crowdsourcing in software development context. these are task modularizations, presenting clearly complex and interdependent tasks to large group of people is difficult and Information Alignment is another challenges when the tasks broadcast to large group of people, scheduling issues, controlling the qualities of the work, motivate and reward the participant, selecting the right participant is an additional difficulty in crowdsourcing and building effective teams and fostering collaboration the crowd workers are challenges that faced on the process of managing crowdsourcing.

## **2.9 Related work**

The work presented in this thesis belongs to the area of crowdsourcing. In this section, we discuss some closely related works. Mao et al. [10] derived classification of crowdsourcing which discusses about the three main components of crowdsourcing- the crowdsourcer, the crowd and the crowdsourcing platform to be used to represent the different configurations of crowdsourcing. Vukovic, et al. [55] Presented sample crowdsourcing scenarios in the context of

software development for deriving general purpose crowdsourcing services and proposed a categorization which represents different type of crowdsourcing platforms and evaluates a number of accessible crowdsourcing systems. Stol et al. [56] presented an industry case study of Crowdsourcing in the context of Software development. They also discussed six key issues in Crowdsourcing Software Development through interviews with the customer company who shared the experience of crowdsourcing software development using TopCoder platform. They also proposed a research protocol by concerning the background, design and execution of this study. Further they mentioned the lessons learnt from the study and expressed their recommendation for crowdsourcing software development. Prikladnicki et al.[16] discussed appearance of the three components of Crowdsourcing (Crowdsourcer, platform and the Crowdworker). Mehta [11] evaluate how software crowdsourcing can be useful for crowdsourcers who are technology service provider. Zogaj et al [52] discussed the three main challenges of managing the crowdworker, managing the process and managing techniques faced by the Crowdsourcing platforms or broker and presented a case study of how a German practice crowdsourcing , testCloud, which is a crowdworker testing platform, solved some of these issues.

This study has similarities and difference with previous crowdsourcing studies. This study investigates on crowdsourcing like other crowdsourcing research. some research deals with the opportunities of crowdsourcing and other researches deals with the challenges of crowdsourcing with requester and platform operator perspective in different fields like marketing, law and other fields. Stol et al. [56] presented six challenges of crowdsourcing in software development in topcoder platform as a framework. But this research studies the opportunities and challenges of crowdsourcing in software companies with requester perspective in software companies and as previously stated , according to Leicht et al.[7] there is only one research which deals with crowd worker in software development context and the paper deals with about the motivation of crowd worker. But this study deals with about the opportunities and challenges of crowdsourcing for crowd worker in software companies. In addition, this study has difference in methodologies and in context with early studies.

## **CHAPTER THREE**

### **3. METHODOLOGY**

#### **3.1 Introduction**

The methodology chapter is very essential section in the scientific paper and it helps the reader to criticize the reliability of the work [57]. In this chapter, the methods used to address the research questions were presented in detail and the chapter describes the type of the research, study setting, population and sample selection, data collection instruments, validity and reliability of the data collection instruments and data analysis of the research.

#### **3.2 Type of Research**

The aim of the research is to describe the current practice of crowdsourcing and to identify the opportunity and the possible challenges of crowdsourcing. According to Melell et al. [58], descriptive type of research used to describe the existing situation and through that it may help to deliver new facts or meaning, so that this research can be categorized as a descriptive type of research.

#### **3.3 Study Setting**

The study was carried out in the selected private limited software companies in Addis Ababa. Addis Ababa is the capital as well as largest city of Ethiopia. Addis Ababa lies at an altitude of 2,300 meters and located at 9°1'48"N 38°44'24"E / 9.03000°N 38.74000°E / 9.03000; 38.74000 Coordinates: 9°1'48"N 38°44'24"E / 9.03000°N 38.74000°E / 9.03000; 38.74000. In Addis Ababa, there are software business organizations and these software organizations located in different areas of Addis Ababa.

#### **3.4 Population of the Study**

The study populations were company owners, managers and software developers who are working in the selected software companies of Addis Ababa. The selected software companies

for this study are ERP software technology private limited companies , Techno Brain IT solution private limited companies, C net software technology private limited companies, Ataker software development private limited companies, Professional Electronic Data System private limited companies, Perfect ICT solution private limited companies ,Crystal software development private limited companies, Rahamy private limited companies, YYT software development private limited companies, continental management systems and Software solution private limited companies and Tactipoint enterp. resource software system private limited companies. These software companies mainly have been worked on software development tasks.

The total number of population of the study was 98. From the total (98) population of the study 5 of them were company owners, 11 managers of software companies and the remaining 82 were software developers.

### **3.5 Sample**

According to Creswell [59], sample is some portion of a population selected to participate in a study. There are different type of sampling methods and techniques.

#### **3.5.1 Sample Method and sample Size**

Sampling is a procedure of selecting some part of the population to represent the entire population [59]. In this study, non-probability sampling techniques were used. Among the non-probability sampling, purposive sampling technique was applied to select the eleven software companies. Purposive sampling which is preferable to take out vital information from concerned body employed systematically for the achievement of the researches objective. In this sampling, the researcher intentionally selected companies to understand more about the core phenomena of the issue under investigation mainly through getting information from resourceful companies or informants. From the selected software companies, there are 11 managers and 82 software developers and the researcher were included the whole managers and software developers (i.e. 11 managers, 82 software developers were selected).

In addition, Convenience sample, a method that is convenient or available members of the population are selected. The researcher was selected 5 software companies' owners.

### 3.5.2 Sampling Criteria

In this research, the following criteria were applied:

Inclusion/ exclusion criteria:

- Companies that are private limited companies (PLC).
- Companies that have more than 4 years experience on software development tasks.

There are some reasons that companies were selected for this research by the above criteria. According to trade and industry Ethiopia data base, Software business organizations in Addis Ababa are found in to two groups. Those are private limited companies (PLC) and Sole proprietors. Sole proprietor is a single person who holds all the assets of a business and has the right to make all decisions affecting it. He or she also bears unlimited liability for the debts and obligations of the business. But private limited companies are a business owned as a "private limited company" is one owned and operated by the company itself. Sole proprietor can be formed informally and need not disclosed business information to the public. But private limited companies is subjected to the governing rule in the companies and thus required to supply certain in information to the public. As the researcher mentioned on the above, private limited companies (PLC) were selected for this study because the focus of this research only on the software companies and regarding experience, the maximum experience of Addis Ababa software companies was 5 years which is recorded in trade and industry data base. So that, the reason that the researcher was selected software companies that have more than 4 years experience was to get highly experienced companies in software development and related tasks. So, from total (282) software business organization, 183 private limited companies (PLC) were selected by excluding the sole proprietors. Among theses 183 private limited companies (PLC) , 109 software companies who have 4 year experience and above 4 year experience selected and finally from 109 software companies, 11 companies were selected by purposive sampling method.

### 3.6 Data collection Instrument

In this study, both primary and secondary data source were used. According to Bryman et al. [60], primary data is a data that is collected by the authors to achieve some particular objective but secondary data is a data that is collected by other authors or might be collected for another reason. The primary data were collected by close ended questionnaires and semi structured interview. The questionnaires were used in the research to collect data from managers and software developers in each selected 11 software companies.

In order to collect data from software managers and software developers, two questionnaires were prepared and both questionnaires was developed based on the literature review and by adopting from previous questionnaires. The questionnaire that was used to collect data from software developers has 4 parts. The first part asked the respondents background. The second part of questions designed to assess the awareness and current practices of crowdsourcing in software companies from software developer or crowd workers perspective. The third part of the questions designed to assess the opportunities and challenges of crowdsourcing for software developers after practicing crowdsourcing. The fourth part questions designed to assess the opportunities and challenges of crowdsourcing for software developers who are new to crowdsourcing and the source of the questions are from [61-63]. The questionnaire that was used to collect data from software managers also has 4 parts. The first part asked about the respondents profile and the second section questions designed to assess the awareness and current practices of crowdsourcing in software companies from requester perspective. The third part questions designed to assess the opportunities and challenges of crowdsourcing for software companies after adopting crowdsourcing and the fourth questions designed to assess the opportunities and challenges of crowdsourcing for software companies which has not been adopting crowdsourcing and the source of the questions are from [11, 56, 62, 63]. In both questionnaires (questionnaires used to collect data from software managers and software developers), the questions that are designed to assess the opportunities and challenges of crowdsourcing were presented in five -point likertscale from strongly disagree up to strongly agree and the other questions were presented in open ended and closed questions with single choice .

According to Creswell [59], the semi-structured interviews is one of a well-popular technique for qualitative research. The researcher conducted semi – structured interviews with software companies’ owners for 25-35 minutes. This interview question adopted from Schnitzer [64] and some questions are modified. Overall, the questions of the interview designed to assess awareness, current practice, the benefit and also the risk of crowdsourcing, Furthermore to assess their plans about crowdsourcing.

The secondary data were obtained from Ethiopia ministry of Trade and Industry data base. From this data the researcher got information about the software companies which is found in Addis Ababa .The information was the list of the companies with experience Furthermore, the secondary data were collected from books, electronic resources, and journal articles on crowdsourcing to share the basic concept of crowdsourcing.

### **3.6.1 Validity and Reliability of data collection instruments**

Validity refer to the certainty of a data collection instrument to measure what the researchers wants to raise in the study [60] In this research, a questionnaire was designed to investigate the opportunities and challenge of crowdsourcing in addis ababa software companies . After pilot tests, the feedback from the pilot test is incorporated to the actual data collection instrument. Regarding to Gray [65] , “in the case of structured and semi-structured, the issue of validity can be directly addressed by attempting to ensure that content of the question directly concentrates on the research objectives.” To get this type of validity in this research, the researcher has attempted to determine whether the content of the question has sufficiently addressed the research topic or not.

According to Bryman et al.[60] a cronbach’s alpha coefficient is indicate the reliability of the research and if cronbach’s alpha coefficient higher than 0.6, it is acceptable but if cronbach’s alpha coefficient higher than 0.7 , it is preferable and regarding to Connelly [66], for pilot testing it is logical to take 10-30% from the total population of the study, so that in this research to ensure the reliability ,the researcher take 20% of the study (14 software developers and 2 software companies managers) for pilot study which was not part of the study and the

reliability of the questionnaire items that used for software developers was 0.79 Cronbach's alpha and the questionnaire item that used to collect data from software companies managers was 0.84 Cronbach's alpha. This result shows that the data collection instrument was highly reliable. Additionally in this study the pilot test helps the researcher to check the clarity of items in the instruments. Finally some questions were modified.

### **3.7 Data Analysis**

For the data analysis the statistical program SPSS 20 and Microsoft Excel were used, as well as the research were used qualitative and quantitative techniques. For quantitative data in the research used table, graphs, frequencies and percentages to show the most common attitude of the managers and the software developers. In addition, in the research the qualitative data for the research was collected through interviews with software companies' owners. The interview questions were prepared in English but the researcher translated the interview in local language (Amharic) to four companies' owners. The remaining one interview was conducted in English because of the owner of the company was foreigner. To analyze the interview the researcher categorize the same idea of interview in to one category and from the five interviews, four of them were translated back in English. The remaining one interview was already conducted in English so that there was no need of translation.

## **CHAPTER FOUR**

### **4. DATA PRESENTATION AND DISCUSSTION**

#### **4.1 Overview**

In this chapter, the results of the study are presented and discussed. The data was obtained from questionnaires and semi-structured interview to achieve the goal of the study.

For this study specifically 93 questionnaires were prepared to collect essential information from software developers and Software Companies managers and 82 questionnaires distributed to software developers and the other 11 questionnaires distributed to software companies' managers. From the total (93) questionnaires ,86 questionnaires were filled and returned back and the remaining 7 questionnaires were not returned back. From the returned questionnaires (86questionnaire), 5 questionnaires were not filled properly. From unreturned questionnaires (7questionnaires), 6 questionnaires were distributed to software developers and the remaining 1 questionnaire was given to software company manager. At last for this study 81 questionnaires were used for data analysis, in addition to that the researcher conducted interview with 5 software companies' owners for the data analysis.

This chapter is organized in to four sections. The first section deals with the respondents' background information. The second section deals with the current practice of crowdsourcing in software companies. The third section identifies the opportunities and challenges of crowdsourcing for software developers. The fourth section indentifies the opportunities and challenges of crowdsourcing for software companies.

#### **4.2 Background Information of the Respondents**

This section presents data on the gender, age, education level, work experience, income of the respondents. As table 4.2 shown below, the majority (70%) of respondents were male and the remaining (30%) of respondents were female and most (66.7%) of respondents' age between 25-35. The other (9.9%) and (23.4%) respondents age between below 25 and 36-45 years respectively and no respondent who was above 45 years old. Regarding educational level most

(75.3%) of respondents were first degree holder and (24.7% ) of respondents were masters degree holder. There was no respondent who has less than first degree. With respect to work experience most (54%) of software developers respondents had below 5 years work experience and only (3%) of respondents had 10-15 years of work experience. To the opposite of this no software company manager respondent had below 5 years work experience. Most (70%) of managers respondents had 10-15 years work experience. Additionally, for the software developers respondents only presented a question to answer their monthly income then software developer respondents replied the amount of monthly income between 1735-20000 and most (46.5%) of software developers respondents income were 5000-10000 per month.

Generally, Most of respondents of the study were male and all software developers and managers respondents had received Bachelor, Master. Majority of software developer respondents' income were 5000-10000 per month. Regarding the work experience most of software developer respondents had low work experience. To the reverse most of managers respondents had high work experience.

Table 4.2: Background information of the respondents (i.e. F= Frequency, %= percentage)

Variable	categories	Software developers respondents		Managers respondents		Total respondents	
		F	%	F	%	F	%
gender	Female	23	32%	1	10.0%	24	30%
	male	48	68%	9	90.0%	57	70%
	total	71	100%	10	100.0%	81	100%
age	Below 25	8	11.3%	0	0.0%	8	9.9%
	25-35	49	69.0%	5	50.0%	54	66.7%
	36- 45	14	19.7%	5	50.0%	19	23.4%
	total	71	100%	10	100.0%	81	100.0%
Education	degree	55	77.5%	6	60.0%	61	75.3%
	Masters	16	22.5%	4	40.0%	20	24.7%
	total	71	100.0%	10	100.0%	81	100.0%
Work experience (Years)	below 5	38	53%	0	0.0%	38	46.9%
	5-10	31	44%	3	30.0%	34	42.0%
	10-15	2	3%	7	70.0%	9	11.1%
	Total	71	100%	10	100.0%	81	100.0%
Income	1735-3737	1	1.4%	-	-	1	1.4%
	3738-5000	17	23.9%	-	-	17	23.9%
	5000-10000	33	46.5%	-	-	33	46.5%
	10000-15000	16	22.5%	-	-	16	22.5%
	15000-20000	4	5.6%	-	-	4	5.6%
	Total	71	100.0%	-	-	71	100%
Total of respondents		71	100.0%	10	100.0%	81	100%

### 4.3 Crowdsourcing in software companies

This section includes two sub sections. The first sub section evaluates the awareness of respondents about crowdsourcing. The second sub section evaluates the current practice of crowdsourcing in software companies with both crowd worker (software developer) and requester (company) perspective. As mentioned in chapter 2, crowd workers are an individuals or group of people who perform tasks on crowdsourcing platform online or offline and requesters or crowdsourcers are any organizations or individuals who need a solution from crowd workers for their tasks.

#### 4.3.1 Awareness level of respondents about crowdsourcing in software companies

Before to investigate the opportunities and challenge of crowdsourcing the researcher evaluate the level of respondents awareness about crowdsourcing and respondents are asked to express their level of awareness about the concept of crowdsourcing by using a scale from very high to very low and never heard of it also included .

Table 4.3.1: Awareness of respondents about the concept crowdsourcing

Level of crowdsourcing awareness	Software developer respondents		Manager respondents		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Never heard of it	3	4%	0	0%	3	3.7%
Very low	7	10%	0	0%	7	8.6%
Low	25	35%	7	70%	32	39.5%
Medium	17	24%	3	30%	20	24.7%
High	17	24%	0	0%	17	21.0%
very high	2	3%	0	0%	2	2.5%
Total	71	100%	10	100%	81	100%

Table 4.3.1 demonstrate that the level of awareness of software developers respondents and software companies managers respondents about crowdsourcing and relatively the majority (51%) of software developers who had experience in crowdsourcing have medium and above medium awareness. The remaining 49% of software developers who had experience in

crowdsourcing before have lower than medium level of awareness. From the managers, none of manager respondent has high level of awareness about crowdsourcing. The majority 70% of the manager respondents have low level of awareness. The remaining 30% of manager respondents have medium level of awareness. So, it can be said that the software developers had better awareness than the managers about crowdsourcing. Generally, the result shows that there is a lack of awareness about the concept of crowdsourcing in software companies.

#### 4.3.2 Current practice of crowdsourcing

This section evaluates the current crowdsourcing practice of software developers (as crowd workers) and software companies managers (as requesters).

##### 4.3.2.1 Current crowdsourcing practice of software developers

To evaluate the current crowdsourcing practice of software developers (crowd workers) respondents are asked to answer ‘Yes’ if they have ever participated in any crowdsourcing platform before or to answer ‘No’ if they haven’t ever participated in any crowdsourcing platform before in the questionnaire and table 4.3.2a as well as figure 4.1 show that from the total(71) number of respondents 43(60.6%) respondents replied “Yes ” and the other 28 (39.4%) respondents replied “No ” that means (60.6%) of respondents have crowdsourcing experience and (39.4%) have no crowdsourcing experience.

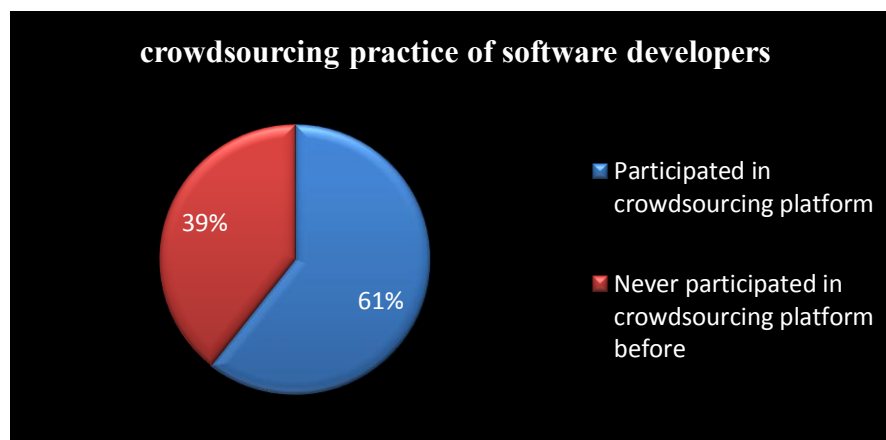


Figure4.1 - Crowdsourcing practice of software developers (as crowd workers)

Table 4.3.2.a: Crowdsourcing practice of software developers

Practice of crowdsourcing of software developers	frequency	percentage
Participated in crowdsourcing platform	43	60.6%
Never participated in crowdsourcing platform before	28	39.4%
Total	71	100.0%

Figure 4.2 below shows that the software developer respondents who have not been practicing crowdsourcing have low level awareness about the concept crowdsourcing but to the reverse most of software developers who practice crowdsourcing have high awareness of crowdsourcing. so that it can be said that one of the reason why the software developers are not being practicing crowdsourcing is that having low awareness of crowdsourcing .

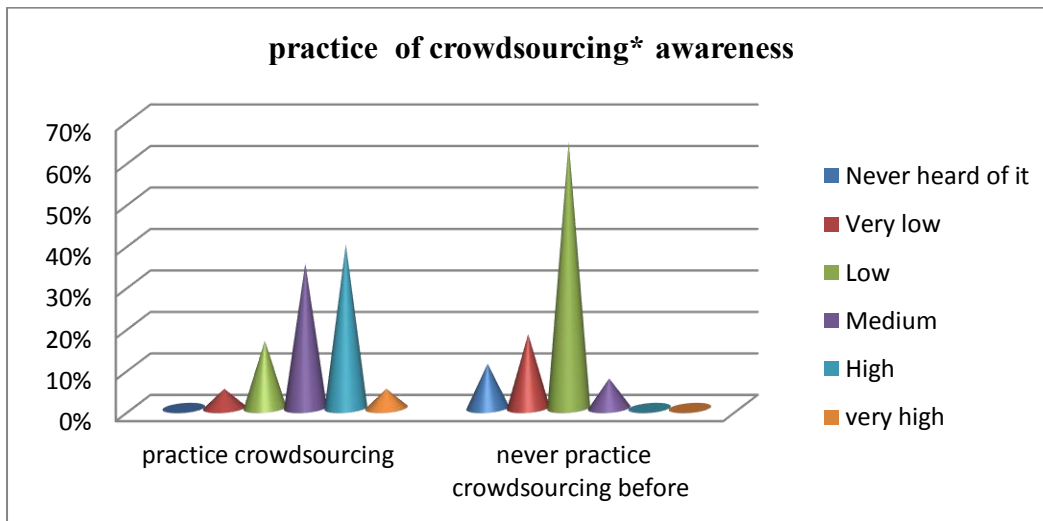


Figure4. 11- Practice of software developer respondents and their awareness

Furthermore, for those respondents who have crowdsourcing experience the researcher presented three additional question, the first question that respondents are asked to answer the type of task that they have usually participated. As mentioned in chapter 2, there are three common tasks in crowdsourcing. Those are routine (daily / simple tasks ),complex tasks (hard tasks ) and Creative/Innovative task (tasks that performed for the first time or new idea) and

Table 4.3.2b show that 37 (86.0%) of respondents usually participate in routine type of tasks. The remaining 6 (14.0%) respondents participate in complex tasks. None of respondent participates in Creative/Innovative type of tasks. Generally, this result show that most of respondents participated in routine type of tasks.

In the second question, respondents are asked to answer how frequently they participate in crowdsourcing platform. As the table 4.3.2b show that (79%) of respondents participate in crowdsourcing platforms daily and weekly. The remaining (21%) of respondents participate in crowdsourcing platform monthly, semi- annually, annually. This result indicates that most of software developers have participated daily and weekly.

Table 4.3.2b: Type of task in crowdsourcing, time of participation and payment in crowdsourcing

	variable	frequency	percentage
The type of task that Participated in crowdsourcing platform	Routine tasks	37	86.0%
	Complex tasks	6	14.0%
	Creative/Innovative tasks	0	0.0%
Total		43	100.0%
participation of crowdsourcing (period )	Daily	18	41.9%
	weekly	16	37.2%
	Monthly	1	2.3%
	Semi-Annually	6	14.0%
	Annually	2	4.7%
Total		43	100.0%
payment from crowdsourcing platform	Participants that get payment from crowdsourcing platform	27	62.3%
	Participants that didn't get payment from crowdsourcing platform	16	37.7%
Total		43	100.0

The third and final question that presented to evaluate the current crowdsourcing practices of software developers respondents was whether they have received payment or not when they are

participated in crowdsourcing platforms. The same table (Table4.3.2b) indicate that Most 27(62.3%) of respondents have got paid for what they work in crowdsourcing platform and 16 (37.7%) of respondents have no received payment before when they are participated in crowdsourcing platforms before. Generally, from Table 4.3.2 c, we can understand that most of respondents who got payment have participated in routine type of tasks as well as most of them have participated daily but the software developers respondents who have no received payment, participated weekly and monthly in routine type of tasks and none of software developer respondents participate in innovative / creative type of tasks

Table 4.3.2 c: Participation in crowdsourcing platform

Get payments			The time that software developer participated			Total
			Daily	weekly	monthly	
Yes	Type of task	Routine tasks	17	6	3	26
		Complex tasks	0	2	0	2
	Total		17	8	3	28
No	Type of task	Routine tasks		8	3	11
		Complex tasks		4	0	4
	Total			12	3	15
Total	Type of task	Routine tasks	17	14	6	37
		Complex tasks	0	6	0	6
	Total		17	20	6	43

#### 4.3.2.2 Current crowdsourcing practice of software companies (as requester)

To examine the current crowdsourcing practice of software companies as requester presented the same question as software developer means that respondents are asked to respond ‘Yes’ if they have ever participated in any crowdsourcing platform before or to replay ‘No’ if they haven’t ever participated in any crowdsourcing platform before and all (100%) respondents replied “no” that means there is no software company that practice crowdsourcing as requester. As mentioned on section 4.3.1, in the software companies there is low awareness

about the concept of crowdsourcing, so that it can be one of the major reason that crowdsourcing is not adopted in software companies.

#### 4.4 Opportunities and challenges of crowdsourcing for software developer

This subsection presents the opportunities and challenges of crowdsourcing from software developers ( crowd workers) perspective and the interpretation was made regarding likert-type scale by categorizing the responds into agree, neutral and disagree.

##### 4.4.1 Opportunities of crowdsourcing for software developer

From total software developer respondents , 43 of them have crowdsourcing experience before. The respondents were asked to mention the opportunities of crowdsourcing

Table 4.4.1: The opportunities of crowdsourcing for software developers. (i.e. 1= strongly disagree, 2= disagree 3= neutral 4= agree 5= strongly agree)

No.	crowdsourcing has an opportunity	1	2	3	4	5	Total
1	To select tasks according to interest or knowledge in freedom.	0 (0%)	1 (2.3%)	1 (2.3%)	25 (58.1%)	16 (37.2%)	43 (100%)
2	To share knowledge with different participants who have diverse background.	1 (2.3%)	1 (2.3%)	2 (4.7%)	16 (37.2%)	23 (53.5%)	43 (100%)
3	To spend extra times in productive way.	0 (0%)	1 (2.3%)	5 (11.6%)	14 (32.6%)	23 (53.5%)	43 (100%)
4	To enhance effectiveness on jobs.	0 (0%)	1 (2.3%)	0 (0%)	18 (41.9%)	24 (55.8%)	43 (100%)
5	Most of Crowdsourcing platforms are user-friendly system.	0 (0%)	9 (20.9%)	2 (4.7%)	11 (25.6%)	21 (48.8%)	43 (100%)
6	To support others by giving solutions. (To enjoy by helping other).	0 (0%)	7 (16.3%)	1 (2.3%)	26 (60.5%)	9 (20.9%)	43 (100%)
7	To get money (for source of income)	0 (0%)	7 (16.3%)	6 (14.0%)	18 (41.9%)	12 (27.9%)	43 (100%)
8	To get recognition.	0 (0%)	15 (34.9%)	2 (4.7%)	18 (41.9%)	8 (18.6%)	43 (100%)
9	To do works in any time.	0 (0%)	1 (2.3%)	0 (0%)	17 (39.5%)	25 (58.1%)	43 (100%)
10	To do works in any place.	0 (0%)	1 (2.3%)	0 (0%)	22 (51.2%)	20 (46.5%)	43 (100%)

The above table 4.4.1 shows that the respondents answer in frequency and percentage and the table 4.4.1 demonstrated that majority (95.3 %) of respondents replied that crowdsourcing has an advantage to select tasks according to crowd workers interest or existing knowledge in freedom, but 2.3% of respondents replied that crowdsourcing has no advantage to select tasks as crowd workers interest or existing knowledge in freedom and 2.3% of respondents were neutral. Felstiner [61] confirm that crowd workers have a freedom to select tasks based on their interest or as their capacity in crowdsourcing

According to Abhinav et al. [30] study, crowdsourcing has an advantage to share knowledge with different participants as well as in this research, majority (90.7%) of respondents also agree with the statement that crowdsourcing has an opportunity to share knowledge with different background of participants. The other 4.6% of respondents replied that crowdsourcing has no advantage to share idea with other participants and 4.7% of respondents had neutral views. Majority (86.1%) of the respondents replied crowdsourcing has a benefit to spend extra times in productive way. 2.3% of respondents disagree with the idea that crowdsourcing has a benefit to spend the extra time in productive way and 11.6% of respondents did not take side and 74.4% of the respondents answered that most of crowdsourcing platforms are user-friendly system. The 4.7% and 20.9% respondents answered neutral and disagree with idea respectively, but as the figure4.3 shows that the majority of respondents who are between 36 and 45 years old have report that most of crowdsourcing platforms are not user-friendly. To the reverse most of respondents who were below 35 years old answered that most of crowdsourcing platforms are user-friendly. So that most of crowdsourcing platforms are more user-friendly for young software developers then old software developers.

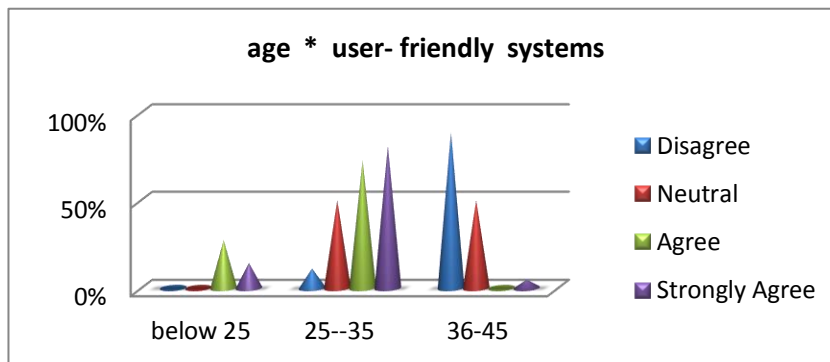
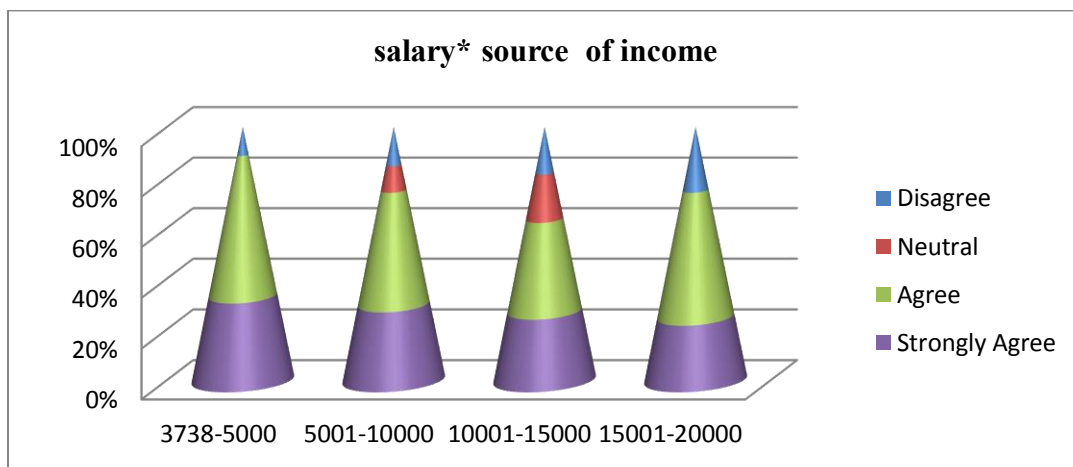


Figure4.12 - Crowdsourcing system for software developers who are in different age

We can understand also from the table 4.4.1, 69.7% of the respondents answered that crowdsourcing used as source of income. 14.0% of respondents answered that crowdsourcing is not helpful as source of income or to get money. 16.3 % of respondents were neutral and figure 4.4 show that in detail, 89% respondents who have 3738-5000 income per month of replied that crowdsourcing is helpful to get money or to source of income and 11% of respondents answered crowdsourcing is not helpful to source of income and also averagely 73% of respondents who have more than 5000 income are agreed that crowdsourcing is helpful to get money or to source of income. The remaining 27 % respondents that have more than 5000 income responded that crowdsourcing is not helpful to get money or to source of income.



**Figure4.13- The advantage of crowdsourcing as source of income for software developer with different salary**

Over all the table 4.4.1 illustrate that crowdsourcing have opportunities for software developers (crowd workers) such as to select tasks according to interest or knowledge in freedom, to share knowledge with different participants who have diverse background, to spend extra times in productive way, to enhance effectiveness on jobs, , to support others by giving solutions, to source of income, to get recognition and to do works in any time as well any place and most of crowdsourcing platforms are user-friendly system.

#### 4.4.2 Challenges of crowdsourcing for software developer

This section presents the respondents answer in frequency and percentage. These 43 respondents have crowdsourcing experience before.

Table 4.4.2: The challenge of crowdsourcing for software developers. (i.e. 1= strongly disagree, 2= disagree 3= neutral 4= agree 5= strongly agree)

No	Challenges of crowdsourcing	1	2	3	4	5	Total
1	Lack of awareness about crowdsourcing.	0 (0%)	13 (30.2%)	4 (9.3%)	26 (60.5%)	0 (0%)	43 (100%)
2	Only limited information about the tasks to be performed.	0 (0%)	5 (11.6%)	7 (16.3%)	22 (51.2%)	9 (20.9%)	43 (100%)
3	Only limited information about the employer.	0 (0%)	2 (4.7%)	5 (11.6%)	20 (46.5%)	16 (37.2%)	43 (100%)
4	The reward is not attractive.	3 (7.0%)	21 (48.8%)	2 (4.7%)	14 (32.6%)	3 (7.0%)	43 (100%)
5	To participate in crowdsourcing platforms. It need much time.	0 (0%)	27 (62.8%)	3 (7.0%)	13 (30.2%)	0 (0%)	43 (100%)
6	It needs high skill or talents.	0 (0%)	21 (48.8%)	10 (23.3%)	12 (27.9%)	0 (0%)	43 (100%)
7	Most of the times the questions are not clearly describe in platforms.	0 (0%)	18 (41.9%)	6 (14.0%)	15 (34.9%)	4 (9.3%)	43 (100%)
8	Low internet access.	1 (2.3%)	31 (72.1%)	6 (14.0%)	4 (9.3%)	1 (2.3%)	43 (100%)
9	Privacy is not protected in crowdsourcing.( can usually see workers' employment history on the platform)	1 (2.3%)	5 (11.6%)	3 (7.0%)	27 (62.8%)	7 (16.3%)	43 (100%)
10	Creative works are unprotected in crowdsourcing system.	0 (0%)	6 (14.0%)	5 (11.6%)	29 (67.4%)	3 (7.0%)	43 (100%)

The software developer respondents provide response for listed challenge of crowdsourcing on the above table 4.4.2 and majority (72.1%) of respondents argue that there is no detail information on crowdsourcing platforms about the tasks. (11.6%) of respondents disagree with this idea and the remaining 16.3% of respondents were neutral and most (83.7%) of respondents answered that there is limited information about employer or requester and the remaining (11.6%) and (4.7%) respondents disagree and neutral about the statement that there is limited information about employer or requester respectively. Felstiner [61] confirm that there is no detail information about tasks that to be performed in crowdsourcing platform and also they have no detail information for who they work in crowdsourcing , But on the other hand the

information of participants easily access in crowdsourcing [61]. In this research also most (79.1%) of respondents have argued that the privacy of crowd workers is unprotected in crowdsourcing and the remaining 13.9% and 7% of respondents disagree and neutral by the statement that participants of privacy is unprotected in crowdsourcing respectively.

According to Felstiner [61], the reward in crowdsourcing is not attractive. But in this research as table 4.4.2 also illustrates that most (55.8%) of respondents replied that the reward in crowdsourcing is attractive. The remaining 39.6% and 4.7% of respondents said that the reward in crowdsourcing is not attractive and had neutral view respectively. However, as figure 4.5 show that most (78%) of the respondents who have 3738-5000 replied that the reward in crowdsourcing is attractive in the reverse most of respondents who have more than 10000 income answered that the reward in crowdsourcing is not attractive. so that from this result we can understand that the reward in crowdsourcing is attractive for respondents who have relatively low income then for the respondents who have relatively high income.

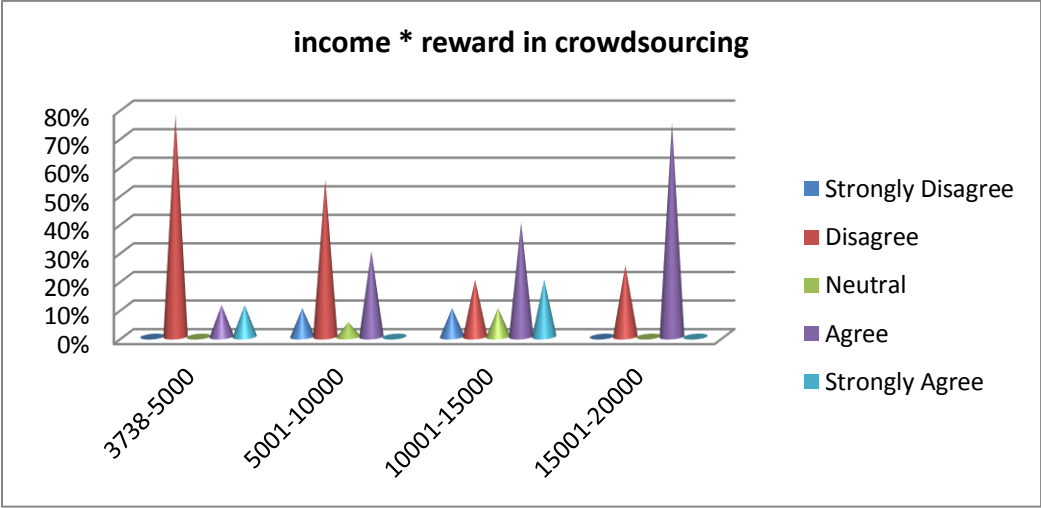


Figure 4.14 - The attractiveness of the reward in crowdsourcing platforms for software developers who have different amount of salary

Generally, table 4.4.2 show that lack of awareness about crowdsourcing, only limited information about the tasks to be performed, only limited information about the employer, there no time to participate, most of the times the questions are not clearly describe in platforms, low internet access, privacy is not protected in crowdsourcing, creative works are unprotected in crowdsourcing system are challenges of crowdsourcing for software developer (crowd worker).

#### 4.4.3 The attitude of software developers on opportunities of crowdsourcing

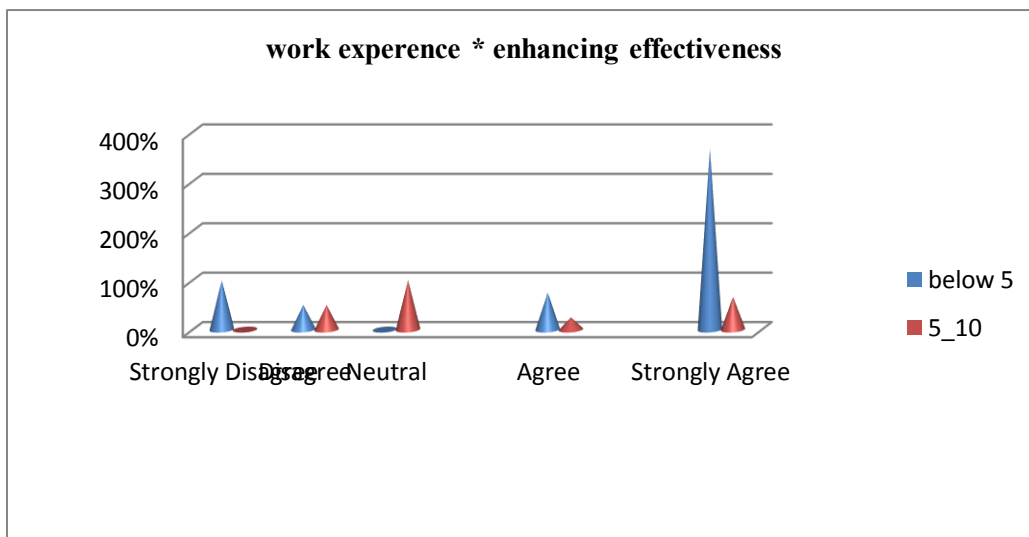
In this section, the researcher identifies the attitude of software developers about crowdsourcing. From total number of software developer, 28 have no crowdsourcing practice before and table 4.3.3 show that the respondents answer in frequency and percentage.

Table 4.4.3: The opportunities of crowdsourcing for software developer who are new to crowdsourcing (i.e. 1= strongly disagree, 2= disagree 3= neutral 4= agree 5= strongly agree)

No	Opportunities of crowdsourcing	1	2	3	4	5	Total
1	To select tasks according to interest or knowledge in freedom.	0 (0%)	1 (3.6%)	1 (3.6%)	15 (53.6%)	11 (39.3%)	28 (100%)
2	To share knowledge with different participants who have diverse background.	1 (3.6%)	2 (7.1%)	4 (14.3%)	8 (28.6%)	13 (46.4%)	28 (100%)
3	To spend extra times in productive way.	0 (0%)	1 (3.6%)	4 (14.3%)	18 (64.3%)	5 (17.9%)	28 (100%)
4	To enhance effectiveness on jobs.	0 (0%)	1 (3.6%)	0 (0%)	20 (71.4%)	7 (25.0%)	28 (100%)
5	Most of Crowdsourcing platforms are user-friendly system.	0 (0%)	1 (3.6%)	0 (0%)	21 (75.0%)	6 (21.4%)	28 (100%)
6	To support others by giving solutions. (To enjoy by helping other).	0 (0%)	4 (14.3%)	14 (50.0%)	6 (21.4%)	4 (14.3%)	28 (100%)
7	To get money (for source of income)	0 (0%)	2 (7.1%)	0 (0%)	16 (57.1%)	10 (35.7%)	28 (100%)
8	To get recognition.	0 (0%)	12 (34.9%)	1 (3.6%)	11 (39.3%)	4 (14.3%)	28 (100%)
9	To do works in any time.	0 (0%)	1 (3.6%)	3 (10.7%)	10 (35.7%)	14 (50.0%)	28 (100%)
10	To do works in any place.	0 (0%)	1 (3.6%)	0 (0%)	16 (57.1%)	11 (39.3%)	28 (100%)

According table 4.4.3 , (92 .8%) of respondents answered that crowdsourcing has advantage to select tasks based on crowd workers interest or existing knowledge in freedom. the remaining (3.6%) of respondents answered that crowdsourcing has no advantage to select tasks based on

crowd workers interest or existing knowledge in freedom and 3.6% of respondents were neutral and 75% of respondents argue with the statement that crowdsourcing has an advantage to enhance effectiveness on jobs, 10.7% of respondents answered crowdsourcing has no advantage to enhance effectiveness on jobs and the remaining 4.3% of respondents had neutral observation . figure 4.6 show that most of respondents who have relatively low experience were argue then the respondents who have relatively high experience with the statement that crowdsourcing has an advantage to enhance effectiveness on jobs .



**Figure 4.6- The attitude of respondents with different work experience about enhancing effectiveness**

The same table (table 4.4.3) shows also that (85.7%) of respondents said that crowdsourcing has an advantage to perform works in any time. (3.6%) of respondents disagree with idea that crowdsourcing has an advantage to perform works in any time. (10.7%) of respondents were neutral .96.4% of respondents replied that crowdsourcing has an advantage to work in any place. (3.6%) of respondents disagree with the statement that crowdsourcing has advantage to work in any place. many authors had argued with statement that crowdsourcing has advantage to work in any time and any place. Felstiner [61] also stated that crowd worker perform can select the work time, place also the task itself by themselves that in crowdsourcing system.

Generally, Table 4.4.3 show that crowdsourcing have opportunities for software developers (crowd workers) such as to select tasks according to interest or knowledge in freedom, to share knowledge with different participants who have diverse background, to spend extra times in

productive way, to enhance effectiveness on jobs, to support others by giving solutions, to source of income, to get recognition, to do works in any time as well any place and most of crowdsourcing platforms are user-friendly system.

#### 4.4.4 The attitude of software developers on challenges of crowdsourcing

Table 4.4.4a show that the respondents answer in frequency and percentage. These respondents were new for crowdsourcing.

Table 4.4.4a: The challenges of crowdsourcing for participants. (i.e. 1= strongly disagree, 2= disagree 3= neutral 4= agree 5= strongly agree)

No.	Challenge of crowdsourcing	1	2	3	4	5	Total
1	Lack of awareness about crowdsourcing.	1 (3.6%)	5 (17.9%)	2 (7.1%)	17 (60.7%)	3 (10.7%)	28 (100%)
2	Only limited information about the tasks to be performed.	0 (0%)	8 (28.6%)	9 (32.1%)	11 (39.3%)	0 (0%)	28 (100%)
3	Only limited information about the employer.	0 (0%)	18 (64.3%)	5 (17.9%)	5 (17.9%)	0 (0%)	28 (100%)
4	The reward is not attractive.	1 (3.6%)	18 (64.3%)	3 (10.7%)	4 (14.3%)	2 (7.1%)	28 (100%)
5	To participate in crowdsourcing platforms. it need much time .	0 (0%)	20 (71.4%)	1 (3.6%)	6 (21.4%)	1 (3.6%)	28 (100%)
6	It needs high skill or talents.	3 (10.7%)	17 (60.7%)	5 (17.9%)	3 (10.7%)	0 (0%)	28 (100%)
7	Most of the times the questions are not clearly describe in platforms.	1 (3.6%)	2 (7.1%)	5 (17.9%)	16 (57.1%)	4 (14.3%)	28 (100%)
8	Low internet access.	1 (3.6%)	20 (71.4%)	5 (17.9%)	1 (3.6%)	1 (3.6%)	28 (100%)
9	Privacy is not protected in crowdsourcing.( can usually see workers' employment history on the platform)	1 (3.6%)	4 (14.3%)	3 (10.7%)	18 (64.3%)	2 (7.1%)	28 (100%)
10	Creative works are unprotected in crowdsourcing system.	0 (0%)	7 (25.0%)	4 (14.3%)	15 (53.6%)	2 (7.1%)	28 (100%)

As a table 4.4.4a, 71.4% of respondents mentioned that lack of awareness as one of challenge of crowdsourcing. The remaining 21.5% of respondents disagree with idea and 7.1 % of respondents neither agree nor disagree with the idea and the majority 71.4% of respondents

agrees as disadvantage that privacy is not protected in crowdsourcing. But 17.9% of respondents replied privacy is protected in crowdsourcing. The remaining 10.7 % of respondents had neutral view.

Table 4.4.4b respondents' age, work experience and time to participate in crowdsourcing

<b>Age * work experience * no time to participate</b>							
Work experience			no time to participate				Total
			Disagree	Neutral	Agree	Strongly Agree	
below 5	Age	below 25	1	0	1		2
		25--35	14	1	1		16
		36-45	0	0	1		1
	Total		15	1	3		19
5-10	Age	25--35	4		0	1	5
		36-45	1		3	0	4
	Total		5		3	1	9
Total	Age	below 25	1	0	1	0	2
		25--35	18	1	1	1	21
		36-45	1	0	4	0	5
	Total		20	1	6	1	28

The table 4.4.4a show that of most (25%) respondents replied it need much time to participate in crowdsourcing but 71.4% respondents disagree with the idea. The remaining 3.6% of respondents ware neutral. But the respondents were between 36-45 years old and at the same time the respondents who have work experience between 5-10 replied that there is no time participate in crowdsourcing then the respondents were between 25-35 years old and that have below 5 work experience . So that from this result we can understand that lack of time is a challenge for relatively old and more experienced respondents then the respondents who have low experience and young people and majority (71.4%) of the respondents answered lack of skill is not as a challenge in crowdsourcing. 10.7% of respondents take lack of skill as challenge of crowdsourcing . 17.9% of respondents were neutral. Mehta [11] stated that the questions are not clearly describe in crowdsourcing platforms and this statement has argued by 71.4 % of respondents in this research, 10.7% of respondents disagree with idea and 17.9% of respondents had neutral sight.

Generally, table 4.4.4b shows that crowdsourcing have challenges such as lack of awareness about crowdsourcing, only limited information about the tasks that to be performed and about employers, take more time to participate, the questions are might not clearly describe in platforms, low internet access, privacy is not protected in crowdsourcing, creative works are unprotected in crowdsourcing system for crowd workers.

## 4.5 Opportunities and challenge of crowdsourcing for software companies

### 4.5.1 The opportunities of crowdsourcing for software companies

The attitude of software managers about the opportunities of crowdsourcing summarize in the table as follow:

4.5.1: The opportunities of crowdsourcing for software companies (i.e. 1= strongly disagree, 2= disagree 3= neutral 4= agree 5= strongly agree)

No.	Opportunities of crowdsourcing	1	2	3	4	5	Total
1	To improve software quality.	0 (0%)	1 (10.0%)	0 (0%)	4 (40.0%)	5 (50.0%)	10 (100%)
2	To get creative solutions.	0 (0%)	1 (10.0%)	2 (20.0%)	6 (60.0%)	1 (10.0%)	10 (100%)
3	To accomplish tasks more quickly (to save time)	0 (0%)	1 (10.0%)	1 (10.0%)	7 (70.0%)	1 (10.0%)	10 (100%)
4	To cost saving.	0 (0%)	3 (30.0%)	1 (10.0%)	4 (40.0%)	2 (20.0%)	10 (100%)
5	To get resource from any geographical location.	0 (0%)	2 (20.0%)	1 (10.0%)	4 (40.0%)	3 (30.0%)	10 (100%)
6	To get highly skillful Workers not available in the company at any time	0 (0%)	1 (10.0%)	0 (0%)	6 (60.0%)	3 (30.0%)	10 (100%)
7	Crowdsourcing is easy to adopt.	0 (0%)	2 (20.0%)	0 (0%)	8 (80.0%)	0 (0%)	10 (100%)
8	To Enhancement the relationship between the company and customers.	1 (10.0%)	4 (40.0%)	3 (30.0%)	2 (20.0%)	0 (0%)	10 (100%)
9	To advert the company's idea or service to broader private	1 (10.0%)	2 (20.0%)	1 (10.0%)	6 (60.0%)	0 (0%)	10 (100%)
10	Complex tasks can be solved	1 (10.0%)	2 (20.0%)	1 (10.0%)	6 (60.00%)	0 (0%)	10 (100%)
11	New works Intellectual property or copy right) is protected in crowdsourcing.	0 (0%)	3 (30.0%)	1 (10.0%)	5 (50.0%)	1 (10.0%)	10 (100%)

In the table 4.5.1, the first three given opportunities of crowdsourcing (quality, time, innovation) have argued by number of respondents. As the table 4.5.1 show that 90.0% of respondents

replied that crowdsourcing has an advantage to improve software quality. The remaining (10%) of respondents replied that crowdsourcing has no advantage to improve software quality, 70% of respondents answered that crowdsourcing has no benefit for the company to get creative solutions for problems. The other 20% of respondents answered that crowdsourcing has no benefit to get creative solution and the remaining 10% of respondents had not take side and majority (80%) of respondents said that crowdsourcing are helpful for the software company to accomplish tasks more quickly (to save time) , but the other (10%) of respondents disagree and equal number (10%) of respondents were neutral as well as this three opportunities of crowdsourcing (quality, time, innovation) also shared by number of authors [11, 30].The other opportunity of crowdsourcing that many authors have stated as advantage of crowdsourcing for software companies was cost. As the table show that the majority (60%) of respondents replied that crowdsourcing has a benefit to reduce cost of software companies. the other ( 40%) of respondents replied that crowdsourcing has no a benefit to reduce cost in software companies . however , figure 4.7 show that no respondents who have low awareness about the concept of crowdsourcing replied that crowdsourcing has advantage to save cost. In the reverse all respondents that has medium awareness replied that crowdsourcing has advantage to save cost.

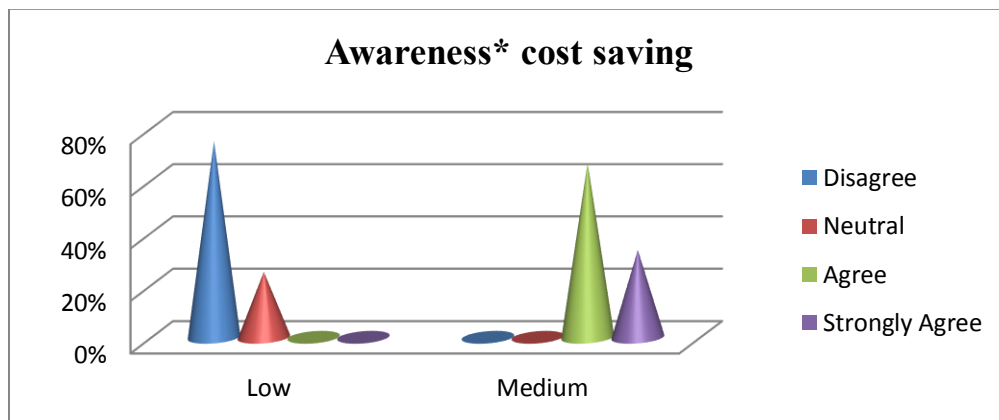
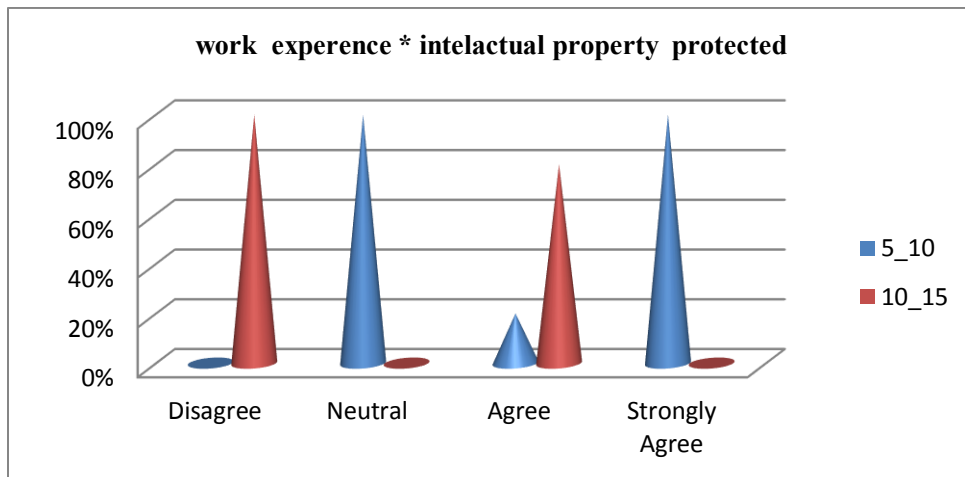


Figure 4.7 the awareness of respondents and cost saving

Table 4.5.1 show that only 20% of respondents replied crowdsourcing has a contribution to enhancement the relationship between the company and customers. 40% of respondents replied crowdsourcing has no a contribution to enhancement the relationship between the company and

customers. The remaining 30% of respondents had neutral view. But Hammon et al. [67] study show that crowdsourcing has advantage to enhancement the relationship between the company and customers.

As the table 4.5.1 show that (60%) of respondents replied that new works (Intellectual property or copy right) is protected in crowdsourcing. But (30%) respondents replied that New works (Intellectual property or copy right) were not protected in crowdsourcing and the remaining 10% of respondents had neutral view. as the figure 4.8 show that the number of respondents those have 10-5 work experience argue than the respondents those have 5-10 work experience in the idea that new works (Intellectual property or copy right) is protected in crowdsourcing.



**Figure 4.8- The attitude of respondents with different work experience about intellectual properties in crowdsourcing**

#### 4.5.2 The challenge of crowdsourcing for software companies

Table 4.5.2: The respondents' attitude about the challenges of crowdsourcing (i.e. 1= strongly disagree, 2= disagree 3= neutral 4= agree 5= strongly agree)

No	Challenge of crowdsourcing	1	2	3	4	5	Total
1	Complex and interdependent software development tasks are difficult to present clearly in to decomposed tasks for large group of people.	0 (0%)	2 (20.0%)	1 (10.0%)	7 (70.0%)	0 (0%)	10 (100%)
2	Integrating decomposed software task in to whole is difficult.	1 (10.0%)	2 (20.0%)	5 (50.0%)	1 (10.0%)	1 (10.0%)	10 (100%)
3	High communication required with large number of worker.	0 (0%)	2 (20.0%)	2 (20.0%)	5 (50.0%)	1 (10.0%)	10 (100%)
4	all tasks and communication cant performed on the internet because the company ideas or business will be unprotected	0 (0%)	3 (30.0%)	0 (0%)	5 (50.0%)	2 (20.0%)	10 (100%)
5	As the complexity of the tasks is huge, planning and scheduling of the task is very critical to complete tasks on time.	0 (0%)	1 (10.0%)	1 (10.0%)	6 (60.0%)	2 (20.0%)	10 (100%)
6	The majority solutions that provide by crowd worker are may not be relevant.	0 (0%)	2 (20.0%)	1 (10.0%)	5 (50.0%)	1 (10.0%)	10 (100%)
7	Difficult to control the qualities of the work	0 (0%)	3 (30.0%)	1 (10.0%)	6 (60.0%)	0 (0%)	10 (100%)
8	attractive payment or reward are required to attract and retain the skilled crowd	0 (0%)	2 (20.0%)	1 (10.0%)	6 (60.0%)	1 (10.0%)	10 (100%)
9	There is lack of legal and regulatory framework which handles crowdsourcing in Ethiopia.	0 (0%)	1 (10.0%)	1 (10.0%)	6 (60.0%)	2 (20.0%)	10 (100%)

Table 4.5.2 summarize the challenges of crowdsourcing for software companies and table 4.5.2 show that most (70%) of the respondents said that it is difficult to present large software tasks in to decomposed tasks clearly for large group of people in crowdsourcing. on the other hand (20%) of the respondents replied that it is not difficult to present large software tasks in to decomposed tasks clearly for large group of people in crowdsourcing and 10% of respondents were neutral and also Stol et al. [6] stated that it is difficult to present large software development tasks in to decomposed tasks clearly for large group of people in crowdsourcing.

The table 4.5.2 result also show that (70%) of respondents agree as a challenge all tasks and communication cant performed on the internet because the company ideas or business will be unprotected the other (30%) of respondents disagree with this idea and Mehta [11] stated that all tasks and communication couldn't performed on the internet because the company ideas or business will be unprotected and in addition software companies owners in the interview raise s a challenge that all tasks and communication couldn't performed on the internet because the company ideas or business will be unprotected. As Mehta [11] stated. As well the table 4.5.2 result show that most (80%) of the respondents replied that there is planning and scheduling problem in crowdsourcing. The other (10%) of respondents replied there is no difficulty to plane and scheduling in crowdsourcing and (10%) of respondents had neutral view and Mehta [11] confirm that in crowdsourcing as the task is big, it is difficult to plan and schedule and (80%) of respondents answered there is lack of legal and regulatory framework which handles crowdsourcing in Ethiopia but the other (10% ) of respondents are disagree and (10% ) of respondents were neutral.

Generally, Table 4.5.2 show that crowdsourcing have challenge for software companies as requester such as task decomposition, all tasks and communication can't performed on the internet because the company ideas or business will be unprotected, as the complexity of the tasks is huge, planning and scheduling of the task is very critical to complete tasks on time, it need high communication with large number of worker, he majority solutions that provide by crowd worker are may not be relevant, difficult to control the qualities of the work, attractive payment or reward are required to attract and retain the skilled crowd, there is lack of legal and regulatory framework which handles crowdsourcing in Ethiopia.

#### 4.6 Analysis of data collected through interview

A semi-structured interview was conducted with the owners of software companies. Some of the owners of the software companies are managers. The main target of this semi-structured interview was to investigate the opportunities and challenges of crowdsourcing with requester perspective.

In the interview, most of software companies' owners had not full awareness about the concept crowdsourcing. Most of these software companies' owners get some understanding about the concept of crowdsourcing by using internet.

As companies owners respond, all software companies don't post jobs for all to see or for crowd before in crowdsourcing platforms in other expiration crowdsourcing is not being adopted in the software companies. In this study, the researcher attempted to identify software companies owners' attitude about the opportunities and challenge of crowdsourcing as requester.

From five software companies three of them have head office and branches outside of the local countries (Ethiopia) and as software companies owners stated that if there is difficult software development and related task, they just outsource for their head office and branch of their companies. The other two software companies also outsource difficult tasks for some specific companies or individuals. The reason why companies adopt outsourcing is that they have better awareness about outsourcing rather than crowdsourcing, But they are willing to adopt crowdsourcing. Furthermore, the software companies' owners believed that crowdsourcing will be adopt in their software companies and also in all software companies in Ethiopia as well as software companies' owners believed that crowdsourcing will be enabler for software companies in future.

Most owners of company raise crowdsourcing as cheaper and they believe that payment for crowd workers is less than the workers (software developers) in the company and they raise regarding to the cost that the payments in crowdsourcing is faire because of the payments is per work not per the time they spend on the work. But most owners of company rise as challenges

of crowd sourcing were presenting software tasks to large group of people in crowdsourcing platform.

#### 4.7 Discussion of Findings

This section presents the discussion of the finding obtained from the collected data for the study. The findings are discussed based on the results of the study.

According to Mao et al. [10] model, crowdsourcing has three main components those are requester (crowdsourcer), platform (broker) and crowd worker. Based on a Mao et al. [10] model, this research tries to study the opportunities and challenges of crowdsourcing with crowd worker and requester perspective in software companies, because of that there were two groups of respondents in this research. The first group of respondents was software developers. This group of respondents selected to study the possible opportunities and challenge of crowdsourcing from crowd worker perspective. The second group of respondents was software companies' managers. This group of respondents selected to study the opportunities and challenges of crowdsourcing from requester perspective and the discussion also presents regarding to these groups of respondents and by considering the following specific objective of the study.

- To study the current practices of crowdsourcing in software company,
- Identify the opportunities of crowdsourcing for software developer (crowd worker) ,
- Identify possible challenges of software developers ( crowd workers ) face while they are engage in crowdsourcing to participate,
- Identify the importance of crowdsourcing for software companies( requester ) ,
- Identify possible challenges of crowdsourcing for software companies (requester).

#### ❖ **The current practices of crowdsourcing in software industry**

Globally, Crowdsourcing highly adopted in different field special in software companies [6] and this study assesses the current practice of crowdsourcing in Addis Ababa software companies.

From the total (71) number of software developers respondents majority 43(60.6%) of software developers had crowdsourcing experience and 28 (39.4%) had no crowdsourcing experience. Among the software developers who had no crowdsourcing experience, most of them had low level of awareness about the concept of crowdsourcing But most of the software developers who had crowdsourcing experience were aware about the concept of crowdsourcing and most 27(62.3%) of software developers had got paid for what they work in crowdsourcing platform and the other 16 (37.7%) of respondents have not received payment when they were participating in crowdsourcing platforms. Most of respondents who got payment have participated in routine type of tasks as well as most of them have participated daily but the software developers respondents who have no received payment, participated weekly and monthly in routine type of tasks and none of software developer respondents participate in innovative / creative type of tasks and there was no software company who adopt crowdsourcing as requesters (crowdsourcer ) in other expiration there was no software company who crowdsource for crowd workers and most of software companies managers and owner have low awareness about the crowdsourcing. So that it can be said that one of the major reason that crowdsourcing is not adopted in software companies is that having low awareness about the concept of crowdsourcing , because most of software companies owners are willing to adopt crowdsourcing and they believed that crowdsourcing in Ethiopia Software Company will be highly adapt in future.

#### ❖ **Opportunities and challenges of crowdsourcing for software developer**

Crowdsourcing has benefits and also crowdsourcing has its own challenges for crowd worker [61]. In this research, there are software developers who had practice crowdsourcing before and who are new for crowdsourcing in software companies. The researcher presents the questionnaires for both software developers (software developers who had practice crowdsourcing before and software developers for who are new for crowdsourcing) to investigate the opportunities and challenges of crowdsourcing.

#### ✓ **Opportunities of crowdsourcing for software developer**

Accordingly the study defined that selecting tasks regarding to interest or knowledge in freedom, sharing knowledge with different participants who have diverse background,

spending extra times in productive way, enhancing effectiveness on jobs, supporting others by giving solutions, for source of income ,getting recognition ,doing works in any time as well in any place and most of crowdsourcing platforms are user-friendly system are opportunities of crowdsourcing for software developer (crowd workers) that the software developers respondents who had practice crowdsourcing before and who are new for crowdsourcing mentioned by using likert scale.

Most of software developer respondents stated that crowdsourcing is flexible. The software developers have a freedom to select tasks based on their interest or as their capacity in crowdsourcing and crowd workers can also choose the time and work place to perform tasks in crowdsourcing.

This study also shows that crowdsourcing has an opportunity to share knowledge with different participants. Regarding the easiness of crowdsourcing, crowdsourcing systems are user-friendly systems for most of younger software developers rather than older software developers, but overall crowdsourcing systems are user-friendly systems.

crowdsourcing have an opportunities to source of income for both software developers who have relatively low income and higher income but still the result show that crowdsourcing a good opportunities for software developers who have relatively low income then for software developers who have relatively high income. Regarding effectiveness , crowdsourcing has an advantage to enhance effectiveness on jobs but crowdsourcing has a benefit to enhance effectiveness on jobs for Software developers who have relatively low work experience then the Software developers who have relatively high work experience.

#### ✓ **Challenges of crowdsourcing for software developer**

Crowdsourcing has its own challenge [6]. Majority of software developer respondents who are have crowdsourcing experience raise as a challenge that in crowdsourcing platform, there is no detail information about the tasks and about the employer but to the reverse the crowd workers detail information presented in crowdsourcing platform. The other challenge in crowdsourcing for software developer is the rewarded. According to Felstiner [61], rewards in crowdsourcing platform are not attractive for crowd workers. However, this research show that rewards in crowdsourcing is attractive, But still rewards in crowdsourcing platform is

not attractive for software developers who have relatively high income. to the opposite for the software developer who have low income rewards in crowdsourcing is attractive .

Generally crowdsourcing have challenges for software developer (crowd worker) who have crowdsourcing experience and who are new for crowdsourcing such as lack of awareness about crowdsourcing, only limited information of tasks that to be performed, only limited information about the employer, there no time to participate, most of the times the questions are not clearly describe in platforms, low internet access, privacy is not protected in crowdsourcing, creative works are unprotected in crowdsourcing system.

#### ❖ **Opportunities and challenges of crowdsourcing for software companies**

Crowdsourcing is an essential tool for different domain including software companies and also on the other hand crowdsourcing has its own disadvantages [6].This research attempted to identify the opportunities and challenges of crowdsourcing in software companies.

#### ✓ **Opportunities of crowdsourcing for software companies**

Crowdsourcing has opportunities for software developers and also crowdsourcing have opportunities for companies (crowdsourcer).

In this research quality, time and getting innovation work are the opportunities of crowdsourcing for software companies. The other opportunity of crowdsourcing is cost saving. however in this research, none (0%) of software companies managers who have low level of awareness about the concept of crowdsourcing respond that crowdsourcing has no an advantage to save a cost , however all (100%) software companies managers who have more than medium level of awareness about the concept of crowdsourcing respond that crowdsourcing has an advantage to save a cost. But generally the result of the study shows that crowdsourcing has an advantage to save cost. Furthermore the software companies' owners rise as good opportunities to save cost. They believe that payment for crowd worker is less than the worker (software developer) in the company and they rise regarding to the cost that the payments in crowdsourcing is faire because of the payments is per work not per the time they spend on works.

Most of software managers respondents mentioned as advantage of crowdsourcing that in crowdsourcing the intellectual properties protected but most of managers who have 5-10 work experience disagree with the idea that new works (Intellectual property or copy right) is protected in crowdsourcing. However most of software companies managers respondents who have 5-10 work experience argue with the idea that new works (Intellectual property or copy right) is protected in crowdsourcing.

The result also shows that crowdsourcing has an advantage to get number of employee that has different knowledge and experience (highly skillful Worker). The software companies' owners also mentioned that any companies may have limited number of knowledge and resource so that the companies will get that unlimited number of skilled person and resource. According to Hammon et al. [67], crowdsourcing has an advantage to advert the companies' idea. But this research show that crowdsourcing has no an advantage to advert the companies idea

Generally, the research show that crowdsourcing have opportunities for software companies as requester to improve software quality, to get creative solutions, to accomplish tasks more quickly (to save time), to cost saving, to get resource from any geographical location, to get highly skillful Workers not available in the company at any time, crowdsourcing is easy to adopt, to enhancement the relationship between the company and customers, complex tasks can be solved and new works (Intellectual property or copy right) is protected in crowdsourcing.

#### ✓ **Challenges of crowdsourcing for software companies**

Crowdsourcing has advantage for the companies and it has also some challenges for software industries.

In this research, most software company manager respondents mentioned some of the advantage of crowdsourcing for software companies. The responds show that software tasks are difficult to present large software tasks in to decomposed tasks clearly for large group of people in crowdsourcing. Stol et al. [6] have stated that software tasks are difficult to present clearly in crowdsourcing platforms by dividing into small tasks and all tasks and communication cant performed on the internet because the company ideas or business will be unprotected. And also this research confirm that is planning and scheduling are difficult in

crowdsourcing , if the task is big and the other challenge of crowdsourcing is that lack of legal and regulatory framework which handles crowdsourcing in Ethiopia .

Generally, crowdsourcing have challenge for software companies as requester such as Task Decomposition, all tasks and communication can't performed on the internet because the company ideas or business will be unprotected, As the complexity of the tasks is huge, planning and scheduling of the task is very critical to complete tasks on time, It need high communication with large number of worker, the majority solutions that provide by crowd worker are may not be relevant, difficult to control the qualities of the work, attractive payment or reward are required to attract and retain the skilled crowd, there is lack of legal and regulatory framework which handles crowdsourcing in Ethiopia.

# CHAPTER FIVE

## 5. CONCLUSIONS AND RECOMMENDATIONS

This section presents the conclusion of the study findings and the recommendation for further researches and for some concerned bodies.

### 5.1 Conclusions

The main objective of the study is to investigate the opportunities and possible challenge of crowdsourcing in software companies in Addis Ababa. According to Prikladnicki et al. [16] crowdsourcing has three components (requester), platform or broker, crowd worker or user. This paper tries to study the opportunities and the challenges of crowdsourcing with crowd worker (software developer) and requester (Software Company) perspective. Finally from the finding of study the researcher identifies the opportunities and the challenges of crowdsourcing for software developer and Software Company.

According to Stol et al. [6], the usage of crowdsourcing increase day to day in software companies to accomplish software development jobs . However, the use of crowdsourcing in Addis Ababa software industry is very low.

From the finding of the study we can conclude that crowdsourcing has an opportunities for software developers to sharing knowledge, to enjoy by helping other , to get reward and crowdsourcing is highly flexible for software developers .crowdsourcing has also its own challenges for software developers regarding to Security ,financial, time, social, performance risk.

There is no software companies who post their project or tasks in crowdsourcing platform ,but when we measure the efficiency of crowdsourcing or in other expiration when we assess the attitude of the software companies managers, we can understand that crowdsourcing has an opportunities for software companies to save cost , to productivity , to get Innovation tasks and crowdsourcing is highly flexible. However, task decomposition, planning and scheduling,

coordination and communication, knowledge and intellectual property, quality assurance, motivation and payment are the challenge of crowdsourcing for software companies.

Generally, there is low awareness of the concepts crowdsourcing in software companies. Because of that crowdsourcing is not widely adopted in software companies and both software developers as well as companies are not sufficiently used from crowdsourcing.

## **5.2 Recommendations**

Based on the research findings some recommendations are made for further research and practice.

### **5.2.1 Recommendation for practices**

- Software developers, managers and software owners should increase their awareness about crowdsourcing.
- software companies should adopt crowdsourcing to improve software quality, to get creative solution, to accomplish tasks more quickly, to save cost, to get resources from any geographical location and to get highly skill fill workers who are not available in the companies.
- Software companies should build user friendly crowdsourcing platforms for all age groups of participants.

### **5.2.2 Recommendation for future work**

- This research can only identifies the opportunities and challenges of crowdsourcing with crowd worker and requester perspective and it require further case study regarding the crowdsourcing platforms.
- This research is general which require further investigations both in breadth and depth. Thus, future researches should consider a case study to forward solution for each challenges of crowdsourcing listed in this study.
- This research considered only crowdsourcing in software companies, but it needs a research for other IT fields, because as my knowledge there is no research which deals about the opportunities and challenges of crowdsourcing in IT fields.

## *Appendix A*

### **QUESTIONNAIRE**

**Addis Ababa University  
College of Natural Science  
School of information science**

This questionnaire is designed to collect necessary information about crowdsourcing for research on the topic **‘crowdsourcing in software companies: opportunities and challenges’** for the partial fulfillment of the requirement for the degree of Masters in information science. The purpose of this study is to assess the opportunities and challenges of crowdsourcing for software companies and software developers. Your response is very important to get accurate result in the study. The information that you provide will be kept confidential and used only for academic purpose. Completing the questionnaire will take about 25-35 minutes.

**DEFINITION OF CROWDSOURCING** - *“The accomplishment of specified software development tasks on behalf of an organization by a large and typically undefined group of external people with the requisite specialist knowledge through an open call.” [56]*

If you have anything unclear you can contact the researcher by:-

Phone number – 0940 19 79 93

E-mail address - mahletgetachew97@gmail.com

Thank you for your honest and responsible response!

Mahlet Getachew

**QUESTIONNAIRE**  
**Addis Ababa University**  
**College of Natural Science**  
**School of information science**

**This questionnaire prepared to investigate the opportunities and challenges of crowdsourcing from software developer (crowd worker) perspective.**

**Instructions:** This questionnaire has four parts. Please fill out part one and part two. In addition, if you have been participating in any crowdsourcing platform before, please fill out part three or if you haven't been participating in any crowdsourcing platform, please fill out part four.

Put “√” Mark in the box sign to show your answer.

**Part One: Respondent Profile**

1. Gender  Male  Female
2. Age (Years)  below 25  25-35  36- 45  Above 45
3. Educational Level Diploma First Degree  Masters degree PhD other \_\_\_\_\_
4. Work experience (Years)  below 5  5-10  10-15  above 15
5. Income per month (birr)  1735-3737 3738-5000 50001-10000  
 10001-15000  15001-20000  above 20000

**Part Two: Questions designed to assess the awareness and current practices of crowdsourcing in software companies from software developer or participant perspective.**

1. What is your level of awareness about the concept of crowdsourcing?  
 Very high  High  Medium  Low  Very low  Never heard of it
2. Have you ever participated in any crowdsourcing platform?  
 Yes  No

***If your answer yes for question 2, please give your answer for questions 3, 4, and 5 otherwise go to part four.***

3. In which type of tasks you mostly participated in crowdsourcing platforms?  
 Routine tasks (everyday tasks)  Creative/Innovative tasks  
 Complex tasks  other \_\_\_\_\_

4. How frequently would you participate in crowdsourcing platform?

Daily       weekly       monthly       semi-annually       annually

5. Do you get payment for what you work in crowdsourcing?

Yes                                       No

**Part Three: questions designed to assess the opportunities and challenges of crowdsourcing for software developers after practicing crowdsourcing.**

1. Show the crowdsourcing advantage using the following rating scale: 5=strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=strongly Disagree

Put “√” Mark in the appropriate column to signify the importance level of each item.

No.	crowdsourcing has an opportunity	1	2	3	4	5
1	To select tasks according to interest or knowledge in freedom.					
2	To share knowledge with different participants who have diverse background.					
3	To spend extra times in productive way.					
4	To enhance effectiveness on jobs.					
5	Most of Crowdsourcing platforms are user-friendly system.					
6	To support others by giving solutions. (To enjoy by helping other).					
7	To get money (for source of income)					
8	To get recognition.					
9	To do works in any time.					
10	To do works in any place.					

2. Show the crowdsourcing challenges using the following rating scale; 5=strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=strongly Disagree

Put “√” Mark in the appropriate column to show your response.

No	Challenges of crowdsourcing	1	2	3	4	5
1	Lack of awareness about crowdsourcing.					
2	Only limited information about the tasks to be performed.					
3	Only limited information about the employer.					
4	The reward is not attractive.					
5	To participate in crowdsourcing platforms. It need much time.					
6	It needs high skill or talents.					
7	Most of the times the questions are not clearly describe in platforms.					
8	Low internet access.					
9	Privacy is not protected in crowdsourcing.( can usually see workers' employment history on the platform)					
10	Creative works are unprotected in crowdsourcing system.					

**Part four: Questions designed to assess the opportunities and challenges of crowdsourcing for software developers (crowd workers) who are new to crowdsourcing.**

1. If you have not been practicing in crowdsourcing as participant, indicate how you feel about the importance of crowdsourcing as participant using the following rating scale:

5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree  
Put “√” Mark in the appropriate column to show your response.

No.	crowdsourcing has an opportunity	1	2	3	4	5
1	To select tasks according to interest or knowledge in freedom.					
2	To share knowledge with different participants who have diverse background.					
3	To spend extra times in productive way.					
4	To enhance effectiveness on jobs.					
5	Most of Crowdsourcing platforms are user-friendly system.					
6	To support others by giving solutions. (To enjoy by helping other).					
7	To get money (for source of income)					
8	To get recognition.					
9	To do works in any time.					
10	To do works in any place.					

2. If you have not been practicing in crowdsourcing, indicate how you feel about the challenges of crowdsourcing as participant using the following rating scale: 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree

Put “√” Mark in the appropriate column to signify the importance level of each item

No	Challenges of crowdsourcing	1	2	3	4	5
1	Lack of awareness about crowdsourcing.					
2	Only limited information about the tasks to be performed.					
3	Only limited information about the employer.					
4	The reward is not attractive.					
5	To participate in crowdsourcing platforms. It need much time.					
6	It needs high skill or talents.					
7	Most of the times the questions are not clearly describe in platforms.					
8	Low internet access.					
9	Privacy is not protected in crowdsourcing.( can usually see workers' employment history on the platform)					
10	Creative works are unprotected in crowdsourcing system.					

## Appendix B

### QUESTIONNAIRE Addis Ababa University College of Natural Science School of information science

**This questionnaire prepared to investigate the opportunities and challenges of crowdsourcing from software company (requester) perspective.**

**Instructions:** This questionnaire has four parts. please fill out part one and part two and if your company have been adopting crowdsourcing ,fill out part three other wise fill out part four.

Put “√” Mark in the box sign to show your answer.

#### Part One: Respondent Profile

1. Sex  Male  Female
2. Age (Years)  below 25  25-35  36- 45  Above 45
3. Educational Level  Diploma First Degree Masters degree Above masters Degree
- 4 work experience (Years)  below 5  5-10 10-15  above 15

#### Part two: Questions designed to assess the current practices of crowdsourcing in software development companies.

1. What is your level of awareness about the concept of crowdsourcing?

Very high  High  medium  
 Low  very low  never heard the word crowdsourcing

2. Have your organization ever posted any software development tasks or related works to any crowdsourcing platform?

Yes  No

If your answer is yes please go to part three, otherwise go to part four

**Part Three: Questions designed to assess the opportunities and the challenges of crowdsourcing for software companies.( for already adopted crowdsourcing )**

1. Show the crowdsourcing advantage using the following rating scale: 5=strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=strongly Disagree

No.	Opportunities of crowdsourcing	1	2	3	4	5
1	To improve software quality.					
2	To get creative solutions.					
3	To accomplish tasks more quickly (to save time)					
4	To cost saving.					
5	To get resource from any geographical location.					
6	To get highly skillful Workers not available in the company at any time					
7	Crowdsourcing is easy to adopt.					
8	To Enhancement the relationship between the company and customers.					
9	To advert the company's idea or service to broader private					
10	Complex tasks can be solved					
11	New works Intellectual property or copy right) is protected in crowdsourcing.					

2. Show the crowdsourcing challenges using the following rating scale; 5=strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=strongly Disagree

Instruction: Put “√” Mark in the appropriate column

No.	Challenge of crowdsourcing	1	2	3	4	5
1	Complex and interdependent software development tasks are difficult to present clearly in to decomposed tasks for large group of people.					
2	Integrating decomposed software task in to whole is difficult.					
3	High communication required with large number of worker.					
4	all tasks and communication cant performed on the internet because the company ideas or business will be unprotected					
5	As the complexity of the tasks is huge, planning and scheduling of the task is very critical to complete tasks on time.					
6	The majority solutions that provide by crowd worker are may not be relevant.					
7	Difficult to control the qualities of the work					
8	attractive payment or reward are required to attract and retain the skilled crowd					
9	There is lack of legal and regulatory framework which handles crowdsourcing in Ethiopia.					

**Part four: Questions designed to assess the opportunities and challenges of crowdsourcing for software companies (company which has not been adopting crowdsourcing)**

1. If your company has not been adopting crowdsourcing, indicate how you feel about the importance of crowdsourcing as requester using the following rating scale: 5=strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=strongly Disagree

Put “√” Mark in the appropriate column to signify the importance level of each item.

No.	Opportunities of crowdsourcing	1	2	3	4	5
1	To improve software quality.					
2	To get creative solutions.					
3	To accomplish tasks more quickly (to save time)					
4	To cost saving.					
5	To get resource from any geographical location.					
6	To get highly skillful Workers not available in the company at any time					
7	Crowdsourcing is easy to adopt.					
8	To Enhancement the relationship between the company and customers.					
9	To advert the company’s idea or service to broader private					
10	Complex tasks can be solved					
11	New works Intellectual property or copy right) is protected in crowdsourcing.					

2. If your company has not been adopting crowdsourcing as requester, indicate how you feel about the challenges of crowdsourcing using the following rating scale: 5=strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=strongly Disagree

Instruction: Put “√” Mark in the appropriate column to signify the importance level of each item

No.	Challenge of crowdsourcing	1	2	3	4	5
1	Complex and interdependent software development tasks are difficult to present clearly in to decomposed tasks for large group of people.					
2	Integrating decomposed software task in to whole is difficult.					
3	High communication required with large number of worker.					
4	all tasks and communication cant performed on the internet because the company ideas or business will be unprotected					
5	As the complexity of the tasks is huge, planning and scheduling of the task is very critical to complete tasks on time.					
6	The majority solutions that provide by crowd worker are may not be relevant.					
7	Difficult to control the qualities of the work					
8	attractive payment or reward are required to attract and retain the skilled crowd					
9	There is lack of legal and regulatory framework which handles crowdsourcing in Ethiopia.					

*Appendix c*

**Interview question  
Addis Ababa University  
College of Natural Science  
School of information science**

**Interview question to be answered by software companies owners**

**Introduction**

1. Can you tell about your role within the company?

**Crowdsourcing & Other alternatives**

2. Did you have awareness about the concept of crowdsourcing?
3. How did you become aware of the concept?
4. Do you post jobs for all to see ?
5. Which alternative did you choose to solve the problem?
6. What are the advantages of crowdsourcing
7. What are the disadvantages of crowdsourcing?

**Crowdsourcing process (if the company adopt crowdsourcing )**

8. What kind of platform did you use?
9. What are the different steps of the crowdsourcing process?
10. What were the incentives for the crowd to participate?
11. Was it a successful project and why?
12. How do you measure success in terms of crowdsourcing for the overall company?

**Future of crowdsourcing**

13. Do you think you are going to use crowdsourcing in the future?
14. Is crowdsourcing in your opinion an enabler for software companies?
15. What is in your opinion the future of the concept?
16. Would you like to raise anything related to crowdsourcing that I didn't raise in my questions?

**አዲስ አበባ ዩንቨርሲቲ**  
**የኢንፎርሜሽን ሳይንስ ትምህርት ክፍል**  
**የተፈጥሮ ሳይንስ ኮሌጅ**  
**ቃለ መጠይቅ**

**ቃለ መጠይቁ የሚመለከው በሶፍትዌር ኩባንያ ባለቤቶች ነው**

**ትውውቅ**

1. በኩባንያ ውስጥ ስላሉት ሃላፊነት ሊነግሩኝ ይችላሉ?

**ክራውድሶርሲን እና ሌሎች አማራጮች?**

- 2. ስለ ክራውድሶርሲን እውቀቱ አለት?
- 3. እዴት ስለ ክራውድሶርሲን ሊያቁ ቻሉ?
- 4. ስራዎችን ፖስት አድርገው ያውቃሉ ?
- 5. የትኛውን አማራጭ ተጠቅመውቃሉ ያውቃሉ ችግሮችን ለመፍታት?
- 6. የክራውድሶርሲን ጥቅም ምንድን ነው ብለው ያስባሉ ?
- 7. የክራውድሶርሲን ጉዳት ምንድን ነው ብለው ያስባሉ?

**ክራውድሶርሲን ሂደት (ኩባንያው ክራውድሶርሲንን የሚጠቀም ከሆነ)**

- 8. ምን አይነት ፕላትፎርም ተጠቅመው ያውቃሉ?
- 9. የክራውድሶርሲን የተለያዩ ሂደቶች ምንድን ናቸው?
- 10. ተሳታፊዎችን የሚነሳሳ ሽልማቶች ምንድን ናቸው?
- 11. ስኬታማ ፕሮጀክት ነበረ ወይ? ለምን?
- 12. ባጠቃላይ በካፓኒው ውስጥ ስኬትን እዴት ከክራውድሶርሲን ያዩታል ?

**ክራውድሶርሲን ወደፊት**

- 13. ወደፊት ክራውድሶርሲን የምትጠቀሙ ይመስሉታል?
- 14. ክራውድሶርሲን ለሶፍትዌር ካፓኒ ጠቃሚ ነው ብለው ያስባሉ?
- 15. ወደ ፊት ምን አይነት የክራውድ ሃሳብ ይኖራል ብለው ያስባሉ?
- 16. ማንኛውም ማንሳት የሚትፈልጉት ከክራውድሶርሲን የተያያዘ ሃሳብ እኔ ያላነሳሁት ጥያቄ ካለ?

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