

A Study on Continuous Delivery process: A Thesis Proposal

Group 03

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GROUP MEMBER'S PARTICIPATION

The group members participated in Literature Review, Identifying the Gap, Research Design and Report Writing with the following amount of involvement.

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Literature Review	35%	35%	30%
Identifying Research Gap	35%	35%	30%
Research Design	35%	35%	30%
Report Writing	35%	35%	30%

Abstract- As implementation of Continuous Delivery (CD) has become a tougher task, is critically acclaimed and has become popular due to its benefits. In this paper we present literature review on the topic “Continuous Delivery”, i.e. finding out the challenges faced in the implementation of CD. We also present the research method to be used in our research thesis proposal. This paper represents extended thesis proposal for identifying the challenges faced in the implementation of Continuous Delivery. The expected result of the survey and future research in this area was also conferred at the end of the paper.

Keywords- *Continuous Delivery, Continuous Integration, Continuous deployment, automated testing, social testing, software engineering, software delivery, deployability, agile software development, Dev Ops, release engineering, Jenkins, software architecture, software reliability.*

INTRODUCTION

Developing a software and releasing it to the client's is often risky, painful and time-consuming. Software value is realised when it is delivered but not when it is being developed. Users, customers and other stakeholders related to software development process expect to get quick responses to changing demands and occurring issues. Eventually the goal of every

software development organisation is to meet the expectation of their customers by generating a valuable software through continuous delivery process.

Continuous delivery (CD) is a software development process which is based on release management. A software can be released anytime while building it. CD is an extension to continuous integration process which consists of set of workflows for automation of build and test cases [1]. CD is one concept where it allows frequent development of software releases while maintaining high quality of the software [2]. Investment on CD is increasing due to the benefits associated with it “reliable releases, increase in the product quality and productivity, accelerated time to market and better customer satisfaction” [3].

To enhance the CD process many measures have been investigated: Tests automation, intense team collaboration, configuration management, deployment automation and good team culture [4].

To reduce the risk of software deployments while releasing the software at high speed, CD introduces a deployment life cycle. Changes made in software life cycle can be implemented at any stage of pipeline. In the deployment life cycle first, every part of the process of building, testing, developing and production in environment. Secondly, the feedback is improved by identifying the problems and resolving them in the early stages. Finally, the teams may deploy and release all the versions of the software in any environment through a fully automated process [5].

Continuous delivery, which is also known as agile delivery ensures that system behaves as required before categorizing it as ‘release candidates’ [5]. To escalate the benefits of CD, besides gathering the customer requirements and etiquette we must also ensure the customer involvement. Customer involvement indicates customer's participation in the software development process, which reduces the development costs and increases the performance of the product [6].

Through continuous delivery we can represent some challenges for software test teams as there is continuous introduction of new features and feedback from customers [7].

Continuous delivery promises to release valuable software continuously to customers, where they can

easily rely on the product [3]. Through continuous delivery is a development practice where the functionality is continuously deployed to customer environment, where by utilizing continuous delivery we can shorten feedback cycles, increase the reliability of new versions and reduce the amount of resources required for deploying and testing new releases [8]. Continuous delivery supports the business needs of online world, but it also increases quality issues and unwanted side effects [9].

Based on the literature review, some research was done on continuous delivery, but challenges faced by CD in its implementations are not mentioned. Thus the goal of our research is to find the challenges faced during implementing continuous delivery process.

BACKGROUND

Continuous delivery is the present hot topic in the software industry, which has gained lot of attention throughout the globe, which made us choose this topic. In paper [7], authors express their concern over the Small Medium Enterprises in the adoption of continuous delivery. In paper [6], he states that it is important to understand customers' requirements and behaviours for building successful software products and services. In paper [10], the author describes the importance to architect for CD, depict the ramifications of architecting for CD and the various challenges associated with it. In paper [3], author explains why Paddy Power adopted CD and by describing the capability of CD, by even mentioning its benefits and challenges. In paper [9], authors described about the usage of automated testing in continuous delivery pipeline of an Austrian online business company. In paper [11], author illustrates about how Jenkins evolved from pure Continuous Integration platform to Continuous Delivery. In paper [12], authors mentioned about Continuous Delivery, so that other can try avoiding mistakes made by them and deploy their teams more frequently. In paper [13], authors tried implementing Continuous Delivery framework for smart X-mini Iot-Cloud Playground. In paper [14], authors tried introducing Rugby, which is based on Continuous delivery and event based releases. In paper [8], authors want to determine the major requirements, problems and key factors in applying continuous delivery in B2B environment, extending the development process and adopting continuous delivery. In paper [15], authors goal is to address the need for systematically handling and establishing suitable application environments as building blocks for continuous delivery pipelines. In paper [1], a multi-purpose project was structured and continuous delivery was incorporated into this project

course similar to project-based organisation. In paper [16], authors tried to address the issues in the industrial project, tailoring Rugby release management workflow was introduced which was extended by splitting it into four activities this allows the project managers to choose the solution which fits their project environment. In this paper, development process of mobile applications with respect to team size and project duration was analysed. In paper [17], authors tried to evaluate the hypothesis that architecture gives to achieve continuous delivery and deployment goals. In paper [4], the authors have tackled the problem of creating a repetitive and risk-free continuous development process by creating a system dynamics model (SD). Author uses agile software development to implement it. In paper [2], the authors have suggested the adoption of the concept of continuous delivery into the software defined networking world. In paper [18], authors proposed about a framework that delivers the optimal test time assignment per chip in order to minimize the delay defect escape rate. In paper [19], authors were interested in investigating the benefits gained from implementing a completely continuous delivery. In paper [20], author have described a framework for the continuous delivery of mission critical network services. In paper [21], authors have experimented with continuous delivery for two years, for overcoming the setbacks in continuous delivery. We were motivated by the above mentioned articles, so we tried were interested in finding out the challenges faced in implementation of Continuous Delivery.

LITERATURE REVIEW

Literature Review has been done using the database Scopus by using the search string "Continuous Delivery", where articles were restricted to the topics related to Computer Science. The search has resulted in 105 documents, of which 20 were selected for our literature study. Of the 20 papers, 14 papers are from IEEE Xplore, 3 are from Spring Link and 3 are from ACM Digital Library. These articles were selected by reading the title and the abstract majorly, but sometimes whole context was considered as the criteria for selection.

Following points were considered in writing the review

- What is the main point of the article?
- How is the author arguing for this point?
- What is the line of argumentation?
- Research method used in the article
- In what way or ways does the article relate to other research?

- How does the author argue for the relevance of the research?
- Reason for selecting this article for our research?

Inclusion and exclusion criteria:

Papers are short-listed by using the following inclusion and exclusion criteria:

- Papers published from 2005 are considered.
- All the papers in English Language are considered.
- Due to time constraint, papers that were to be ordered or bought are neglected.

A small review of selected articles, with the above mentioned points is written below:

Review of Article 1

In paper [7], Authors main concern is the adoption of continuous delivery by SMEs. They have mentioned about the challenges which software test teams face due to CD because of continuous introduction of new features and feedback from customers. To keep in pace with large enterprises solution providers, SMEs have adopted continuous delivery to reduce the software delivery cycle. The main aim of this article is to examine the role of the customer in generation of field effects, i.e. taking inputs from customers in rectifying the defects found by them and produce a better quality product through their skill. Authors mentioned that Facebook, Google and Netflix are the sources for word-of-mouth marketing. According to authors, conducting programs like big bounty helps in finding defects in the product, before it is being exploited by general user base. Research method used by authors in this article is case study. Authors examined data set from a large enterprise. On conducting the research, authors found that customer was quite adept at minor functional defects and supports earlier work particularly in the gaps between in-house software testing and customer usage. As this article is about the adoption of CD in SMEs, which is related to our research topic CD and this made us choose this article.

Review of Article 2

In paper [6] Authors state in the article that it is essential during the development process to understand customers' requirements and behaviours for building a successful software products and services. According to authors in this paper, customer involvement refers to the process by which end users or customer actively or unintentionally become part of any stage of the software development life cycle. Research method followed by authors in the article is

Systematic Literature Review, followed by the usage of descriptive statistics and thematic analysis for answering the research questions. Their motive of the research is to summarise the background on customer involvement in CD. Authors have found from their studies that scientific rigor of the studies was lower than their industrial relevance, which could show that the field has the future scope. On conducting the research, authors have identified the gap between the advantages of involving customer in CD and the real world utilisation of existing knowledge. As our study is about continuous delivery and article all about that which led us to choose this article.

Review of Article 3

Author through this paper [10] has tried explaining the need to architect for CD, describe the implications of architecture for CD and talk about the challenges it creates. Research method employed in this article is experimentation. Author has tried implementing it in Paddy Power (large bookmarking company) for the last two years, where 22 software applications were moved to CD. With this author observed that this movement has created new context for architecting the software applications and could context in terms of its essential practices and principles. On conducting the research, author made an observation that for effectively practicing CD, these applications should meet a set of architecturally significant requirements. According to the author, his research can invoke several other people to perform several other research activities on this increasingly important topic. This paper is based on architecting for CD, which is well within our research, which lead into choose this as one of our 15 articles.

Review of Article 4

In this paper [3], Author wants to convey through his article by explaining the reason Paddy Power adopted CD. He also describes resulting CD capability and report its benefits and challenges involved. These can explain the need for adopting CD and identifying the challenges that can provide researcher with the valuable input for developer through this agenda. Research method used in this article is experimentation. On conducting the research, author has observed 6 benefits and organisational, technical and process challenges. They had moved 20 applications to CD, through which "accelerated time to market, building the right product, improving the productivity and efficiency, reliable releases, improving the product quality and improving customers' satisfaction" were the benefits observed. The author would also like to address the challenges

by having a close collaboration with researchers and companies, so that others can also benefit through this. As our study is on CD and this article is based on CD, which has made us select this article.

Review of Article 5

In paper [9], author has described about the usage of automated testing in the continuous delivery pipeline of an Austrian online business company which allows sports betting, online gaming and entertainment services. Authors also illustrated the complex technical and organizational challenges involved. Authors had also summarized their learnings from six-year of their experience in the build and maintenance of a CD pipeline. The research method employed is case study on an Austrian online business company which has about 250 employees that includes 60 people in IT. On performing the research, there are various lessons learned in establishing the pipeline and operating the continuous delivery pipeline. Ensure management commitment, take collective responsibility for the pipeline, establish test environment management, improve testability and manage test data provisions were the various lessons learned by the authors in establishing the pipeline. Define the ownership of acceptance tests, acceptance tests should not compensate for missing unit tests, insert in the maintenance of automated tests, combine automated and manual testing were the various lessons learned by authors in operating the pipeline. Initially, according to the authors their main purpose of the continuous delivery pipeline was to get the features of the software system ready for the user acceptance testing in the best possible quality. This article is very much related to our research topic, which made us select this article.

Review of Article 6

In paper [11], author illustrates about how Jenkins evolved from pure Continuous Integration platform to Continuous Delivery, embracing the new design tendency where not only the build but also the release and the delivery process of the product is automated. Authors claim that the goals of his paper is to introduce the challenges that are yet to be solved for strengthen Jenkin tracking capabilities. Research method used in this article is experimentation. On performing the research, author has identified versioning of continuously shippable artefacts and tracking of the build environment as the challenges. According to the author, CD pipeline required the implementation of new features in Jenkins with the objective of facilitating the creation of complex workflow, allowing the traceability reducing the time to market

and improving the productivity the Notification Plugin and the Workflow Engine Plugin. As this article is related to our research topic CD, this made us choose this topic.

Review of Article 7

In paper [12], authors described their journey to CD with the aim that others can learn from the mistakes and deploy their teams more frequently. Their article presented the experiences in moving from an eight-week release cadence to CD. They had put forward their views on the transition by describing and contrasting in business and engineering perspective, by providing the motivation for why and based on their observation how to adopt CD in other teams. Experimentation is the research method employed by them. On conducting the research, authors could learn something from experiments and something from pain. Tests, gates and checks are there for a reason and the ability to release quickly doesn't mean to rush, is one of the important lesson learned by the author. Work life balance, things to do for moving fast, on boarding, livelihood, speed is difficult, must trust tests, in some cases pain gets things done, transparency and managing stakeholders are the other lessons learned by the author through this experiment. Following lines from the author, "It is not free, and it is not easy, but the journey towards continuous delivery will result in the best of class engineering discipline and velocity," made us select this article for the report.

Review of Article 8

In paper [13], authors have tried to bring in their initial knowledge on deploying an experimental CD framework for smart X-mini IoT-Cloud Playground. According to authors, the smart challenge of IOT-based services is required for multiplying the profits with the Big Data analytics. In this paper, authors focused on Docker container based application development. Research method employed in this article is experimentation. On performing the research, authors could get the output of Jenkin Server, which shows Docker image, and it also depicts Docker remote API server, which is running as an Open stack instance. Authors, through this experiment could verify only the continuous integration part by leaving the CD portion for the future work. As this topic is well within our research topic which made us selecting the article for the report.

Review of Article 9

In this paper [14], the authors introduced an agile process model: Rugby which is based on continuous

delivery and event-based releases. Rugby is a light weighted methodology which helps in developing and releasing rapid prototypes. An experiment was conducted using this model in two large capstone courses in universities, which were multi-project courses with industry partners. In 2012 they had 11 projects whereas in 2013 they had 10 projects both had 100 participants. Online questionnaire, a retrospective and personal interviews were also conducted and metrics to measure the effect of Rugby's release management and feedback workflows were also defined. Executable prototypes were introduced to communicate their team status in less time and understand the status of the projects better. The results of the experiment showed the rapid delivery and increase on number of releases.

Review of Article 10

The aim of this paper [8] is to determine the major requirements, problems and key factors of success in applying continuous delivery in B2B environment, extending the development process and adopting continuous delivery. A case study is conducted which explains how continuous delivery is operated in B2B domain. In this case study two research questions were formulated and were answered by conducting interviews, and thorough understanding from available literature study. Units under the study are two teams within the case company and developed software products of these two teams. A total of 12 participants were interviewed and are divided as 6 in each team. Template analysis was used for data analysis, which thematically analyses the qualitative data. The results are calculated by analysing the answers and are categorized into three areas: Technical, procedural and customer challenges in continuous delivery. This study was motivated due to lack of studies in continuous delivery in operating the B2B domain. continuous delivery can solve problems like long feedback cycles, low reliability in new versions, human error factors and resources required for deploying and testing new releases. This article explains the benefits of continuous delivery related to many business problems which made us to choose this article.

Review of Article 11

In this paper [15], the goal is to address the need for systematically handling and establishing suitable application environments as building blocks for continuous delivery pipelines. Continuous delivery pipelines are established based on application environment requirements (AER) and application environment topologies (AET). A web shop

application is used as an example to implement Continuous delivery pipelines. The authors proposed a concept of application environment requirements, formalizing predicate logics allowed in defining the mapping between AET'S and AER's and usage of knowledge base in combination with resolution process with distinct tasks, which focused on deriving suitable application environment by diverse environment preferences. The point of argument was to use AER's and knowledge base which help in application migration. Therefore, this helped us in better understanding of continuous delivery pipeline which made us to select this article.

Review of Article 12

In this paper [1], A Multi-customer course was structured and Continuous delivery was incorporated into this project course similar to a project-based organization. For better understanding of CD, 4 questions were addressed. A workflow based deployment pipeline was introduced and tools like JIRA, Stash, Bamboo, Hockey app was used to implement the workflow. This project course was conducted in 2013 and in participants around 75% of the students were graduates while other 25% were undergraduates. The students got to work with customers of 10 software projects with real industry partners and solve the real problems within a semester deadline. Mainly three types of teaching methods were used for knowledge transfer i.e., cross-project team, lecture and tutorials. For evaluation online survey and personal interviews were conducted which was answered by students after the project course. This questionnaire had 16 questions related to the questioned addressed. Continuous delivery automates release management so developers deliver the software earlier and this improves the communication between customers and developers. Hence, this information relates to our research topic which made us to select this article.

Review of Article 13

In this paper [16], an agile process model Rugby was introduced based on the release management workflow specific needs for project-based organisation were identified. Both applicability and acceptance of CD depends on its adaptability. For addressing the issues in industrial projects, a concept of tailoring the Rugby release management workflow was introduced which was extended by splitting it into four activities this allows the project managers to choose the solution which fits their project environment. In this paper, development process of mobile applications with respect to team size and

project duration was analysed. Eight project managers of Capgemini who developed software for external customers in industry were interviewed. For better understanding of tailored version of workflow two examples observed at Capgemini were described. Five research questions were formulated in the survey which were asked to project managers who had multiple years of experience in the domain. The questionnaire includes both qualitative and quantitative data to evaluate this formal and informal interviews were also conducted. The results were categorised according to the research questions. The authors have anecdotal evidence that tailored workflow give good understanding between technical promises and business needs. The value of workflow is appreciated for less time and effort required for setup which allows projects to start quickly. As this article contains information related to our area of research which made us to choose this article for our report.

Review of Article 14

The main of this paper [17] is to evaluate the hypothesis that architecture gives to achieve continuous delivery and deployability goals. Authors conducted interviews with technical leads and architects who is working on deployability as a focus. Two interview questions were formulated and collected examples to derive results using “incident descriptions”. From the responses of the IQ’s an initial set of embedded goals that are used to form the top layer of tactics tree are discovered. To make decisions of long and short deployability, understanding of visibility and stakeholder’s priorities should be considered. “Architecture Tactic” is used as quality attribute requirement by architects. Thus by growing interest in the field of continuous delivery it is important to enable fast and reliable deployments. Architectural designs are important for achieving project goals. Thus we select this article as this would help us in further research.

Review of Article 15

The major aim of this paper [4] is to develop a System Dynamic (SD) model to evaluate the dynamic effects variables within the delivery life cycle and their impact on the success of continuous delivery. SD model should achieve repetitive, risk-free, and effortless CD to process to deliver the risk of delayed delivery, delivery cost overrun and poor quality of delivered software. This model will act like a crucial tool for release managers, project managers and senior management of software organization for releasing the software to the customers. In this paper, 3 research

questions were formulated, and the authors mentioned various empirical study approaches like interviews, literature review, questionnaire, and author’s discretionary assumption which can be used to conduct this research. Hence, this study helps us in achieving continuous delivery process efficiently which made us to select this article.

Review of Article 16

In paper [2], the authors Steffen Gebert, Christian Schwartz, Thomas Zinner, Phuoc Tran-Gia suggests the adoption of the concept continuous delivery into the software defined networking world. Author also specifies that CD can be seen as an enabler for risk free and frequent changes in production infrastructure through push button deployments. Authors work is to apply continuous delivery to networks comprising Software Defined Network and the concept of Network Function Virtualisation, where he expects results are higher agility and effortless risk free deployment of new networking software. The process was illustrated by author by describing deployment pipeline of software defined network controller. on conducting the research, author could find some potential implementations and open issues. “Releasing More Frequently, Adaption of Behaviour- Driven Development to Networks, Monitoring” are the reasons for the author to introduce continuous delivery for networks. Author has described in the paper about continuous delivery as an important technique for agile and high quality software development, which have made us select this article.

Review of Article 17

In paper [18], the authors Baris Arslan and Alex Orailoglu have proposed about an analytical framework that delivers the optimal test line assignment per chip in order to minimize the delay defect escape rate. According to author, a continuous process variation space by the adjustment of the chip-specific test time can be attained through an adaptive test flow that utilizes process data measurement from the device under test. In the paper, author attempts to address the delay test effectiveness makes in an era of pronouncedly individualized chip instances by addressing the optimal use of our all test time so as to deliver but possible test quality by identifying the upside and optimal amount of delay test resources for each chip. Research method employed by author in this article is experimentation. On conducting the research. author evaluated the effect of possible process measurement inaccuracies on the overall delay of the test quality gained. Authors conclude by preferring a process aware test flow and a

corresponding analytical framework to adjust the test time allocation based on the process parameter in order to improve the delay test quality at no additional cost. As this article is within our topic continuous delivery, this made us choose this article.

Review of Article 18

In paper [19], authors Marke Leppanen, Terhi Kilamo and Tommi Mikonen were interested in investigating the benefits gained from implementing completely continuous delivery workflow using a domain specific productized development infrastructure. Authors main goal in the paper is to study what kind of infrastructure and feedback cycles are used in development to enable continuous deployment. Author has presented a case study as the research method which describes the continuous delivery pipeline in a Finnish software intensive company which is developing online services. On conducting the research, author learned some lessons in the light of the research questions formed by him. Authors study indicates that Continuous delivery offers the possibility to improve the development process and adopting it is beneficial when aiming for development culture that can fluently move to new business directions. According to authors, there is a need to for further investigation on the subject as the continuous deployment pipeline is only realized in a constrained domain of web services. Through this paper, it is clear that continuous delivery gets as a driver for innovation and software development which has made us choose this paper for the proposal.

Review of Article 19

In article [20], authors Rajiv Kumar and Piotr Cholda described a framework for the continuous delivery of mission-critical services. Clear recognition of events, challenging network continuity and assessment of their likelihood and assessment of their impact were the risks addressed by the authors. Authors presented their aspects of the research as to show a new model for infrastructure reliability of mission critical network services and elaborate a methodology to allocate resources for maximizing the service reliability. Quality of service, service availability and service reliability were identified as the requirements at the service level by the authors. In this paper, authors methodology consists of computing the best performing path as first step and the resource allocation for later recovery as the next step. So, on conducting the research author could evaluate the performance metrics capacity, delay and reliability for characterizing service performance requirements. As

the paper is well within our research topic, this paper is being selected for the report.

Review of Article 20

In paper [21], author Lianping Chen have been implementing continuous delivery in Paddy Power (large organisation in a bookmarking industry), where author has reflected his journey on continuous delivery. The main goal for the research is that there had been a major setback in full software development cycle. So for overcoming or recovering from the setback, author has used experimentation as his research method. He has done this experiment for two years by moving over twenty applications to continuous delivery. On conducting the research, author have achieved huge benefits in terms of release frequency, productivity, efficiency, release reliability, product quality and customer satisfaction. In this paper, authors main objective is to bring industrial challenges to researchers' attention and help to bridge the academia industry gap in software engineering. As this paper is well within our research topic, this has made us select this paper for the report.

PROBLEM AREA

On the detailed study and analysis of the relevant literature in continuous delivery, it is noticeable that challenges faced in the implementation of the CD can be categorised into technical, organisational and process challenge [3]. Some of the authors presented the challenges faced by the SMEs, large bookmarking companies, online business company, industries. While focusing on the problem aspects of different organisations, the approach for overcoming the challenges is also specific to particular context. Studies from [7], suggest that customer is capable in mitigating minor functional defects. In [3], it is suggested that having close collaboration with researchers and companies is also helpful. Yet, there is more to research in identifying the challenges in continuous delivery across the globe. So, this was identified as the research gap with the problem area. There is an essential need to fill this gap, as identifying the challenges will help in the framework of the solutions. These can be applicable to companies depended on CD and trying to enhance CD, which helps in overall success of software project, by the faster delivery of the project.

AIMS AND OBJECTIVES

The main aim of the research is to analyse and identifying the challenges in the implementation of Continuous delivery process.

The objectives of the research are:

- By understanding the real-time challenges faced by the practitioners in the implementation of continuous delivery for the Swedish companies.
- Selecting some companies in some particular area and finding out the challenges faced by them in real time projects.
- Conducting formal interviews with project managers and software developers. And preparing an online survey that is to be reached to the companies.
- Analysing and synthesising the data collected from the studies.
- For finding out the challenges faced by the companies, data collected should be prioritized according to more common problems faced by the companies and find the best way out in overcoming these challenges.

RESEARCH QUESTION

On identifying the research gap found in the literature review following research question was formulated:

RQ1) What are the challenges faced in the implementation of the Continuous Delivery Process?

Motivation:

Our motto has been the faster delivery of the product by overcoming the challenging faced in achieving it. For achieving our objectives, the formulated research question can be answered by the analysing the data collected from the various companies.

PILOT STUDY

A pilot study was designed so as to conduct a preliminary analysis of the research. Various steps are followed in conducting this research which are illustrated in the figure:

A literature review was conducted initially to find out the problem domain and research gap was identified from the selected articles. Research questions were formulated from the problems identified. Online survey was selected as a research method for conducting this research. Hence, as a part of the survey formal interviews will be conducted for data collection. The data collected will be analysed using 'Grounded Theory approach'. The results are validated and conclusions are drawn from those results.

A detailed description of these steps is discussed in the following sections.

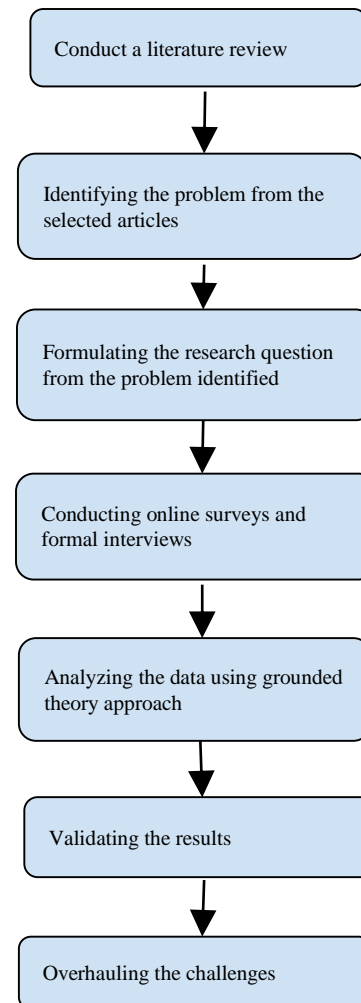


Figure 2: Research process

RESEARCH PROPOSAL

Research Method

A systematic literature review was conducted on continuous delivery process and a total of 20 articles were selected. By analysing these papers a research question was formulated which states the challenges faced in implementing CD. There are various empirical studies like survey, experiment, case study etc., from which we chose online survey to as our research question has got different perceptions in different companies i.e. every company need not face the same problems. Research method was selected based on research question [22]. As the research question is about the challenges faced by project managers in a software company we conduct a qualitative study rather than quantitative study.

A Survey on Challenges of Continuous Delivery

Name of the Designation and Organisation

Your answer

Rate your experience on Continuous Delivery

☐ 1-3yrs

☐ 3-7yrs

☐ 7-10yrs

☐ >10yrs

What are the challenges faced in implementation of Continuous Delivery

Your answer

Figure 1: A sample Questionnaire

Questionnaires and formal interviews were conducted for answering the research questions. As we are planning to conduct a survey in different organisations' in the nearby companies, a non-probabilistic sampling method would be suitable for our further study. Basically, our idea is to involve people related to the fields of release management and software development to answer the research questions. Therefore, chosen research method should be an observational study which is qualitative in nature. We choose survey over case study as the results of survey are more generalised compared to case study [23].

Unit of Analysis

Sample selection plays a significant role in a research process. In this research non-probabilistic sampling can be used for selecting our respondents. We have planned to use convenience sampling from the available non-probabilistic sampling methods. The participants may include technical product managers, technical project managers, software development managers, software developers, project leader, business analyst. The optimum sampling size which may be required to collect optimum inferences from results which are to be obtained from selected population. Optimum size is depended on various parameters that happen under the study of expected results obtained by participants [24]. Due to the time and resource limitation 30 responses have been selected.

Data Collection Method

We intended to prepare a questionnaire for online survey, this survey would have been sent to software professionals from Sweden, Denmark and India through some known references. Formal interviews were planned to be conducted for a time frame of 15 minutes and telephonic interviews were also planned for given constraint of distance. Even some semi-structured interviews were also considered as data collection tool. These interviews would have been recorded for future use. The questionnaire would contain cover letter, questionnaire link, and acknowledgment. Interviews were planned because of several advantages of them over questionnaires. One major advantage is that we can directly interact with the respondent and reduce any kind of ambiguity that is possible in questionnaires. We have planned to use google forms for conducting the survey. The responses recorded would be saved in excel sheets. Interviews have an advantage over questionnaire as the perceptions and opinions of the respondents on complicated arguments can be explored. They have more strength to overcome the below par responses of questionnaires.

Data Analysis Method

Grounded theory approach leads to flexibility in interpretation of data. Data collection and data analysis can be streamlined and integrated which inspire us to select this method. The theory will be derived from the data collected as there is no hypothesis formulated. The logic of the formulated theory strengthens with each collected data [25]. A useful template is provided by grounded theory for conducting qualitative research [26] thus we consider grounded theory approach as it suitable for our research.

Grounded theory approach includes axial, selective and open coding to prepare a theory. Open code identifies high-level concepts and categorizes them, the similar data and differences are compared and open code is stated [27]. In axial code the relationships are identified and connections are established between open codes to obtain axial code [28]. From selective code the theory is established. It is imperative that all the axial codes are connected to core category and theory generated from code category is consistent and reliable[29]. For grounded theory theoretical sensitivity is important. Research should identify which of the collected matter is important and how it is related to existing literature and personal experience.

DISCUSSION

Expected outcomes

By conducting a survey and examining the results, we expect to get reliable results to identify the challenges faced in implementing Continuous Delivery. All the identified challenges will be shown as the part of results. On conducting the research, we can expect to improve our knowledge on continuous delivery of a software, by gaining some knowledge on the reliability issues of CD. We can also address the challenges in the architecture of CD. With this we can even enhance coordination and management of customer involvement in CD. From the literature review performed, [7], [10], [3], [11], [13], [8], [16], [17] and [2] focus mainly on the challenges in CD. From these we can expect results from our research can come in hand in identifying the problems faced.

Below are some of the expected outcomes of the research:

- Results from the survey which will be conducted will be the first outcome of the research.
- Tabulate the results obtained from various companies.
- Mentioning the significance in finding out the challenges.

Contribution and Future Work

The contributions of our research is to the field of Continuous Delivery are as follows:

- We will try to add existing knowledge on the challenges faced by CD in software development process.
- By identifying these challenges, it would be helpful for various companies to improve in delivering the software in a continuous process.

Our research also contributes in this aspect. The main findings of our research are:

- Organizational challenges effect the implementation of CD than process and technical aspects.
- We can achieve reliability in CD by automating the deployment process rather than the manual process addressed [3], [7].

In future work, research can be done to develop an approach to tackle the implementations issues in CD from our proposed research.

Risk Management

Analyst bias: This is mitigated as there is no hypothesis formulated as we selected grounded theory analysis to generate the results.

Respondents Bias: We need to make it clear that there is no external influence on participants while answering the questions

External validity: Comparing external validity to other research methods in survey will lead to generalised results [23]. In some cases, results may not be generalised.

Conclusion validity threats: Conclusion validity was reduced by following systematic guidelines for survey [30] and data analysis [29].

Reliability threats: This occurs when the outcomes and implementation differ among various companies on the same topic.

CONCLUSION

In our study, we had planned to address the challenges faced in implementation of customer delivery was addressed. Initially, a literature review was conducted where it was identified that there are some technical, process and organizational challenges in the implementation of continuous delivery. Therefore, some methods will be required for enhancing the coordination and management in CD. Hence, the objective of the paper is to address the challenges in implementing CD. In the next phase, a survey was conducted for finding out the difficulties faced by various people in implementing it. Survey will be conducted targeting software professionals. There is a need to develop strategies in order to tackle the implementation issues in CD and how customer involvement can affect CD. Due to time constraint, a case study couldn't be performed for addressing the issue.

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