Causal Analysis of Software Project Quality Management Challenges in Outsourced Agile Projects

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Abstract—Software project outsourcing (SPO) is one of the leading methods in software development. SPO is the practice of paying an outside organization to develop a software application or a software module instead of developing in-house. SPO is very cost effective and beneficial activity for companies. But by using SPO, there are risks of achieving quality of software for outsourced projects. Even in many cases, failure rate of outsourced project is higher than in-house developed projects.

The aim of this research was to perform causal analysis and identifying various challenges which affect the quality of an outsourced software project. In this paper we focused on service provider tasks and the processes to manage quality of partially outsourced module of the outsourced software project.

Interviews of key professionals and systematic literature review related to outsourced software agile project were conducted for the identification and mitigation of challenges to achieve successful outsource quality project.

Keywords—Critical challenges of quality management of agile software outsourced project, Quality Management of Agile outsourced software project, Software outsourced agile project, Software project outsourcing (SPO)

I. INTRODUCTION

Purpose of this research paper was to identify challenges of software quality management of outsourced software projects or its modules and its causal effect with recommended guide- lines to mitigate these challenges. Interviews of experienced professionals involved in software agile outsources projects were conducted.

There were two major perspectives to perform work:

- Software Quality Management challenges in outsource agile projects with the Vender Perspective
- Software Quality Management challenges in outsource agile projects with Software Development Service Provider Perspective

This work only focused on the Software Quality Management challenges and its causal effects on outsource agile project with respect to software development services. There were a number of studies already conducted regarding Software Quality Management challenges with vendor perspective but no research work yet performed to find out Software Quality Management challenges in outsource agile project. It may be due to its difficult nature of work and involvement of high complexity level.

Focus of this research was what challenges could be faced by software development Service Provider while outsourcing a project or component / module of software to Outsourcee organization and how to tackle these challenges.

Fig. 1 Scope of Research

II. THE MAJOR RESEARCH QUESTIONS OF THE STUDY

A. Research Question 1

Q.1 What are the critical factors to achieve quality in outsourcing software project?

Quality of outsource software projects can only be achieved if all possible quality factors are not only known but also adequate strategy has adopted to mitigate its associated risks. This research question has helped to find those factors that are important and highly influential on the quality of outsource project.

B. Research Question 2

Q.2 How quality of agile outsourced software project impacted due to low budget of software agile project?
Quality of Outsource Agile Project (OAP) and its budget has very critical relationship. Although there are other factors that can affect the quality of agile project but budget constraint also play major role in poor quality of agile software project. This research question has helped to find out effects of limited budget on quality of OAP.

C. Research Question 3
Q.3 How to assess potential outsourcee for agile outsource software project or its modules?

Quality of OAP can only be produced if software outsource service provider organization is capable of doing such job. Before assigning project and agreement it is very important to assess the potential vender among best venders available in market. This research question has helped to guide about assessment of potential outsourcee for agile outsource software project.

III. RESEARCH METHODOLOGY

Research aim was to explore, find out and perform causal analysis of the challenges of Quality management in OAP. Being qualitative research in nature, exploratory research methodology was used.

The interviews of key professionals involved in OAP and a detail systematic literature review were conducted with proposed solution.

A. Grounded Theory

According to Grounded Theory, coding is constantly looking at the link of data and concept logically in more than one ways [24].

i. Free Coding

By coding and seeing the linkage between diverse concepts and data, the deduction and induction makes easier to gain insight which is the core of explanatory research [24].

ii. Sorting

Sorting refers to as categorizing similar concepts and linkages for accurate conclusions and refinement of analysis results.

iii. Axial Coding

Axial Coding refers to set of procedures where data is put back together in new ways after open coding, by making connections between categories.

B. Research Process

C. Sources of Primary Data

The detail interviews of professionals involved in quality and software development of OAP and systematic literature review were conducted.
Focus on employees of different software companies involved in OAP. JCRs and publications were used for systematic literature review. Data was collected from all levels of quality management and software development arena e.g. Project managers, System analysts, Software Engineers and Quality Assurance (QA) Engineers. Direct personal meetings (where possible), voice call on Skype and cell phone were used to collect data.

D. Data Collection Method(s)

Quality is very important and sensitive issue for any project and organization. Collection of quality related data for research study is really a challenging and time consuming task. To collect success story of project is quite comfortable and routine work but in opposite situation, collection of failure or quality related data of outsourced software agile project is very difficult task. Software professionals involved in software development, project management and quality assurance at different levels (junior / senior) always remain busy with tight deadlines.

Convenient sampling Method was used to collect data for this research work. The advantage of this type of sampling is the availability and the quickness with which data can be gathered.

According to review paper: “How many qualitative interviews are enough?” of National Centre for Research Methods, S. E. Baker and R. Edwards suggests that there ought to be sample of 12 for qualitative research. This number gives them the experience of arranging and organized meetings, directing and incompletely deciphering these, and creating quotes for their papers. More than this number is by all accounts unrealistic inside of their standard time imperatives. For a more drawn out undertaking (a distinctions proposal, a two-semester course) they may expand that marginally, yet once in a while to more than 20 [15].

In order to perform this research work open ended questions were asked from 21 software professionals involving quality of OAP’s. These professionals were working at different levels and for various software outsourcing companies located in different countries of the world. Among 21 respondents, 40% were from managerial and senior positions in software production and quality assurance department, 40% were middle managers and 20% responders were senior / junior software engineer.

E. Limitations of the Study

Quality management of software project is dynamic and ongoing process. The research team tried to find out all challenges that can impact the quality of software outsource agile project and its recommendation. But due to rapid change of technologies and methodologies of OAP, quality challenges may vary.

IV. LITERATURE REVIEW

Managing and controlling quality of OAP has various challenges. It depends upon the used model and how it has to develop; in-house or outsourced. In-house Software Agile Development is suitable to develop quality project but it is very costly as compare to outsourced project. Outsourcing is a cost effective technique used by various organizations but it may cause to increased quality challenges to project’s final output. This research will explore and find out all possible challenges to OAP’s and guidelines to tackle them.

Causal Analysis of Software Project Quality Management Challenges in Outsourced Agile Projects

Figure 3 Venn diagram

There are three variables in research title that are

- Software Project Quality Management
- Outsourcing
- Agile Software Project

The Analysis of quality specific challenges are the tools and techniques for the desired output and therefore these were not made as part of the Venn diagram.

A. Software Project Quality Management

What precisely is software quality management? To address this inquiry it was required to operationally define the term "quality". ‘Quality’ can be termed as the attribute that is set to be achieved during the development of a software project to an extent that it qualifies to the expectations and needs of the end-user [10]. From a management point of view, quality is the extent to which an arrangement of intrinsic attributes satisfies pre-requisites.
Quality Management is the aggregate of all arranged methodical exercises and procedures for making, and guaranteeing quality [10].

ISO defines Quality as “The totality of elements and attributes of product or an administration that bear on its capacity to fulfill the expressed and suggested needs” [9].

A Quality Management System can be defined as an arrangement of facilitated exercises to direct and control an association with a specific end goal to consistently enhance the adequacy and productivity of its execution.

A Quality Management Process is an arrangement of systems conducted afterwards to guarantee that the deliverables created by a team are fit for goal [7].

The initiation of the Quality Management Process includes setting quality milestone with mutual agreement of clients. Software quality management applies these standards and best practices to the advancement, development, administration of software. Software quality management applies to project (e.g., guaranteeing that it meets prerequisites), forms (e.g., executing deformity recognition methods), projects (e.g., outlining quality) and individuals (e.g., advancing quality building abilities).

Software quality is a troublesome subject, on the grounds that there is no characterized software quality standard with goals and systems that apply to every product. Software quality has numerous aspects, for example, reliability, maintainability, security, well-being, and so forth. Indeed, cost is viewed as a quality property but when products are intended to be of minimal effort, they are discharged to the business sector with high after-deals cost. It is troublesome in light of the fact that there is no total level of quality [10].

B. Outsourcing

Software business tendency towards outsourcing is increasing day by day. One can say a practice used by different companies to reduce costs by transferring portions of work to outside suppliers rather than completing it internally [19].

Software outsourcing is a proven practice as a cost effective and efficient solution to the demand for new and specialized applications in today’s internet-based market place. There are numerous reasons for a product company to move towards outsourcing as a strategy. Some of them are to reduce cost, speed up development, complement internal staff competencies, achieve resource/scalability, etc. Statistics show that outsourcing continues to be a significant business strategy for application development [3].

The reasons organizations outsource their software projects or services are varied. Software are outsourced due to

- Cost economics
- Access to global expertise and talent pool

- To Tackle rapid technology change
- Poor chargeback systems for information systems services
- Emphasis on core competency
- Top management discomfort with technology
- Management innovation
- Management imitation
- Changing goals and objectives [12].

C. Agile Projects

The software development based on the ‘Agile Methodology’ was introduced in the twentieth century. This methodology involved the introduction of the concept of ‘agility’ during the process of software development. The term agility refers to: “responding to the proposed changes on a quick note in an efficient manner” [5].

Agile project outsourcing is combination of outsourcing and agility to get maximum speedy output with reduced cost.

The trends of Outsourcing software development and introducing Agile practices are not new. However, there is a growing emphasis on combining Outsourcing with Agile to achieve total greater combined benefits [13].

A detail research was performed on these key words but no comparative research work found. There were some researches which focused only one or two perspective of research separately and below are literature reviews of them.

D. Related Work

i. Monitoring the Quality of Outsourced Software

“Monitoring the Quality of Outsourced Software” by Tobias Kuipers, Joost Visser, Gerjon de Vries was focused to continue monitoring the quality of outsourced software projects. Managing the quality of outsource project has been challenging job. In this article authors focused on continuous monitoring throughout the life cycle of outsource project. This article was very good resource for this research. They argue outsourcing dilemma can be resolved by performing tool-assisted monitoring of the quality of outsourced software. Such software monitoring is a highly specialized activity that supports IT management by translating technical findings to actionable recommendations. To avoid the need for in-house technical know-how, this highly specialized activity of monitoring outsourced software can in turn be outsourced to a third, independent party. They not only explain the importance of quality of outsource software project but also proposed a framework to monitor. They proposed a framework to achieve quality of outsource project. In their framework they focused on Source code analysis, Scope, Deliverables, and Iterations [4].
They majorly focused on iteration and further divided it into nested three iterations of monitoring methodology. The shortest iteration was of one month but shorter and longer iteration were also used. The yearly iteration is optional and only when a significant part of software is being monitored. The divisions of iteration are Monthly, Quarterly, Annual iteration. They discussed these iterations in detail and explained about data are collected and entered in centralized repository. Different types of reports were generated to monitor and analyzed status, progress and quality of project. These reports were presented to IT Management together with recommendations about how to react to the findings.

The authors were very experienced in software outsourcing and tackling quality challenges. Being professionals they accept their framework at its incubation stage and will mature with passes of work. This article was very good research work and authors have depth knowledge of software engineering and outsourcing. They use diagrams to explain their outcomes and ideas. The article was very helpful to this research but has a number of limitations in his work. They only focused on quality of outsourcing software projects but this research focuses on agile software outsourcing project. Only monitoring is not good enough, there would be more challenges that are not yet explored and this team tried to find out those challenges and recommendations to mitigate its effect.

### ii. Agile software development methodology for medium and large projects

In “Agile software development methodology for medium and large projects” by M. Rizwan Jameel Qureshi, explained small agile software development methodology for medium and large project. He focused only on Extreme programming (XP), an agile methodology. In this article authors explained this methodology and explain how to use this technique for medium and large software project [1].

He explained different phases of XP model e.g. Project Planning Phase, Analysis and Risk Management Phase, Design and Development phase, Testing phase. They used different case studies to explain XP model for medium and large projects.

This article was very good and informative work to understand agile methodology on basic level. But this research article has focused only one type of agile methodology e.g. Extreme programming (XP) and had not even touch other types of agile methodologies like scrum and the quality issues of software outsourcing agile project. The paper can be used to understand the Extreme programming (XP) but cannot act as a base for research work this.

### iii. Critical Success Factors for Offshore Software Development Outsourcing Vendors: A Systematic Literature Review

The article “Critical Success Factors for Offshore Software Development Outsourcing Vendors: A Systematic Literature Review” by SiffatUllah Khan, Mahmood Niazi and Rahid Ahmad, was a good effort to find critical success factors for offshore software development outsourcing vendors. Offshore software development outsourcing is a modern business strategy for producing high quality software at low cost. They performed a detail systematic literature review to find out success factor of potential vendors for offshore software development. They came up with some success factors like cost-saving, skilled human resource, appropriate infrastructure and quality of product and services [14].

This research was a good work to explore success factors for selection of potential offshore vendors for client. Researcher used very simple and effective words to explain their work and outcome with full reference. This work helped in understanding effective factors on offshore software development outsourcing vendors but it is not fully focusing on this work. They have not much focused on quality of OAP and factors that affect its quality. They only focus at vendor's end but not on the services provider end.

### iv. Software Project Quality Management

The article “Software Project Quality Management” by KunalJamsutkar, VikiPatil and P. M. Chawan, was good effort to explain the software project quality management. They explained quality attainability with the level that a software project confirms the end user requirements and expectations; in other words it also means that a software project should meet its functional and non-functional specification. They have explained about what quality is? What is the quality management process? And how they will help to manage quality of software project? They also explored software quality management models, software quality factors and life cycle approach of software quality management. In short they have analyzed how to manage quality of software project and benefits of quality management [7].
In this research, authors used very simple and attractive method to explain quality management, effective factors, quality management process, and cost of quality and benefit of quality management. They have done good work but they only focused on quality management of software projects developed in-house. This article helped us to understand quality management but cannot be base of this research work since this research was performed for causal analysis of quality management challenges of outsource agile project.

v. A Framework for Agile Development in Outsourced Environments

The article “A Framework for Agile Development in Outsourced Environments” by Raghvinder S. Sangwan, Colin j. Neill and Phil Laplante was focused on agile development in outsourced environments. Authors explained very thoroughly the stages of life cycle for software development with standard methodology. They divided whole software development cycle on four significant stages that are inception, elaboration, operational capability and finally transition. These four stages can span over multiple iterations for agile process, each iteration end with executable release. He explained each phase by using detail flow diagram with all objectives, activities, deliverable and locations [25].

The method of writing and explaining the problem of author is very impressive and simple. He fully focused to explain and develop a framework for agile development in outsource environments. He has mentioned possible issues of collocation like language barrier, different cultures, team building and difficulties of managing projects at different location [25].

This article was a good resource to understand and used agile methodology in outsource distributed environment. Instead of focusing agile outsource project, authors only focused on distributed environment and its possible challenges. The scope of this article was only to focus offshoring or distributed environment and its possible challenges to manage during software product development. Whereas, aim of this research was to find challenges of quality management for agile outsource software project, causal analysis and recommend guidelines to mitigate the effects of quality challenges.

Although this article was a very good effort to design framework for agile project in distributed environment but due to change of scope, the article did not act as base for this research work.

vi. Agile Outsourcing of Software Development

The article “Agile Outsourcing of Software Development” by Aziz Ahmad Raiz was a very good effort to develop new agile methodology for outsource agile project. He had very clear understanding of outsourcing environment, advantages and disadvantages and risks associated with outsourcing. He admitted the risk management of software project in outsource environment is very difficult with respect to in-house developed software project. In outsourcing, different parties are involved with different interests and each has to protect his own interest while in-house software development, only one party is involved with one goal and interest [26].

The scope of this article was to develop new methodology to mitigate the associated risks with agile outsourcing. The authors proposed new methodology name as “interface base development (IBD)”. Author claimed that IBD can be used to simplify analysis and design of software development outsourcing with unifying view, architecture design, implementation and testing by using interfaces. One of the main advantages of IBD is reducing the redundant analysis and design work [26].

By providing number of examples of IBD and its comparison with Object oriented analysis and designed (OOA&D) authors recommended IBD as a suitable methodology for outsourcing of software development as well as for in-house software development. IBD will also help to solve the risks for both type of software development environment [26].

This was a very good article, which proposed new software development methodology for both outsourcing and in-house environment to mitigate the risks to achieve successful software project. The authors focused to develop new methodologies to mitigate the risks but has not paid any attention to identify the quality management challenges for agile outsource software project. Without identification and tackling quality management, it was very difficult to achieve the quality outsourced software agile project.

In this research, a detailed analysis has been performed and challenges have been found out for quality management of agile outsource software project and its causal effect with guide lines to tackle these challenges to achieve quality software outsource project.

V. ANALYSIS AND DISCUSSION

To find out challenges of Quality Management of Agile outsource software projects, their causal effects of challenges and how to tackle these challenges is very tough job. Outsourcer organization has to analyze accurate client requirements, scope and choose best software service provider organization for outsourced module or project. After selection of potential software service provider the most critical issue is, how to get quality software outsource project that will not only fulfill client’s functional and nonfunctional requirements but also works efficiently and effectively in actual client environment.

Every organization has set patterns and standards which they always follow to develop software project or module(s) of software agile project.
In-house software development is comparatively easy but expensive process as compare to agile outsource projects. Mostly organizations prefer to follow those tools and techniques which increase the profitability and performance. For any software project having a good profitability increases the risks to produce quality outsource project. Achieving maximum profit is very attractive goal which motivate organization to adopt outsource agile model to get software project or a module of it. But quality is also important so software outsourcer organization wants quality project output with low cost and maximized profit.

Software development is usually performed on software service provider’s end but outsourcer has to monitor and manage challenges that may cause the issues in quality of outsource agile project. Maximum quality issues are caused at the software service provider’s end but outsourcer should have knowledge about all those challenges and must have a clear plan to tackle them. In this research challenges of quality management of agile outsource software project are identified using Grounded Theory axial coding with categorization of interviews data and recommendations to address the challenges of quality.

A. Research Approach

Qualitative research approach helps to find challenges of Quality management of outsource agile software project. A productive open-ended questionnaire was prepared which focused to opt out maximum challenges. Convenient sampling technique was used to collect the interview because respondents of this questionnaire were professionals, having a tough working schedules and residing around the globe.

B. Questionnaire Creation and Analysis

“A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents”. [21]

There are two types of questionnaire used in research; one is open-ended and other one is close-ended. In close-ended questionnaire, respondent has to choose from available options while in open-ended questionnaire, interviewee reply via free text. The Open-ended questionnaire is recommended for qualitative research.

Questionnaire plays very important role in interviews and it should be reliable and valid. The questionnaire acts as a tool of collecting data and it should be authentic. The Interviews will be valueless if the questionnaire has relative questions, too many questions and/or incorrect ordering of questions [21].

The good questionnaire should be focused to get relative and important information. It should motivate interviewer to answer and questions should be in logical order. The flow of questions should be from general to specific [21].

C. Questionnaire Development

In order to develop valid and authentic questionnaire, a pilot-study was performed consisting of five interviews of software professional involved in quality management of software outsourced agile project. The study included personnel meetings with professionals after which an instrument was developed. Nine variables and three concepts were identified during pilot testing which helped the development of research questionnaire for interview data collection.

Pilot study gave rise to important variables and concepts to focus with regard to quality outcome for outsourced software modules. The written and used for detail interview of software professionals involving agile outsource software project.

D. Interviews for Data Collection

For this research work, interviews of professionals involved in agile outsource software projects were conducted. Software experts from all over the world like Pakistan, UAE, Australia, Ireland, Canada and New Zealand were interviewed for this research work on Skype and Cell phones. Interviews of professionals were conducted till saturation of ideas reached and repetition of concepts started.

This questionnaire included key questions which helped and motivate software professionals to explain quality of outsource project easily. There were total 12 questions that covered all the major areas of research questions and aspects of challenges for quality management of agile outsource projects and their relationship among each other.

Software engineering is global profession in the world and software professionals use standard approach to achieve global standardized quality of agile outsource project. For this research, software professionals from different countries were interviewed and very valuable information was collected from their responses.
E. Analysis of Interviews by using Grounded Theory

The research work is qualitative in nature so interviews of key professionals involving quality management of agile outsource software project were conducted by using open ended questionnaire. All interviews were voice recorded and were imported in QSR Nvivo (Version 8) software for analysis.

Data collection and open coding process was performed in parallel and interviews were conducted and categories were developed. All interviews were listened very carefully and open-coding was performed direct in QSR Nvivo 8.

The memos regarding any new idea, codes and relationship with other codes were written throughout the process [22]. These memos were very helping for developing theory.

Open coding is about to writing anything about any idea from respondent interview [22]. After certain process, core category and main issue appeared via frequency of interviewee. Now coding of core category and related categories were started only. By sorting memos and found theoretical codes which helped to organized important and essential codes. A research model for this work was generated via QSR Nvivo 8.

F. Challenges

After conducting detail interviews, following challenges regarding quality management of outsource agile projects were found.

i. Selection of potential software project outsourcing service provider organization

Selection of reliable and experienced software outsourcing organization is very important for quality of software outsource agile projects. After detail analysis the following factors were explored to choose good software project outsourcing service provider organization for quality agile outsource project.

One very senior analyst and project lead said:

---“In order to measure the capacity of a service provider for outsourcing, one has to consider that the service provider has the same skill set as of the project.

---“In our organization, we focus on continuous monitoring of outsource module and perform regular communication or some time excessive” (Sharp Technologies).

Regular and effective communication plays an important role for build, its testing and integration. Any communication gap may cause quality issues in the agile outsource project.

--- “There should be comprehensive acceptability test in a real environment with actual data and users load” (Innokat).

--- “There should be planned and regular meetings with Outsource to discuss issues and monitor progress of the project” (Shirazi Trading company).

The selection of potential outsource is very important for achieving quality outsource agile software project.

--- “We mostly give more value for nature and size of already completed agile projects of software project services provider with confirmation that outsource project type is the core competency of the organization and what’s the feedback of customers are?” (CSG International)

Below are parameters for selection of potential outsource for outsourced agile software projects.

- Similar Project Experience
- Core Competency
- Desired Skills Set
- Customer Reviews
- CMMI Level

ii. Continuous Monitoring

In agile outsource project, deadline is always shorter than traditional software models. One professional commented about continuous monitoring as:

--- “In our organization, we focus on continuous monitoring of outsource module and perform regular communication or some time excessive” (Sharp Technologies).

Regular and effective communication plays an important role for build, its testing and integration. Any communication gap may cause quality issues in the agile outsource project.

A senior project manager explained the importance of Acceptability Testing as a final quality assurance test in real environment.

--- “There should be comprehensive acceptability test in a real environment with actual data and users load” (Innokat).

--- “There should be planned and regular meetings with Outsource to discuss issues and monitor progress of the project” (Shirazi Trading company).

Below are child factors of continuous monitoring

- Regular Communication
- Acceptability Testing as Real environment Testing
- Regular Meeting With Outsource
iii. Contract Nature

After selection of potential outsource the next most important step is to legally bound software service provider organization to deliver as per contract with agreed standard by following recommended procedures and model. One senior Project manager explains this as:
--- “We focus on comprehensive agreement with a software service provider organization, but focus on Agreed Scope, documentation of code and bound them to follow agile process model” (InnoKAT).

The scope of the project plays important role in cost, on time delivery and quality of project. The project should have clear and accurately defined scope provided to software project outsourcing service provider organization as it provides a base for measuring of quality while handing over the outsourced project.

Another very senior software professional explain as below:
---“There should be agreed and signed requirement with clear scope of the project to obtain quality project” (Orbis Technical Services).

Another sr. software engineer said:
---“Outsourcee should legally bind to follow agreed agile process model to deliver quality software project” (Next Gen Technologies).

After delivery of outsourced software agile project, it is very important that output code should be properly documented.

A senior professional explain this as below:
--- “Proper documentation of the outsourced agile software project reduces time to understand and to perform changes in later stages” (Valentia Technologies).

iv. Source Code Access

Unable to access and view the code of outsourcing agile project is another major challenge to monitor and control the quality of project.

a) Coding Standard

Using good quality coding standards is a prerequisite for developing the quality of project. No extra hardware can replaced deficiency of poor code and bad logic. One senior professional explain this as
---“Software project outsourcing service provider organization needs to follow same international quality coding standard which are being followed by outsourcer organization” (InnoKAT).

Another software engineer comment as
--- “Source code access enable outsourcer to verify either Outsourcer is following same agreed coding standard or not” (Next Gen Tech).

b) Low Budgets with respect to scope of project

Software project outsourcing service provider organization(s) with experienced professional employees use to charge more than un-experienced organization(s). A senior software professional share his view as:
--- “Quality software project required enough budgets, even some bonus should be offer to motivate outsourcee to deliver highly quality project on time” (Power Object)

So budget of outsourcing project should be compatible with project scope else it is nearly impossible to get quality output.

c) Short Deadlines with respect to scope of project

Agile projects are completed within very short deadline but this deadline should be suitable with respect to scope of work to produce quality project.

A Senior Team Lead explain this
---“Adequate time required to produce quality software project. Our all projects that have suitable time with respect to scope were more successful than others” (F3 Technologies).

d) Release base Code Review and Testing

With each new release of module/project, it should be properly reviewed, integrated and tested in actual environment so that quality output can be achieved.

A Senior Professional explain release base code review as
--- “We always performed release base review of code and testing to monitor the quality of project” (CSG International)

e) Online Version Control System

Source code access will be only possible if outsourcer configure project on some online (LAN / WAN) version control system like Team Foundation System).

A very senior professional and project lead said:
--- “Team Foundation System (TFS) is used as version control system for outsourcing agile project and it fulfills all need to manage quality of agile projects, right from analysis to final handover” (F3 Technologies).

f) Integration Management

There should exist clearly defined guidelines which create standards for outsourcing service provider organization. Data communication protocol between projects and outsourced module should be clearly defined. One of very senior professional explain:
--- “Adequate time required to produce quality source code access enable outsourcer to verify either Outsourcer is following same agreed coding standard or not” (CSG International).

a) Compatible Technologies

Two projects or modules can only be able to integrate if both are using compatible technologies. A software professional said:
--- “It will be best to use same technologies & programming standard but if different technologies are not compatible it will surely affects the quality of project or some time may cause failure of project” (Valentia Technologies).
b) Change Trace

In order to achieve quality outsource project, it should be defined and agreed who has power to initiate change and it should be properly communicated to all concerned organization. A senior software engineer comment on this issue he said:

--- “In our organization we properly take care of change initiation and its tractability. We always monitor the impact of that change on all modules of project” (TEO).

There should be defined role and area where software project outsourcing service provider organization can perform changes

c) Mismatch and unreliable schema

When two or more organizations working on different modules of same project simultaneously and these two modules have to communicate with each other then there should be a defined schema. One software engineer explain this as:

--- “Without agreed schema it is not possible to communicate among modules of project” (SNL).

In some cases, schema on both side are same but still both modules are unable to communicate successfully. A senior software professional comments as:

--- “Integration of modules should be tested properly in real environment. Sometime schema is same but all possible input from other end are not properly handled which may cause to crash the system” (Sharp Technologies).

Any event and action should be logged to trace and understand the issue.

G. Relationship among discussed challenges
i. Positively Effect To

Below are the challenges of agile outsourced software projects which “Positively Effect To” between each other. If one challenge is tackled properly it will help and positively support to tackle other one. These are

a) Potential Outsource and Integration Management
b) Integration Management and Contract Nature
c) Continuous Monitoring and Integration Management
d) Source Code Access and Continuous Monitoring

Below is table with frequency of respondents on each category or challenge.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Challenges / Categories</th>
<th>Frequency</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Lack of Source Code Access</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>Compatible Technologies</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>Similar Project Experience</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>Agreed scope</td>
<td>17</td>
</tr>
<tr>
<td>5</td>
<td>Integration Management challenges</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>Release base Code Review and Testing</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>Online/Remote Version Control System</td>
<td>15</td>
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<td>8</td>
<td>Coding Standard</td>
<td>15</td>
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<tr>
<td>9</td>
<td>Continues Monitoring Challenges</td>
<td>15</td>
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VI. CAUSAL ANALYSIS OF QUALITY CHALLENGES OF OUTSOURCE AGILE PROJECT

The causal analysis of quality management challenges of agile outsource software project has been performed by using Ishikawa/ Fishbone Diagram. Ishikawa diagram is very helpful to perform causal or root cause analysis. There are five challenges or causes of agile outsource software projects and each cause has further sub-causes. The first and important cause is “Lack of source code access”. Currently after completion of milestone or project, source code is handed over first time to outsourcer but during project development there is no way to view and review source code. Without source code access and control, outsourcer is completely blind and he has to rely on outsourcee feedback. There is no way to monitor and find out what is actually happening and how many resources are working on project? Either committed software professionals are working on project or not?

There are three sub-causes of this first challenge that are “lack of using version control system”, “Release base code review and Testing” and “Coding Standard”. Currently version control system like Team Foundation Server (TFS) or Visual Source safe etc. is only used for in-house development. The “Coding standard” has further two more causes that are:

• **Short Deadline with respect to scope of project**

Agile methodology is used for rapid and fast development of project but in order to produce the best quality of software project, there should be adequate deadlines with respect to the scope of project. Very short deadlines with respect to scope of project is one of the root cause of bad coding standard and which further effect the overall quality of software project.

• **Low Budgets with respect to scope of project**

Experience and senior software developers can write standard code as compare to junior resource where as senior software engineers are expensive than junior software developers. Senior professionals can only be appointed on those projects which have adequate budgets with respect to scope of project. Extraordinary low budget with respect to scope of project is one the cause of bad coding lead to major quality challenge of outsource software agile project.

The lack of desired “Continuous Analysis” of agile outsource software project is second major root cause of poor quality management of agile outsourced software project. Achieving the best quality project without continuous monitoring is nearly impossible.

The cause “Continuous Monitoring” has further three sub causes that are “Regular Meeting with outsourcee”, “Regular communication with outsourcee technical team” and “Acceptability Testing as Real environment Testing”. There are two different levels for communication and interaction between outsourcer and outsourcee, one is management level and other is technical level. Communication gap at any level may cause quality risk for agile outsource software project.

The third sub-cause of continuous monitoring plays very vital role for quality of agile outsource project. Mostly acceptability test of agile outsource project is performed in outsourcer environment and it is possible a software work properly in testing environment at outsourcer premises but may fail with actual data and users load in real environment.

The “Integration Management” is next major root cause of quality management of agile outsource project. To obtain quality outsourced software project or module from outsourcee is comparatively easier than proper integration of outsourced module or project with in-house developed project. There are three further sub causes of integration management challenge that are “Compatible Technologies”, “Mismatch and unreliable schema” and “Change Trace”.

Integration of agile outsource software project or module is only possible if it is compatible with outsourcer’s in-house developed project.
After compatibility of outsource module another quality challenge is using matched and reliable schema. Mismatch and unreliable schema may cause to crash the software application. The last sub cause of integration management is lack of “Change Trace” and its proper logging which may cause serious threat to quality of software outsource project.

The next major and second last cause that affect the quality management agile outsource project is “Potential Vendor” or potential outsourcee. The software quality project can only produce by a software provider outsource provider if it has capability of doing such job. If potential vendor has been selected it will help to tackle other causes as well. There are five sub causes of this cause that are “Similar project Experience”, “Required Skills”, “Core Competency”, “Customer Review” and “CMMI Level / ISO Certification”.

The outsourcee will consider potential if he has required and matched skills set as per need of outsource software agile project. Secondly it must have past experience of doing similar nature of projects with satisfied customer’s reference and the outsourced project’s nature should be its core competency. This may cause much better if it follows some international standard like ISO or it has achieve minimum CMMI level 2.

The “Contract Nature” between outsource and outsourcee is last but not least cause of agile outsource software project. Contract nature should be as per need of outsource project and it is the only way to legally bound outsourcee to deliver quality software agile project as per agreed terms and conditions. There are three sub causes of “contract nature” that are “Agreed scope”, “Documentation of Code” and “Strictly Follow Agile Process Model”.

VII. FINDINGS, CONCLUSIONS, RECOMMENDATIONS AND FUTURE WORK

A. Findings

Software outsourcing has become a routine and preferred way to get required software. Managing quality of these projects is very tough job for both vendor and service provider. Quality is a continuous process and it has to manage, monitor and control from the first phase of software engineering till the handing over or deployment phase. Each phase and module of software agile project is critical for quality and success of project. It is not possible that one phase or module has quality loophole and the OAP is being considered as quality project.

After performing interview of professionals involved in quality management of outsourced agile project and literature review, below are the findings for research work “Causal Analysis of Software Project Quality Management Challenges in Outsourced Agile Projects” that are

i. Lack of similar project experience of software project outsourcing service provider organization
ii. Communication Gap
iii. Ambiguous project analysis and scope
iv. Lack of following of international Coding Standards or agreed defined standards
v. Integration Management Challenges
vi. Unable to access project code for review after each agile release
vii. Unmatched and unreliable schema for communication among modules / projects
viii. Bad coding quality and logics
ix. Short and inadequate Deadlines with respect to scope of project
x. Small or incompatible budget of project with respect to scope of project
xi. Lack of detail Quality assurance and automated testing before acceptability of project.

B. Conclusions

i. Source Code Access or Remote/Online Version Control software should be used for outsourcee. So far it is only used in in-house software development.
ii. Monitor actual resources working on project by using Version Control software.
iii. Agile software outsource projects have number of quality challenges but still it is very helpful and effective way to achieve quality software project with less cost.

C. Recommendations

Software project outsourcing service provider organization should have similar project Experience in his portfolio
Selection of potential software outsourcing organization for agile project is very important and challenging job. If service provider organization is appropriate for outsource project then it is very helpful to get quality project. Due to agile nature of project potential service provider must have experience in few projects of similar nature to get maximum quality of project delivered on time and budget.

Regular Communication

There should not be a communication gap between vendor and software service provider. Communication and log of communication play important role. Email, for written communication and Skype (with voice recording plug in) or similar tool should be used for voice communication and this could be very helpful in case of conflict on quality and requirement issues.

Correct Analysis and Well defined Scope with signature of both end

Detail and well defined analysis act as base for the scope and quality of software outsource agile project and helpful to maintain quality of software.

Use of proper coding standards

The work of Software Service Provider Company will be presented as Outsourcer Company. Code standards should be followed as per international standards. Proper commenting should be used for any complex work, name of variable and methods should be self-explanatory. Libraries, classes and methods should be declared properly. Variables and methods should be declared properly. Libraries, classes and methods should be used to avoid the repetition of code.

Proper Integration Management

In case of possible need of integration of modules for outsource agile software project, all module should be compatible to each other. Quality of outsource module also depends upon compatibility of outsource modules and integration management. There are some tools and plugins that help to perform integration.

Full access of outsource project code

Outsourcer should have full control and access to actual code of project. It is highly recommended to configure some on-line source code management like Team Foundation Server (TFS) and assign rights to software services provider organization.

Well defined schema for communication among different modules of outsource project

Sometime real time data synchronization treats quality of outsource modules. It is highly important to have same and well defined schema for data synchronization.

For partial outsource module of agile outsource project, if a module of database was design by outsourcer then it will help for real time quality data synchronization. Later on, if module causes trouble then only front end is needed to troubleshoot or developed again.

Quality of Code

Bad code cannot be covered with extra and powerful hardware. Quality of outsourced software has depended on quality and good logic of software code. It is highly recommended that experienced developer should code for project.

Deadline should be appropriate with respect to scope of project

Outsourced agile project requires appropriate time to develop and test the project. Inappropriate short deadline is one of major issue of low quality project.

Appropriate budgets for project

Quality outsource agile project is obtained with experienced software developers but due to small budget junior developer are hired by software outsource services provider to complete outsource project. It is recommended to allocate appropriate budget for experienced developers to get a quality product.

Again Quality Assurance in real environment as Acceptability testing

After completion of OAP, it is handed over to outsourcer. At this stage, a detail Quality Assurance (QA) should be performed by outsourcer. The outsourced agile software should be as per provided functional and no-functional requirements with full stability. Before signing acceptability report, this outsource software should be tested on actual environment or at least on automated testing tool simulating actual load testing. Sometime software works with limited concurrent users but fails in actual situation.

Contract

Contract of service acquiring organization and outsource Service provider play very important role. It is the contract that legally bound service provider organization to handover decided quality deliverable on time.

VIII. FUTURE WORK

Software outsourced agile project's quality management is dynamic and ongoing process. Challenges of Quality management increased and changed due to rapid changes in software project management techniques and technologies.
A future work on this research might be to perform a detailed study and analysis of all agile models and recommend the most suitable agile process model, which if followed strictly, will help to get quality software agile outsource project.

REFERENCES
[22] Gorra,“An analysis of the relationship between individuals perceptions of privacy and mobile phone location data - a grounded theory study”, Leeds Metropolitan University, pp. 87

BIBLIOGRAPHY
K. Abdul Wahid, K. SifatUllah,”Critical challenges in execution of offshore outsourcing contract from perspective: A systematic literature review”, IEEE, 2014