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Creating One-click Development Environment

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Abstract

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Working on a new project brings challenges when onboarding a new SW developer. First things which a new employee performs is to get their PC machine ready which becomes a long process as it involves installation of multiple professional tools. This thesis proposes a solution of a one-click development environment as a remedy to this challenge. By automizing the process of getting their machine ready, a new employee can focus on the work to be done rather than setting up the environment.

The case organization is a global corporation with multiple new employees. So, its very often that new people join the team or project and a huge time and resources are invested into the process of setting the environment for each of them individually. Hence, this thesis aimed to create a solution where a new user can join the team and their machine can be ready via the one-click development environment.

This thesis employed Applied action research and qualitative research methods. The current state analysis was conducted via a series of interviews and group discussion with stakeholders, developers, testers and mangers within the case organization, and the data collection was done in three data collection rounds. The current state focused on investigating the current practices of setting up the machine and environment in the case organization, and revealed the main pain points and obstacles. Next, in the literature review, best practice for atomization of the machine setup were studied. Thirdly, thesis proposed a solution and validated it by evaluating it with various users and stakeholders from the case organization. The Final proposal created the key steps in the new process by which the case organization can automate their machine building process quickly and enhance the process with less pain and trouble. The thesis also provided the action plan for the implementation of the final proposal by which the case organization can achieve a one-click development environment. The Thesis provides a quick solution for the implementation of the one-click environment including the software and tools to the user to perform their day-to-day work with minimum preparation time. By doing it, the thesis saves time of the newly hired developers and re-directs it towards performing their key responsibilities. One of obvious business benefits is that the solution can reduce the risk of delay in the starting of a new project.

Keywords Automation, process re-engineering, machine setup, process optimization

Preface

It was a great opportunity for me to work on the topic of one-click development environment, as this topic will bring a new level of automation to the organization. While working on this thesis, I came to know about many interesting topics in automation tools and had a chance to interview many of my colleagues and taking a deep dive into the current processes. It also provided me the opportunity of building valuable connections and relation with the experts in different fields.

After working for a decade in the technical field, I was planning to work on the managerial topic. With the help of this thesis, I was able to understand the core concepts of management, such as the evolving process, collaborating and cooperating with other projects, and other enhancements to my knowledge. My thesis provides a proposal which should help the case organization to have automation this process and promote the execution speedily, which was one of the key focus areas of the case company.

I would like to thank my Employer and my fellow colleagues who gave me their valuable time so that I can write my thesis. The thesis has evolved over a period of time and initial proposal received quite good suggestions. I would like to thank my classmates also for supporting me in various courses which I have taken with them and done a lot of teamwork together.

I would like to thank Metropolia University of Applied Sciences and my instructors Antti Hovi and Zinaida Grabovskaia for giving me their ultimate support and guidance for writing this thesis. Finally, I would like to thank my mother, father and friends who were always supportive and motivated me to achieve.

Shubham Bhardwaj
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1 Introduction

In any organization, hiring new employee, starting a new project, or shifting their resources from one project to another, is a process which requires considerable time, and happens quite often. However, this process can also open doors to new opportunities, if done with better planning and resource arrangements. This planning work includes re-thinking the technical preparation, so that to re-arranging resources in a more efficient way.

The case organization of this Thesis has a lot of different departments and very much focuses on the research and development. So, it is quite common to start new projects or hire new people when the project is scaled up. However, it has been identified that initial days for onboarding new people to projects require a lot of knowledge gathering, learning and installing new tools, alongside understanding the project itself.

This thesis deals with a problem of arranging tools and software and getting the PC machine ready for the development. It proposes a solution which can simplify the complex process by automizing the process of getting machine ready for a new project. By doing so, it also eliminates the redundant, repetitive work to get a machine ready for the development done by many people, with just a click, by running a series of commands or just by clicking an interface. It simplifies the arrangement of the proper environment and reduces the headache of gathering tools and software to start the development.

1.1 Business Context

The case company is a leading company in the telecommunication world with 1.6 billion subscriptions (Ericsson 2023). Along with the 30 % 5G mid-band population coverage all over the world (excluding mainland China), the case company has observed the increase in the coverage of 5G band by 10 % from year 2022 to 2023. Table 1 gives some understanding about the scope of mobile data subscription worldwide in the last year and predication until 2029.

Table 1. Mobile data subscription and forecast (Ericsson mobility report, 2023).

Mobile subscriptions	**2022**	**2023**	**Forecast 2029**	**CAGR* 2023–2029**	**Unit**
Worldwide mobile subscriptions	8,310	8,460	9,210	1%	million
• Smartphone subscriptions	6,620	6,970	8,060	2%	million
• Mobile PC, tablet and mobile router subscriptions	230	260	510	12%	million
• Mobile broadband subscriptions	7,090	7,470	8,740	3%	million
• Mobile subscriptions, GSM/EDGE-only	1,110	890	380	-13%	million
• Mobile subscriptions, WCDMA/HSPA	1,040	850	270	-17%	million
• Mobile subscriptions, LTE	5,180	5,130	3,210	-8%	million
• Mobile subscriptions, 5G	963	1,570	5,330	23%	million
• Fixed wireless access connections	107	132	330	17%	million
• Fixed broadband connections	1,450	1,530	1,850	3%	million

Mobile data traffic	**2022**	**2023**	**Forecast 2029**	**CAGR* 2023–2029**	**Unit**
• Data traffic per smartphone	16	21	56	18%	GB/month
• Data traffic per mobile PC	20	22	34	8%	GB/month
• Data traffic per tablet	12	14	33	16%	GB/month

Total data traffic**	**2022**	**2023**	**Forecast 2029**	**CAGR* 2023–2029**	**Unit**
Mobile data traffic	97	130	403	21%	EB/month
• Smartphones	95	128	398	21%	EB/month
• Mobile PCs and routers	0.8	1	2.4	16%	EB/month
• Tablets	0.7	0.9	2.8	21%	EB/month
• Fixed wireless access	22	30	159	32%	EB/month
• Total mobile network traffic	119	160	563	23%	EB/month
• Total fixed data traffic	270	330	660	12%	EB/month

Table 1 describes the company´s mobile subscription in the year 2022, 2023 and forecast for 2029. Along with these figures, CAGR (compound annual growth rate) was projected to increase from 1% to 23% by 2029 in terms of subscription. From Table 1, it is very clear that the company is growing its customer base and definitely needs new employees to support the customer satisfaction and its R&D projects. Along with

accomplishing the current goals, the company is introducing new projects which will help the existing customers to have more convenient network usage, along with getting more customers in the case organization. So, the company needs a hand-on solution which can fasten up the process of onboarding the new employes, where their machine can be ready with some clicks.

1.2 Business Challenge, Objective and Outcome

Cost cutting and improving the way of working and automating the process are common business challenges which many organizations are targeting to achieve. Standardization of the tools is another challenge in many companies.

The case company of this Thesis has predicted potential growth in their customer base by the year 2029. So, to avoid the repetitive work, the company is focusing on improving the ways of working and automation of the processes, including installation of machines automatically. The key areas which are identified by the case organization to work on in order to achieve its targets, are shown in Figure 1.

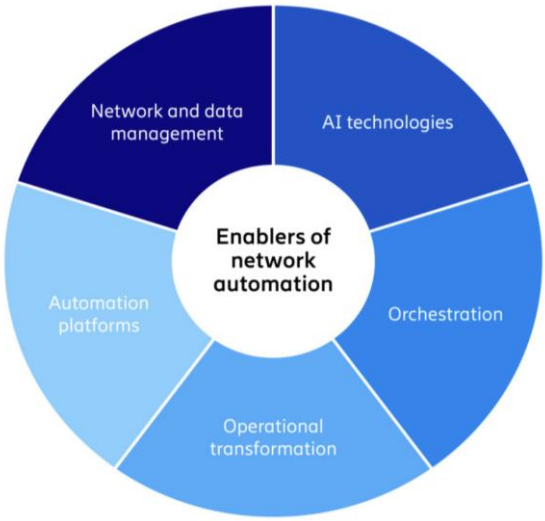

Figure 1. Case company goals domain (Essential technologies and processes for network automation, 2023).

As seen in Figure 1, the company is going to achieve its goal in those five fields i.e., AI technologies, orchestration, operational transformation, network and data management and automation platforms. To help the case organization to achieve these goals, this

thesis is proposing a solution where the automation of the development can be done with a single click and thus help in efficiently onboarding more talent in the organization.

This thesis is focusing on the challenge of removing the redundant work and make the onboarding process smooth and automated. The case company is expanding its customer base and automation is very much required to fasten up the onboarding of new employees in the organization.

Keeping in mind of the challenge of the automation and improvement of the process of onboarding a new employee in the organization, the Objective of this Thesis is to propose *a proposal which can provide an environment for developers which would consist of all the necessary tools, software and environment needed for performing the tasks related to the project.*

The Outcome of the thesis is *a process which helps in developing the work machine for a newly hired employee* in which they have all the necessary tools required for the development. This is called “one-click environment” in this Thesis.

The proposed solution should help the organization to fasten up the onboarding process, as well as to ease up the process of shifting the existing employees from one project to another. The proposed solution will also help the company in standardization of its machines all over the world. Finally, this thesis will also help the case company in implementing its policies to have code only in the company repositories, and not in a developer/employee own machine.

1.3 Thesis Outline

The scope of the thesis is to propose a process which can automate the installation of the tools, software, and environment for performing the day-to-day tasks of a developer/employee when they join the organization. The process is mainly executed in Finland, but it is planned to scale globally with minor changes as per the need of individual project.

This thesis is written in seven sections. Section 1 shows the introduction along with explaining the business context of the case organization, challenges faced by the case company, after that show the objective and proposed outcome of the thesis. Section 2

describes the various methods and material used in the thesis. Section 3 shows the current state of the process of onboarding and how newly joined employee setup their machine for working in day-to-day life. It also includes the challenges faced in setting up machine with the current process, its strength and its weakness. Also describe the focus areas of improvement for the thesis. Section 4 deals with the existing knowledge in the automation process of getting a machine ready for development. It shows various tools and software which can be used in making a solution which could smooth up the process of building the automated machine setup with a single click or command. Section 5 discusses the initial proposal of the process of building a tool which can automated the machine setup with minimal effort and reduce the time in getting a machine ready for the development. Section 6 describes the validation process of the proposed solution by the thesis, this also include the final proposal of the thesis which validates the process of building an automated system with single click. Section 7 has the summary of the thesis and its evaluation.

2 Method and Material

This section describes research approach, design and data collection and analysis which are used in the thesis.

2.1 Research Approach

Research is a systematic process of investigating and finding new fact and details. Research is typically based on the collection of various data, analysis of the existing information, and interpretation of existing facts, revision of the found information and documentation of the information extracted. Basically, research is a method of improving the current level of knowledge and exploring those topics which have limited knowledge and enable that information to understand the topic effectively (Adams et al., 2014, 1-2.) Research starts with collecting the data and information about a particular topic or subject. Research requires the intense study of the existing knowledge, reading the facts about the research topic and find new information about the topic. Applied research family in particular focuses on the solving an existing practical problem and proposing an outcome with a solution driven approach. (Sauders 2019, 43-45.)

There are various *research methods*, and they can be categorised as qualitative, quantitative or mixed. Qualitative research method focuses on the non-numeric analysis of data, and used the data collection techniques like interview, questionnaires, document and image analysis, etc., while a quantitative method focuses on the numerical data uses statics for data analysis. Moreover, in the mixed approach, both qualitative and quantitative methods are used. (Sauders 2019, 269-270.)

Research strategy is the approach used by a researcher to find answers to research questions. To find these answers in a systematic way, a research objective and research questions are used as guiding principles. A few examples of qualitative research strategies are Ethnography, Case study, Action research, Narrative inquiry, and Grounded theory. In quantitative research, one can also experiment and perform surveys with the help of questionnaires or planned interviews. However, qualitative research strategy focuses on using data gathered via qualitative research methods. Example of these research methods are interviews, document analysis and observations. While doing any qualitative research in the field of business, one needs to engage the people

with a particular set of actions for understanding the complex problem and to receive fruitful results. (Sauders 2019, 292-293.)

In this thesis, Applied action research strategy is followed as it fits well in the thesis topic. Applied action research strategy deals with the problems related to the day-to-day business issues and improving existing solution. Applied action research is meant for the change to the better rather that theorizing and focuses on providing solution by identifying and resolving the practical problems. (Kananen 2013, 7.)

In this study, qualitative methods are used to investigate the current practices of setting up their environment when new employees join the company, or when they switch from department to another, or start working on the new project within the same organization. Qualitative methods undertaken in this research are interviews of the employee and their view on the existing process of getting their machine ready for the development. Interviews examine the views of different people with different level of experience and various work domain to identify the pain point which the employees are facing in the organization and try to resolve them with by proposing a solution which automates the process and removes the redundant work. However, along with the interview, this thesis has extensively used the company internal documentation, conducted a questionnaire and used participant observations.

2.2 Research Design

Research design used in this thesis contains five step which are displayed in the figure below. There are three data collection phases in the research design is explained in the figure below.

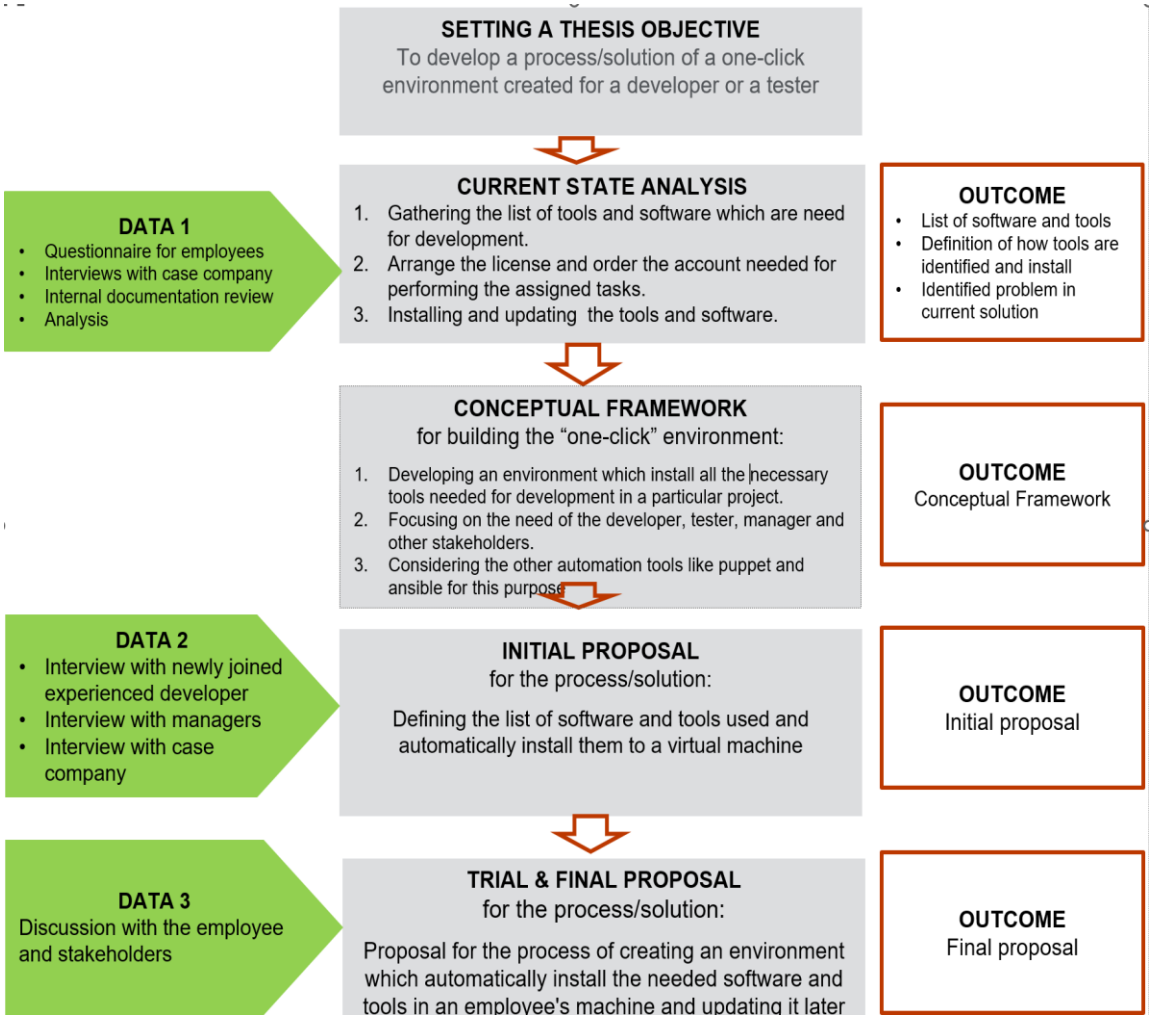

Figure 2. Research design for the thesis on one-click development environment.

The initial step of the research design is to set the objective for developing a process for a creating one click development environment which can help the case organization in onboarding the new employee in the company by automizing the process of setting up the development environment.

The second step is to analyse the current state which is based on Data1 to identify the views of employees when they first installed the machine before starting the development. It describes how the current employee gathers the information about the tools and software that they are going to use further. In the current state analysis, the focus is on identifying the strength and weakness in the current process of installing the software and tools needed for the development. Questionnaires were also part of the current state analysis which helped in identifying the areas of improvement to automate the process of getting the machine ready for development. The primary goal of current

state analysis is to identify the strength, weakness, and areas of improvement in the existing practice of getting a system ready for the development. It also provides an insight where the ordering and licensing parts can be eliminated, and use automation when a new employee join the company.

The third step is the literature and best practice review that ends with the conceptual framework which help us in understanding the things which are needed to do before automating the process of setting up a machine for the development. this provide a conceptual framework for setting up an automated process.

The fourth step is focusing on the building an initial proposal for the automated process of generating a machine which can be ready for development. Here, Data 2 was collected by the interviewing employees about the pain points which they have faced when they are creating an environment before start working or programming. Initial proposal considered the result from the current state analysis along with the ideas gained from the existing knowledge and best practise on developing an automated process in order to get a machine which is ready for the development.

The final step validates the proposed solution. The final solution was built by the stakeholders and employees, and received their views on newly developed solution collected as Data 3.

2.3 Data Collection and Analysis

In this thesis, data was collected from various sources listed in the table below and analysis of the gathered data was done.

Table 2 Details of Data collections 1-3 used in this study.

	Participants / role	**Data type**	**Topic, description**	**Date, length**	**Documented as**
	Data 1, for the Current state analysis				
1	Respondent 1: A newly joined developer with around 24 years of experience	Teams meeting	How to fetch the list of tools which need to be installed in the machine used for development	Oct 2023, 1 hours	Field notes

2	Respondent 2: An existing employee	Face to face Interview	How often update the software and install new tools, what all tools have been used, when to update	Oct 2023, 1 hours	Field notes
3	Respondent 3: A tester with around 10 years of experience	Face-to-face Interview	What tools are needed for testing the code. Limitation of the tools. How to get the licenses of the tools if needed	Nov 2023, 90 min	Field notes and recording
4	Respondent 4: Trainee	Telephone interview	How easy it was for installing all the needed tools and how often tools are updated	Dec 2023, 45min	Field notes and recording
5	Respondent 5: Product owner	Face-to-face Interview	What are the exceptions in order to start working on a new project and how to reduce the cost in ordering and licensing account and software	Jan 2024, 75min	Field notes
	Data 2, for Proposal building				
6	Respondent 6: Program manager.	discussion	Benchmarking from the existing solution outside the organization	Jan 2024 60 min	Field notes
	Data 3, from Validation				
7	Respondent 7: Consultant, developer, tester	Group interview/ Final presentation	Validation, evaluation of the Proposal	Feb 2024 120 min	Field notes and recording

Table 2 shows that data was collected in three data collection rounds, namely for the current state analysis (Data 1), for proposal building (Data 2) and from validation (Data 3). In the current state analysis, several interviews were taken around the end of last year 2023. Interview were primarily conducted face-to-face. The main goal for the current state analysis round was to identify the pain point of the employees in following the existing solution. In this data collection round, the satisfaction of the new employee was also taken into account with the current way of getting the machine ready for the development. After the analysis, focus area was considered and selection of the area where the thesis will focus has been finalised.

In this data collection round, interviews were done about the experience and domain of the employees. For example, interviews of the several developers were conducted to distinguish their experience. Other domain experts were also involved such as tester, line manager and stakeholder which are people facing the customer in the company. The checklist about the main questions asked in the interviews (Data 1) can be find in Appendix 2.

In the Proposal building, based on the identified strengths and weaknesses and inputs from literature and best practice, a new solution was co-created which will automate the process of developing a machine for doing the programming. In Data collection (Data 2), data was collected based on the interview sessions with the program manager to gather what they want to achieve from the proposed solution. The main goal for interview program manager was to collect the functional idea via benchmarking. The outcome from the interview provided the basis of the input for the initial proposal and explained the requirement of the automated process of machine setup which is named as one-click development environment.

Final data collection (Data 3) was collected in a collective group discussion where the view of the consultant, developer, tester, and manager were taken all together and analysed the proposed solution. In the discussion, impact of the proposed solution was also evaluated.

Table 3. Internal documents used in the current state analysis, Data 1.

	Name of the document	**Number of pages/other content**	**Description**
A	Internal documents	7 pages	- Local environment setup • Mac development • Virtual Ubuntu development - Tools and tips
B	Internal Wikis	~50 pages	Development, CI/CD and verification
C	Discussions	~1 hour (per each)	About ways of working with • Master developer • Senior developer • Test engineer • Database developer • Architect
D	Approvals	1 hour	Taking approvals from the higher management. Discussing the cost involved in the implementation
E	External communication	Email communication	As the solution require hosting in the cloud so discussion with cloud department and the price for utilizing their services
F	Strategy planning	Continuous	Planning the strategy with the team to execute the solution with a MVP(minimum viable product)
G	Task defination	Continuous	Happened along with the team in several agile ceremony(backlog refinement, sprint planning, daily, retro)

H	Evaluation	Daily	Checking the progress in daily standup along with identifying the dependencies and removing blocker

Table 3 lists the documents used in analysing the current state of the existing process. It used internal documents, internal company wiki, approval process, strategy planning, task definition and evaluation. These are the process documents which are currently used in the organization. Internal wiki allows the new employee to understand the way of working within the organization. This Thesis used them for gathering the requirement to get the machine ready. These documents are also updated by the existing employees in a timely manner as the new version sometimes require a change in the instruction.

3 Current State Analysis of the Practices Used to Set Up the Developer's Machine & Environment Presently

The current state analysis evaluates the process, how new employees who join the company or a new project, manages to install the needed software and tools in their machine. The current state analysis helps in understanding the procedure of preparing the laptop for writing code. This section ends with highlighting the strengths and weakness in the process and a summary identifying the key findings.

3.1 Overview of the Current State Analysis

The study focuses on providing a key insight of the process by which new employees make their machines ready for writing code, which enables them to work in their dedicated project in the case organization.

The analysis is based on the data gathered from the employees of the case organization who have recently joined the company, interviews from the representative of that group and their observation; and the analysis of the company internal wiki which the targeted audience is referred to during the process. The current state analysis is divided our study into four segments.

First, the analysis provides an overview of the process of installation of various tools and software to get a machine ready for writing and testing a piece of code in a particular project. This segment also highlights about the usability of those software and tools. Secondly, the analysis of the process is done from a developers, testers, stakeholders and manager´s point of view. Lastly, the strength and weakness of the process are identified along with other relevant findings which affect the current process.

3.2 Description of the Current Process of Preparing the Machine in the Case Organization

In the current state analysis, the process was followed in the case organization via the employee feedback, conversations with new joiners, observing the developers who are installing the software and tools, and following the internal documentation available in

the company's wiki. Visualization of the current process for the system readiness can be seen in the Figure attached below.

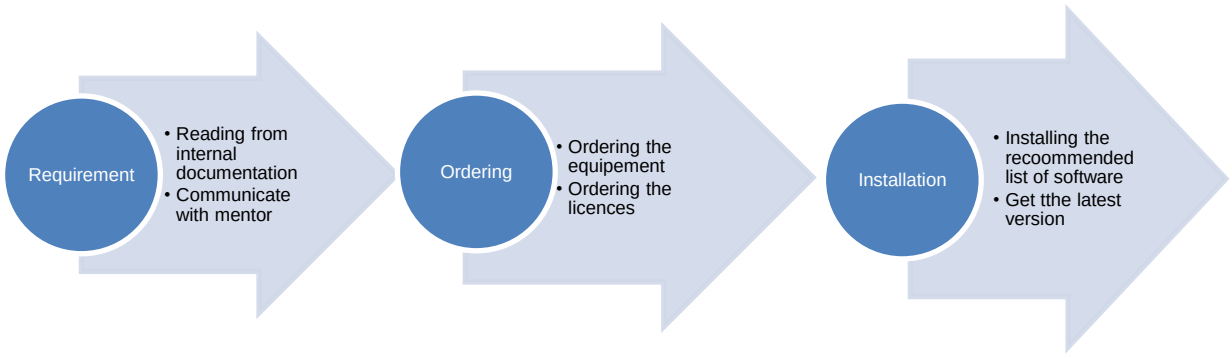

Figure 3. Current way to make system ready for use.

As shown in Figure 3 above, the current process includes three steps. The process start with (a) understanding the requirements of the project which can be done in various way main two way are as follows.

First, Reading the internal documentation. In the case organization, an employee has created some pages by themselves where they have written "first thing first" to be done when joining the case company. This internal wiki has details of the project along with the tools and software used by existing employees.

Second, Communicating with the mentor. In the case company when a new person joins the company a mentor which is the reference point for new employee. The new employee talks with his assigned mentor and gets the details of the project. Mentor also guides new employee by recommending software and tools they use for product development. One of the mentors describe the list as:

> *One can install the recommended tools and software but after all its their personal choice and prior experiences. People are using different version of the same software and it work for them. However, others prefer to have same version as their team. (The case company employee who played the role of a mentor when a new employee joins the company). (Respondent 1).*

The next phase in this process is (b) the order of the machine and equipment for the new employee, it also includes an authentication card, email address, company internal account etc. Orders are mainly classified into two segments.

First, Order of machinery (Hardware). In this step, a new employee orders a machine i.e., laptop, monitor, table, chair with the help of his manager. Manager is the single source of contact for the employee until he/she join the company. Manager can provide him/her with the details of the available option from which a new employee can select. Ordering these also depends on previous experiences. For example, some users prefer a Mac whereas other like to use latest Windows. The case organization provides a range of options from where an employee can select which is best for him. Again, employees order the machine according to their prior experience. In the case company, all the available options for the machinery are documented but no recommendation is provided to the new employee. Moreover, their mentor can help them in taking decision as they are aware of what kind of machine will be suitable for an employee to work the project they are about to work.

Second, Ordering licenses (Software). While an employee can proceed to order his hardware which normally takes a day to get, in some cases, their manager asks the employee about his preferences and order a laptop which can be available when they join the company. In any case, once the employee received their machine, they can ask for the licenses for the software which could be needed for his work. Ordering the email account and communication chat is another task which an employee does once done with hardware order.

The last phase in this process is (c) an installation phase. After finalizing the order in this phase, the employee starts to install the software in their machine. While installing the software, they can install either a specified version or a latest version.

First, Installing a specified version. Some developers tend to prefer the version which are mentioned in the case organization internal documentation, which helps them to get the same software as their new team is using. Moreover, sometimes new employees also try to install a specified version if they have used that in the past or familiar with its look and user experience. In a discussion over the installation a new employee said that

> *I have prior experience of using a particular Integrated development environment (IDE) and don't want to start using the new IDE as I am familiar with the old IDE while the recommended list was proposing to use the different IDE. (Respondent 2)*

Second, Installing the latest version. Some people prefer to use the latest version available to that software. They say that they want to be updated to the market and will prefer to use the latest solution available in the market. Hence, they sometimes end up in using a software version which is new to the whole team. In one of the introductory sessions with a newly joined master developer, it was said that

> *I would like to try out the latest version all the time. It brings the new enhancement and flavour to our development. It helps us in keep on exploring the new things and force us to update*. *(Respondent 1)*

3.3 Analysis the Current Process of Preparing the Machine in the Case Organization

Analysis of our current procedure was done by gathering perspectives of several types of employees which are of different experience groups (one trainee, one junior developer i.e. around a year experience, one experience developer i.e. around 2-3 years of experience, one master developer i.e. around twenty years of working experience, one tester, one architect, and one manager). The analysis initially explores the user experience when they make their machine ready for development depends on their experience and work domain. It divided the people into the several groups mainly based on their field of work (developer, tester, architect and manger) and experience (senior, junior and trainee), and classified the group as their field of work. The group focused on interviewing developers (since the machine and environments are created for them), with four people there since their experience was related to development (named as master developer, senior developer, developer and trainee).

3.3.1 Master developer´s perspective

This perspective gathers the challenges faced by a master developer who has enough of working experience on the demanded tool which need to be installed for starting the development. Along with the challenges, he was asked about the experience and time

taken in installing the various tools and software and getting the machine ready for the development. Moreover, he was also asked what their thoughts and ideas are to faster the installation of various tools and software and how to make it less time consuming. A master developer described his experience as follows:

> *I would like to focus on the code rather than gather information of tools and software they are them to help in make my work easier, but it will be good if it is an automated process. (Respondent 2)*

The Master developer also pointed out that the company is focusing on the strategy of having no code in the local machine. It means the company should have a system which could set a remote connection to the code repository over a secured network. The Master developer specified that they faced challenges in getting the license of the software for which they need to ask for their manager, and a long process of approval needs to happen. It may take from a day to week to get the approval for those licenses and hence it results into the delay in the installation of their machine. However, the master developer also specified that, with installing every software manually, they have the freedom of choosing the software according to their need and demand.

In addition to the experience in setting his machine to start a new development, it was stressed that sometimes the documentation gives misleading and outdated information in the internal wiki of the organization.

3.3.2 Senior developer´s perspective

Senior developers have experience of around 10 or more years of working in the same domain and they are also familiar with using those tools. They have used and download those tools and software in their previous company and mostly aware of the problem with them. However, they have encountered the same issue of licencing which master developer were complaining. Senior developers also told that they need to identify the version of the software it has been observed that latest versions are always not very suitable for the company all the time. As latest version might have some issue, or user experience is not same as the previous one. In an interview, a senior developer stated that

> *A senior developer stated that once updating development Ide(namely IntelliJ) it was hard for him to set the debugging option in that ide. However, when they were using previously the same tools it was very easy for them to start debugging. They need to read the documentation of the Ide to set the debugging in the Ide. (Senior Developer A)*

So, rather than the latest version, they suggest using the stable version and test well before updating the version. Senior developer said they need 3 – 5 working days to install the tools and software and later even some more time to be familiar with updated tools.

3.3.3 Junior developer´s perspective

Junior developers are the group which have an experience of 1 – 5 years. They have been exposed to these tools for a much less time or they are using them for the first time. They are relatively new with these tools, and they sometimes even don't realise if the tools installed are allowed for commercial use. It was also observed that they are using community version of the tools which can cause a legal issue to the company. Developers also often need help from senior developers if they are not able to download the software and tools. Also, it has been noted about developers and the tools they are using that often time they realise that they need other tools to work only after working some time; it could be weeks or even months. In general, it was seen that it requires 7-10 days for properly setting the environment. A junior developer shares his thoughts:

> *I prefer to have those tools discussed with my team rather than collecting the information from the internal pages as they are sometimes not updated, and I receive several updates notification every now and then soon after installation. (Junior developer A).*

3.3.4 Trainee´s perspective

Trainees are mainly students who are either in university or recently graduated from university. Trainees have much less experience about the vulnerability coming with those tools, and they download the first version that came out from the google search. In general, it was seen that they need more than 10 days to start working and get familiar with the environment they are working on.

This analysis investigated the current methods used to implement the development environment. It also included the best practise and existing solution available in the market. This analysis mainly focused on the problem encountered in setting the environment currently as well as the points to consider while learning from the existing solution in the market.

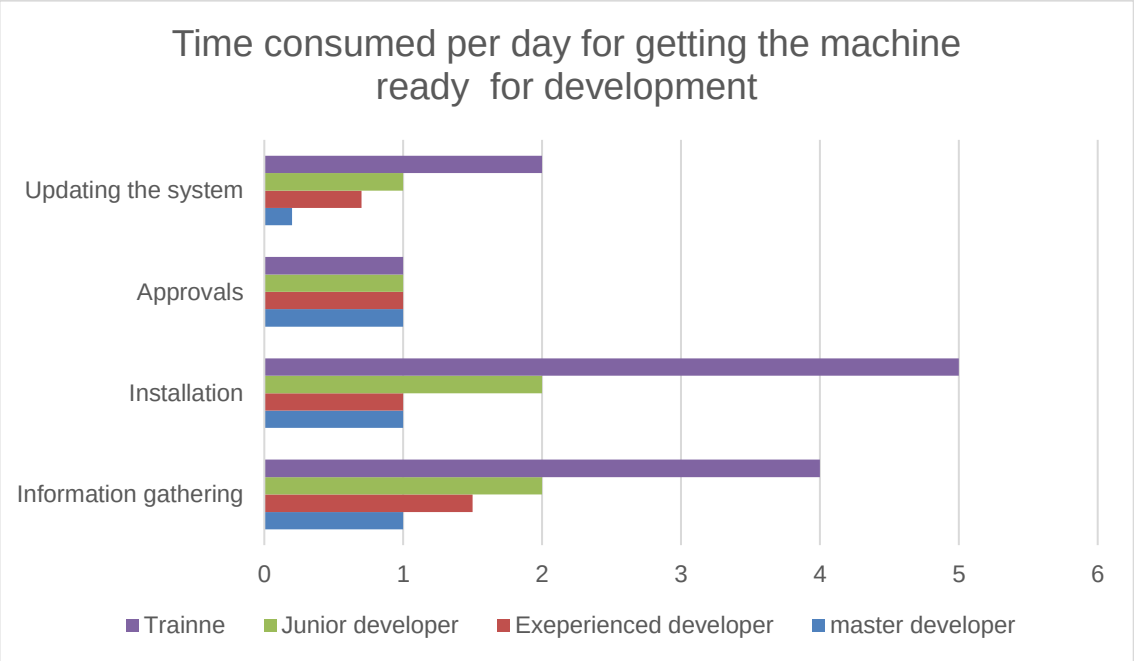

Figure 4. Time consumed as per experience in getting a machine ready for development(own questionnaire).

From Figure 4 above it can be interpreted that trainees take more time in gathering the information as compared to the experience developers. The same trend is seen in relation to the different levels of experience. Similarly, it was also noticed that the experience matters in installing the tools. It was clearly observed that master developers were faster than the new developers who have recently joined the industry. However, a different pattern has been seen in approvals, as in this process managers are involved. As they are guiding all employees, so the approvals are taking the same amount of time for all. However, it could impact the time if the manager is new to the process of approvals. Moreover, when it comes to updating the system, the same pattern has been observed again for managers with less experience.

3.4 Summary of the Current State Analysis

The current state analysis focused on the process of getting the machine ready when a new employee joins the organization. The current state analysis recorded the step which a new employee needs to do before they start to work on their machine, starting from understating the requirement for the machine which need to get ready for the development in an organization. It also included the process of ordering, and finally installing the gathered information, i.e. the list of the software and other needed component to the new machine which need to be ready for the developing the code. The current state analysis also described the experience of the user, from a newly join inexperienced employee to a very experienced person, along with the people who are guiding them in starting their role i.e., developer, tester, manager, or other role already working in an organization. The current state analysis specifically focused on the time involved in the process of collecting the requirement and discussion with other employees during the process. Also, it traced the time involved in ordering machine and licenses and after that, the installation process time and challenges involved.

The current state analysis also touched on the impact and experience which a person face while helping the new employee to join the organization. The current state analysis also analyzed the involvement of the existing employees when they supporting or guiding the new employees. Presently, there is a difference in the onboarding process based on the experience meaning that there is a difference while a trainee joins the company, a person with a few years of experience joins the company, or a very experienced person joined the company. The current state analysis showed the diagram of the time consumed in the process of getting the machine ready in each case, according to the experience.

Next, this section focuses on identifying the strengths and weakness of the current process of getting a machine ready for the development.

3.4.1 Strengths of the existing process in getting the machine ready

The current process of getting the machine ready has been used for several years and it has evolved as per the change in the need and convenience. Here are the following points which shows the advantages of the current solution in making a new employee machine ready for the development.

First, Quick selection. The current solution or existing solution provide an employee an opportunity where they can select the tools and configuration quickly according to their prior experience gained either in school or in other organization. In the current process, selection of the tools and software can be done after the discussion with the mentor which is assigned to the employee by their manager to support while onboarding. However, in the current process, the user is free to select and install the tools and software on their machine.

Second, being adaptive. As described in the above strength of the existing process of getting the machine ready for development quickly, the IT team often needs to make changes in the existing configuration or install new software when needed. So, the current process is very adaptive, which means that a developer is free to install new tools and make changes to the existing configuration as per their need any time.

Third, having the freedom on tools utilization. The existing way of making a machine ready gives a person to choose which ever tools they like to use, until it doesn't involve any additional licensing cost. As a result, different developer has different tools which they might have used in their previous organizations. It gives a new employee a feeling of similar experience which they were using in the previous experience. As new comers are free to use the tools of their choice, there is less time in learning the tools.

Fourth, being a self-driven activity. The existing process of making the machine ready for development gives a new employee a free hand to make their machine in their own flavour. Activity requires the support and collaboration with the existing employee to the team, but a person is fully responsible and allow to make a machine of their taste. It gives the newly joined employee a sense of responsibility and flexibility of their own way of working. Weakness of the existing process in getting the machine ready.

The current solution is being used and evolved in several years, but it has been observed to contain several flows which pointed to the need for improvement in the process itself. Given below are the following weaknesses of the existing solution.

First, frequent updating. In the existing process, it has been observed that users need to do frequent updates to their tools and software. In some cases, it has been observed that the existing tools are not supporting the development anymore. So, we need to study the new tools as well. Also, with the individual update of the software, different developer

has different version of software or tools they are using which end up in the different user experience in development.

Second, being time consuming. Though the current process gives the leverage to use the software and tools according to own preference but in some cases, it has been seen that a tool might not be suitable for our project implementation or it is not that effective as compared to other tools. However, new employee installed the software as they were using that tool or software in their previous organization.

Third, requiring licensing permissions. When the current tools and software installation and configuration process give freedom, sometime developers require some additional software which is not approved by the organization or it requires additional cost for the organization. So, while installing the software a user needs to pay attention on tools licensing. It has been observed that the user installed the free and open-source version of the tools which is not allowed for the commercial use, which result into the breakage of code of conduct and business ethics as well.

Fourth, having no support for new tools. As a user is allowed to use the tool of their preference, it has been observed that a new tool used by the developer is the only user of that tool in our organization and which sometimes end up in the situation where a developer don't get any help from their team, as the team is not using the same software of their development.

Fifth, having ambiguity, e.g. in the cases when the version installed by the user is independent to the other members of the team. Sometimes versions are miss-matched and the tools are not supporting other team members, which results into ambiguity and extra cost of debugging, or sometimes it leads to install the software again to get the desired results.

Finally, in case organization, *permission and authorization need to be modified* for the single user role. So that new employees need not to wait for the granting the access right, and the user can have access once the role is approved and no other additional request for the approval need to be taken. With the current manual setup, the developer needs to separately check for the licenses and access right. But it can be sped up by the removal of bureaucracy in an organization, which is needed since the case organization

has very dynamically changing technologies and tools, which require continuous improvement, upliftment and updating.

3.4.2 Other findings: Additional benefits

In addition to time and costs, there were also discovered additional benefits in addressing the need for one-click environment.

First, enhancing the machine as per the user´s need and demand, the users can select the machine according to their need. However, in this process a new employee to the organization need to consult with the team members about the requirement of the hardware to perform the team-related activity. However, by selecting the machine as per need, they can save the cost spend on the hardware as not everyone needs a powerful machine. Those who are involved in the task which don't require much cpu, memory and other resources, can opt for a lighter version of the machine.

Second, a new employee can set the bare minimum software and tools to his/her machine and later they can install the tools and software according to their need. Another advantage of this idea is that new employee can have a quick start and once they have understanding of the business logic, they can later download the needed software and tools to their machine.

3.4.3 Selected focus areas

The key findings and focus area of this thesis were decided after the evaluation of the results of the current start analysis. The strengths, weakness and other observations of the process to get the machine ready for the development, pointed to the following main selected area for building the proposal, as given below.

1. Concept of Automation of Machine Setup
2. Business process re-engineering.

These selected areas aim to improve the process, first, by evaluating and enhancing the concept of automation of machine setup where the tools which need to be used to achieve the automation are pre-selected and the human intervention in the process of

setting up a development is reduced. . As a case organization is quite vast in size and has lot of departments, using various tools and technology were described and their usability with respect to the case organization. Second, after, pre-selecting the appropriate tools, the solution will include building the new process of setting up the one-click environment with the help of business process re-engineering

Next, for developing the solution, the thesis will seek help from available knowledge and best practice how to build automation for a machine setup and how to reengineer a business based on similar solutions which are used in other companies and combine this knowledge into the effort to build own solution.

4 Existing Knowledge and Best Practice on Creating One-click Environment

This section describes best practices and existing knowledge in automation of system setup and its impact on the performance of employees. This section starts with the overview of the automatization of system setup as a concept, its complexity, and challenges. This section also covers the impact of setting up the environment automatically on the employees along with the impact on switching the project or machine refreshes.

First, this section overviews the concept of the machine setup with the help of the Groover (2013, 71) process for automation which describes the benefits of process automation. Second, this section describes the tools which can be used to fasten up the process, and advantages and disadvantages described. In this section, several tools were compared and identified the potential problem, risk, issues, and challenges if an organization take them into use. There is a wide description of using those tools and their market coverage. Later, this section also describes the implementation of those tools to create a process which can lead to a ready to use developer environment.

4.1 Concept of Automation of Machine Setup

Groover (2013, 71) states that automation is a process being executed without any human intervention. It helps in reducing the redundant work and make the process and system fast and reliable. Sheridan (2002) describes automation as a major part of the design and analysis which is required in every traditional branch of engineering.

Nowadays, it is very common employees in IT firms are switching the jobs very frequently. So, a lot of time spent on setting up the machine for starting a new project by a new developer. However, the need to set up machine is not limited to switching the company, it also needed when a company decide to start a new project and resources are internally relocated within the organization. It needs a new developer and various other people to start development with some specific tool and software and again that take time. This process becomes even more tedious when it includes approval from a manager of the employee or arranging the software licences. Currently, various IT firms are focusing on this process and these firms are using multiple methods which can be classified in mainly four categories by which we can alter the process in creating a

development environment which is easy to setup, less time consuming and a lot less pain.

4.1.1 Using Automation Tools

These tools can help in automating the process by which we can install and configure the workstation. Here are few very popular examples given as follows.

Puppet allows the users or organization to defines the software and tools needed to be installed in a development environment. It is an open-source tool creating and managing the configuration of machine (Turnbull, 2011). It helps the developer to install all needed software. It also helps in updating the software as well. It also provides the periodically upgrades the development environment or machine (Martin, 2017). As per Turnbull in his book Pro Puppet (Expert's Voice in Open Source), Puppet handles the how a software upgrades, performs, or installs after analyzing an operating system or platforms and how resources are managed in those systems (Turnbull, 2011). Puppet also uses a rehearsal tool for configuration validation and verification (Shambaugh, 2016). One can achieve the following objectives by using Puppet:

1. Puppet reports to system administrator about the change in the configuration to ensure the configuration changes served properly.
2. All the changes made in the configuration goes by the version control system and then in deploy to the puppet server. (Vanbrabant, 2011)
3. Syntax of the configuration file committed for the change can be pre-evaluated by puppet before committing to the repository.
4. Puppets reduce the actions for editing and creating new user accounts and its controlled centrally (Turnbull, 2011)

Thus, it creates a fast and safe environment for testing purpose as well before using it in customer environment. Following are the advantages of Puppet as an automation tool:

- Declarative language: It use Puppet DSL (Puppet declarative language) for managing and defining the system config. Puppet DSL allow a user to define the state of system in a declarative manner which make it easier to maintain and increase the developer understand of the automation process.

- Agent-based architecture: Puppet provide agent-based architecture, which can run on the system and communicate with the master puppet system. This enables the centralised management of the larger system.

- Idempotency: Puppet ensure that the applied configuration is implemented to all the other system in whole network.

- Scalability: Puppet is highly scalable and can be used for large-scale deployment. It can provide the parallel and distributed system which make installation of large-scale system convenient and easy.

- Ecosystem: It has a huge ecosystem of module and plugin that can easily manage various aspects of the system which provide a wide range of functionality and help a user to automate the tasks and support multiple components of the infrastructure.

- Integration: Puppet is widely acceptable in the market and hence support the integration with other tools and system as well. It can be used with monitoring system, database configuration management, and other automation system and tools.

- Security: It has features for securing the infrastructure such as secure communication to communicate between master and agent, and it could encrypt the sensitive data.

- Reporting and auditing: Puppet has the reporting and auditing capabilities which allow a user to track and monitor the changes applied to a system. (Arundel J, 2011).

Cfengine is the tool that can help us by automatising the configuration and installation. However, it has its own limitation. Cfengine comes in free and open-source version and a commercial distribution which include the additional support features. However, the major problem with this tool is it don't support all the operating system like windows. Moreover, they have decided to add some more popular operating system in their solution. (Automate your infrastructure (n.d.)). Cfegine brings the following advantages:

- Security: Cfengine makes the system more secure by secure communication between master and agent and encrypt the sensitive data.

- Flexibility: Cfygine allows the user to manage and define configuration of a system in a flexible and modular way. It also supports various configuration format.

- Community and support: Cfygine has a large and strong community of developers and user who contribute in the development and provide support.

- Ease of use: Cfygine is easy to use and provides a customer-friendly interface and documentation (M Burgess, 1993).

SmartFrog support is also an open sources framework which can support various operating systems. Smart frog is a good option for the small company which can easily use it but it's not very favourable solution in terms of scalability. It is a prototype-based language tool which supports templates. The prototype approach makes it very easy for system configurations for customer dedicated context, without removing any default configuration and other changes in case of modification. Smartfrog also support reliability 'patterns', but these are optional and can all be replaced with dedicated components that are more relevant for a specific context.

Shell Scripts are the scripts generated by the internal company employee, the most common advantage is that they can be easily customised, but they need dedicate time to develop and company need to invest their resources to work on them. Updating and maintain them is also one of the major challenges. (Casimir, 2005.)

To produce an automated solution for getting machine ready, organizations can use the shell scripts and customized them according to the use. It can be customised as per the use of the company and can easily modified as per the demand.

Ansible is also another automation tools which can help in automation of the software installation. With ansible engineering, product and agile practitioners could work in a structured way and delivering the valuable outcomes for the customers. Figure 5 shows the use of Ansible for one-click development environment (Subhi, 2023).

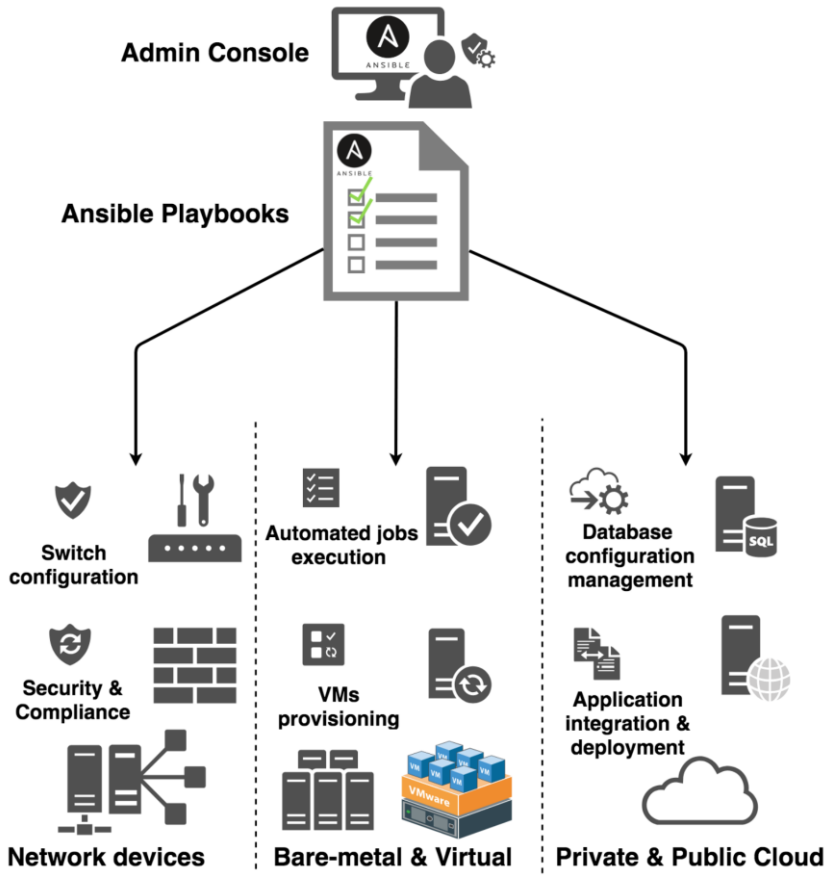

Figure 5. Ansible used for one-click development environment (Subhi, 2023).

Figure 5 describes how Ansible manages the various network, bare-metal and virtual and cloud (public and private). Figure 5 illustrates how one can run the playbook for various configuration from their console.

4.1.2 Disk Images

Disk imaging software store an image of a configured host which can be easily restore to various other hosts. Disk imaging methods are very fast and reliable when we need to generate the same setup in various machine. However, it’s a challenging and tedious process to keep the images up to date.

4.1.3 Virtualization

The concept of virtualization was discovered in 1960-1970 by IBM. The first virtualised machine came into existence in 1972 when IBM launches its virtualization operation system virtual machine VM/370 (Paulson, 2001).

There are many tools available for virtualization such as Xen, VMWare, Virtual PC and VirtualBox. With the help of these tools, we can create virtual machine images with several different configuration and multiple installation. Moreover, with the virtualization developer can restore a machine to the previous version in case of any problem with new setup which give them a leverage to experiment and try the new software and solution as they can anytime rollback to the previous version. It also gives the liberate to the user to work on multiple projects as they can easily switch from one environment to another with a command or a click.

It is common practise that the user has a disk image which they can install in their system and connect that with remote repository. On latest hardware virtualization has shown exemplary performance and no performance degradation has been observed.

4.1.4 Source code control

The last step for atomization in the setup process is to entail the source code. Development teams can set their project in source control, So, developers can start deploying, building and checkout the commits. Users can also check-in helper infrastructure i.e build files, makes files etc. and set the tools for the development.

With source code control, code can be controlled in a centralised way that help the big organization to mitigate the legal and geopolitical issues as well. Source code control also help the organization to evaluate and analysis the code by providing the single source of information. Source code control is an essential part of business process re-engineering as it provides the source of automation and can be a starting point of analysis in the business process re-engineering.

4.2 Business Process Improvement & Re-engineering

This section discusses and compares the two approaches, and select the one that is best for creating the one-click environment.

4.2.1 Business Process Improvement

Business process improvement is a process that target to attain the efficiency by the continuous improvement by reiterating the process. Business process improvement doesn't result in the quick responses to fulfil a business rather it's a steady process. So, it is important of adopt agile methods for Business process improvement (Martins, Paula and Mariebla, 2017).

Business process improvement can be applied to a wide range of business processes, including inventory management, customer service, order fulfilment, and more. It is often used with Agile and DevOps practices to deliver continuous improvement and innovation.

According to (Kirke, 2012) business process improvement has a structural approach which has following steps:

- Current state of the business process has been identified and then current state is analysed. With this step the understanding of the current process has been done and later the potential improvement ideas are also identified and recorded.

- Defining the proposed situation of the process, here one define the outcome or objective of the process for example defining the efficiency of the process, quality which will be achieved with the introduction of the new process and customer satisfaction which will be achieved one the process has been executed.

- Creating a roadmap, based on the finding from the current state roadmap which outlines the steps required to draw the changes for the enhancement of the process is done.

- Implement the identified changes this may involve introduction of the new tools, compatibility with the new technology and re-structuring the process to achieve the goal from the current process.

- Monitoring the process, process has been monitored to check the effectiveness of the changes made. These changes are monitored to measure the progress.

- Continuously improve: Continuously evaluate and improve the process based on feedback and performance data. This may involve iterating on the process, refining and optimizing the changes made, and addressing any issues or challenges that arise (Saari, 2006).

Thus, with the help of business process improvement one can increase the efficiency of the process, reduce the cost involve in the process execution along with fasten up the execution. Business process improvement improves the customer satisfaction and help in uplifting the overall performance.

4.2.2 Business Process Re-engineering

Business process reengineering was introduced by Hammer, Davenport and Short in 1990s, and since then it widely used and known as one of the popular tool for the management (O'Neil and Sohal, 1999). Tanoglu (2004) points to three driving forces which result in the business process reengineering: *the customer, competition, and change,* which were the outcome of globalization and pace of development in the IT area. As per Adeyemi and Aremu (2008), business process re-engineering is a powerful tool for company which are looking for the improvement in their current operations. Business process re-engineering combines business processes and reduce the operation costs (Hartigh and Segveld, 2011).

Business process re-engineering is the process of improving the performance of the key process in an organization, with the intention of reducing the overhead work and automizing the repetitive process in an organization. Process engineering is a method of investigating the current phenomena to achieve a dynamic and "non-linear effects of action under complexity" to improve the company growth (Langley, 2007.)

Business process re-engineering identifies the problem in the process and in eliminating the redundant work and improve the efficiency of the employee in an organization. It slot the process into the pieces and make them more agile and cover the end-to-end process from requirement analysis to product delivery and customer feedback. In business process re-engineering process are considered to be more resultful and identifying the

need of the customer. Process thinking in an organization should be scrutinize over a period to attain quality competence (Davenport & Short, 1990).

Business process re-engineering also helps in reducing the operational cost in an organization. For maximum output from the business process reengineering the whole process need to be first studied deeply and identify the risk and pain point of the process and then later define the strategy of improving the process. In business process re-engineering processes are analysed based on various fundamental factor such as cost, time, culture and quality. After an analysis, organization deploys innovative process using computer-supported automated technologies to modify the existing procedure (Dumas et al., 2018.)

For continuous improvement, an organization must revise its process in a timely and regular interval (Marchand & Stanford, 1995) to meet the market requirement, update the process, being competitive and support their customer with cost effective solutions. For revising the current process, it's very necessary that an organization must have an intensive knowledge of its process (Earl & Khan 1994). To get the better understanding of the processes and working effectively one need to facilitate the robust resource management (Attaran, 2003).

Business process reengineering have been implemented in the various reputed firm such as ford (Hammer 2001) and reduces the headcount in their accounts payable and procurement process from 500 to 125 and reduce the time significantly with the implement of these process. Its impact was visible into the company revenue and employee satisfaction. However, process redesign has a little different observation. For service process, processes are not measurable and tangible in the service perspective and hence they are not compatible for service process (Chakrabarty and Tan, 2007.)

4.2.3 Comparison between Business process improvement and Business process re-engineering

Business process improvement (BPI) is a methodology that focuses on analyzing, identifying, and optimizing existing business processes to improve efficiency, reduce costs, and enhance overall performance. BPI typically involves a structured approach that includes steps such as process mapping, process analysis, and continuous improvement.

On the other hand, *Business process re-engineering (BPE)* is a broader concept that encompasses the design, development, and implementation of business processes. BPE involves the development of new or improved processes, often using a system thinking approach. It is concerned with the creation of new processes or the redesign of existing processes to meet specific business needs.

While BPI is focused on improving existing processes, BPE is more concerned with creating new or improved processes. BPE may involve the development of new tools, technologies, or processes to meet specific business needs. Thus, business process re-engineering is very helpful in making a process more effective and powerful. It improves the efficiency in the following ways.

Table 4. Benefits of Business process re-engineering (Rao L & Mansing G, 2012).

Benefits of Business process re-engineering
➢ Cost reduction: Business process re-engineering automates the processes and hence result into the effective cost reduction to an organization. ➢ Operational agility: Business process re-engineering simple down the complex process. It also divides the steps into the simple and small steps. ➢ Repeatable solutions: Using the business process re-engineering one can create scalable, efficient and adaptive solutions. ➢ Streamlined workflows: Business process re-engineering reduces the bottlenecks and limit the redundancy by optimizing the identified process. ➢ Improved user experience: Business process re-engineering reduce the tedious work and eliminated the bottlenecks and increase the accuracy. Hence, process has less mistakes and improved customer experience and employee satisfaction. ➢ Structured service delivery: Business process re-engineering improves the customer service by making process responsive more effectively in lesser time which result into the reduction in the response time and faster customer service delivery (Ramirez, 2012).

So, with the help of business process re-engineering one can modify the process of their organization and further analyse them to make them more cost effective and improve the performance. Business process re-engineering also provide the structure way which can easy the process of implementing the process.

4.2.4 Life cycle of business process re-engineering

Every process has its own lifecycle management, similarly business process re-engineering has its own lifecycle. Step in the lifecycle are *Analysis, Design, Modelling, Execution, Monitoring* and *Optimization* (Pega, 2019). This lifecycle can be view for the simplification as given in the following figure.

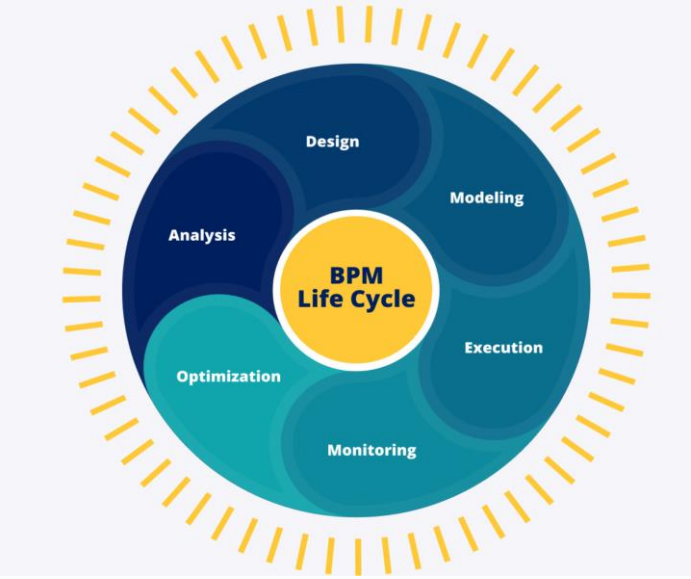

Figure 6. BPR lifecycle (Pega, 2019).

Figure 6 shows that the business process re-engineering lifecycle can be divided into six common steps. The first step, *Analysis,* is needed to discover and find out the process or workflows which need to be improved. These process or workflows can be modified to minimize the cost involved in the process or to improve the performance. Workflow analysed in this step are analysis to meet the business requirement (Pega, 2019).

The second step, Design, is needed to create a process or workflow design are created which can be include the machine-to-machine, human-to-human or machine-to-human interactions. These designs should map the complete process so that it can display the complete workflow of the process and later help in reducing the problem with the process. This design will also help the process to keep the relevant procedures for the operations and should support the service level agreement (Pega, 2019).

Modeling is the first step. In this step, use of various software and automation tools are done to produce a effective model and evaluate the process designs. Once an

organization has a process design, use different input values to evaluate the behaviour and if a mature model is identified after providing the different values, then its stable and can be consider as a selected model otherwise iteratively design need to change and re-evaluate (Hammer, 2001).

Execution is the second step. In this step the process selected or designed in the previous steps are automated with case management, decisioning, business rule and other related technologies (Shambaugh, 2016).

Monitoring is the second step. For the process executed in the previous step, use the data generated from the process implemented in system performance, compliance and errors. This data help in evaluating the performance of Business process re-engineering against corresponding proposed design and model. Monitoring also test whether the model or design proposed for process improvement help in meeting the KPIs. (Ligus, 2013).

Optimization is the fourth step. Once an organization has the data from the modelled process and monitoring step of the process, it can be analysed again to identify the areas where the process can be modified to produce high quality results. Process can be optimized by monitoring result to gain high efficiency and better results. (Samaranayake, 2009).

4.2.5 Business process reengineering tools and techniques

According Matinsuo and Blomqvist (2010), the business process´s key characteristics are customer focus, goal orientation, focus on value-adding activities, effective use of feedback in modifying operation and performance improvement. Gronroos and Voima (2013) state that co-creation of value within the organization happens when all parties benefit. Grisold (2020) describes that the changes in process can be achieved with enactment of established routine process and drawing the concept of affordance.

The goal of the business process is to have the radical improvement in the actions of an organization. However, there is no reference of any technology and tools used in business process reengineering and this happen due to different BPR implementation use different tolls for the best reengineering application; yet, business practice points to the following traditional tools.

First, *process visualization***.** Many scholars in Business process re-engineering suggest to an ideal “end state” for a process that need to be re-engineer, Barrett (1994) said that a vision for the process is the key to the success for the a business process re-engineering.

Second, *Process mapping/operational method* study. Cypress (1994) said that operation study methods are mostly suited for the re-engineering but they are not considered in many cases. Few years ago, these concepts are incorporated in various tools such as (a) Integrated Definition Method (IDF), (b) Data flow diagram(DFD), (c) Object oriented Analysis (OOA) (Yu and Wright, 1997), and (d) Process based project management.

Third, *Process modelling & Process measuring* (Martinsuo & Blomqvist 2010) remove the factors that affect the performance and place the resource in an adequate manner. Process can be explained in a holistically form with the help of process mapping or architectures.

Fourth, Setting Objectives and Selecting Improvement Areas (Martinsuo & Blomqvist 2010) set processes to be in line with the strategy of the company and fulfill its vision. Objective should take care of the customer and value creation.

Fifth, *Change management*. Many authors focused on the human base re-engineering that need to take in account for an organizational change. Authors such as Mumford and Beekma, 1994; Bruss and Roos, 1993) wrote that the management of change is the largest and complex task in a business process re-engineering task. Kennedy (1994) wrote that incorporating the human element in the re-engineering process is needed due to the perceived impact on the work methods and jobs.

Sixth, *Benchmarking.* Many authors propose that benchmarking becomes an integral part of the business process re-engineering as it help in the better visualization and process development which are known as operation in other project/organizations (Harrison and Pratt, 1992; Changm 1994; Furey 1993).

Seventh, *Process and customer focus*. According to some authors, primary goal of a business process re-engineering is to have redesign a process for the improvement of the performance from a customer perspective (Vantrappen, 1992). It shows a link

between authors which talk about the improvement related to the quality process (Harringthon, 1991).

Thus, the above business process re-engineering tools can help execute the process enhancement. In the case organization case, these techniques will help in implementing the proposed solution in a synchronized way.

4.2.6 Conceptual Framework of This Thesis

This section discussed available information about automating the machine set-up in an organization based on case studies, articles, literature, and research papers. The previous section discusses how the case company supports a newly joined employee to set up their machine, and this section explored the literature and hands one practice of setting up the development environment quickly when a new employee joins the organization.

Based on the readings discussed, the conceptual framework for this thesis focused on the two selected areas: *Automation & Standardization,* and *the Business Process re-engineering for fast implementation* as described in the section above that discussed existing knowledge in this area.

Automation focuses on the removing the manual intervention. In this context, the automation means the installation of the software and tools which saves the time of an employee and make the process reliable and fast. In the existing knowledge section, some tools for automation have been discussed. *Standardization* is the act of promoting, implementing, mandating, and developing the similar constituents and routines, in this case, based on the compatible technologies and frameworks in the industry. The effort of standardization focuses on ensuring the quality, fast execution, and consistency. So, that the evolved process can resolve the organizational problem and provide a valid solution which is cost effective and acceptable to the industry as well.

For utilizing these elements, *the Business process re-engineering* for fast implementation is applied. *Fast implementation* means that the process is re-engineered in such a way so that new changes can be easily implemented, and quick fixes can be applied to the solution. Figure 7 below summarizes the conceptual framework for doing the nest steps in this thesis.

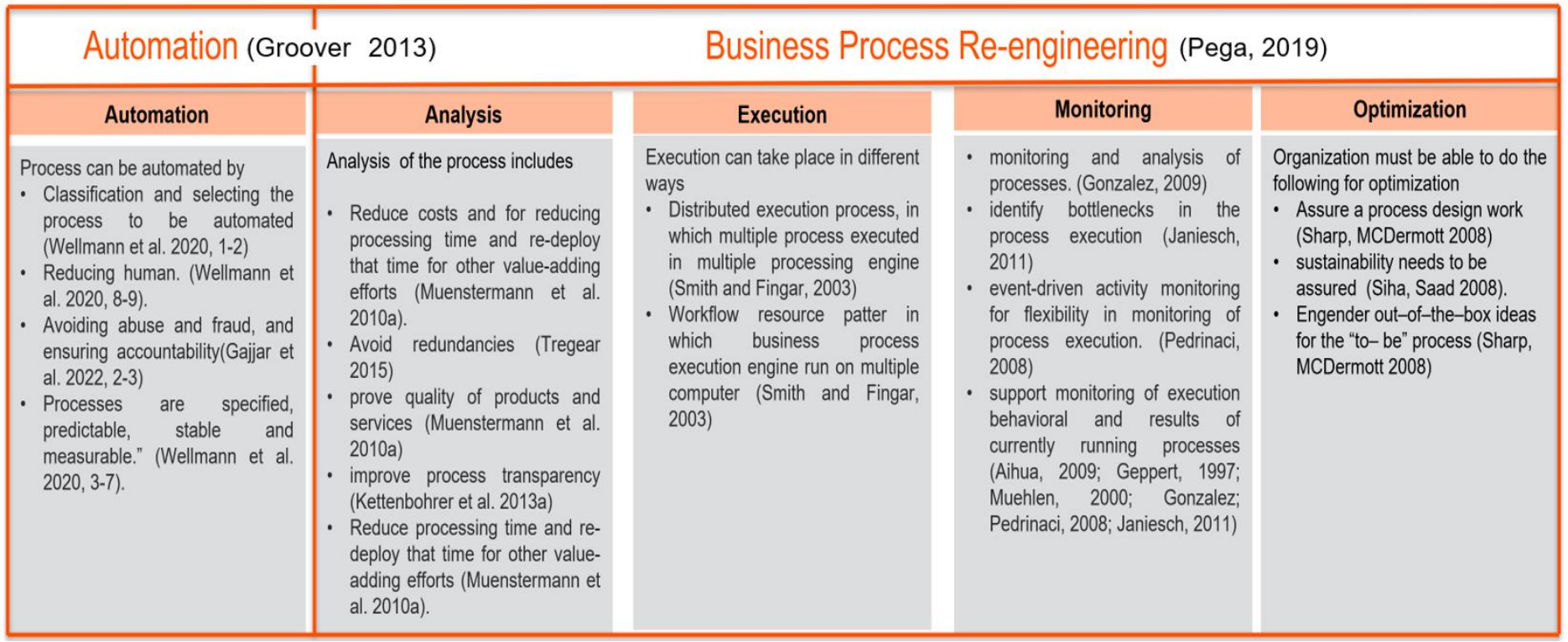

Figure 7. Conceptual framework of this thesis.

5 Building Proposal for One-click Development Environment for the Company

In this section, results from current state analysis, existing knowledge as well as best practices from conceptual framework are combined to formulate a proposal for the process of building one-click development environment. This process identifies the automation tools and steps to improve the existing process. The proposal came up as per the discussions and collaboration with the case company stakeholders, employees, and representative from the organization. The information received from them is collected and represented as Data collection 2.

5.1 Overview of the Proposal Building Stage

The goal of the proposal is to implement a process by which an automation of system development can be achieved which can save the case organization and its employees from redundant work. The proposal utilizes the automation and allows the new employee to focus on innovation and business critical problems.

The goal of the case company is to promote the automation of tools and software and promote the innovation in work by which new employees can be onboarded easily and redundant work can be avoided. The current process of getting the machine ready for the development is performed by individuals along with the support of their manager and other team members. The current process takes several days to get a machine ready once a new employee joins the company, and new employee also need to gather the information from various sources and still ends up in different problems. Sometimes these problems need to be solved by the other team members, which impacts the team's capacity to work.

As per the finding form the current state analysis and information gathered from the existing knowledge section, the thesis pointed to the best practice by which other organizations are improving their process of getting machines ready. Along with the best practice, the solution building is divided into the two main sections which is automation and business process re-engineering. Furthermore, business process re-engineering can be sub-divided into analysis, execution, monitoring, and optimization.

For formulating the initial proposal, the results from the current state analysis and conceptual framework were discussed and the solution for one-click development environment was proposed. Furthermore, the case organization stakeholders were asked in an interview to highlight the desired outcome of the process after implementation. Output from the interviews with stakeholder came as a requirements list for the one-click development environment solution. Later, other employees of the case organization were also interviewed to suggest their wishes and draft a proposal of one-click development environment. Finally, Data 1 and Data 2 were utilized together to structure the proposal for one-click development environment.

Data 2 collection consisted of the interview and internal employees, stakeholders, and representatives of the case organization. The output from the interviews came as a proposal for the improvement to the current process. Stakeholders are the key owner of the product such as program manager and internal employees are user of the existing process. Data 2 which came from these interviews and discussion is summarized in Section 5.2 below.

5.2 Finding form Data 2

Inputs for building the proposal of one-click development environment includes, first, Data 1 outcome from current state analysis; second, inputs from the existing knowledge, best practices and conceptual framework; third, Data 2 inputs from the stakeholders.

Data 1 was complemented with the existing knowledge and best practices for changing the current process and adapting the best practices. Data 2 evaluated the best possible process to automate the machine setup and proposed to improve the current solution in two steps: selecting tools for automation and changing the process which is business process re-engineering. According to the process re-engineering best practice, it also divided the implementation into four steps: analysis, execution, monitoring and optimization.

Table 5 summarizes the inputs for the proposal building. It includes Data 1 from CSA, the best practices, and Data 2 by the case organization stakeholders of the case organization in the interviews who are using the current process for getting ready their machine for development. Table 5 shows the stakeholder suggestions (Data 2) for

building proposal in relation to the current state analysis (Data 1, CSA) challenges and ideas form the conceptual framework (CF).

Table 5. Stakeholder's suggestion to the initial proposal.

Key focus area from CSA (Data1)	Input from literature (CF)	Suggestion from stakeholder for proposal, summary (Data 2)	Description of their suggestion
Automation Processes are manual, Tools and software required are install manually. Updates are done by individuals.	Tools like Ansible, Puppet can be used for the automation of the configuration of the machine. Software and tools can also be update with the help of customized scripts or with the automation tools.	a) Utilize ansible as automation tools b) Define the list of software require in the configuration files. c) Customized automation script should be written and updated time-to-time or automatically.	1. Ansible was suggested as tools for the automation as case organization has already used the ansible 2. Stakeholder focused on defining the list of software and tools listed in an automatic configuration, considering the licensing and various authentication and authorization. 3.Stakeholder suggested to discuss and collect the list of needed software with experienced developers and testers.
Business process re-engineering: **Analysis** Processes are executed manually, and no analysis has been recorded. Machine setups happen as per the situation and no pain points or improvements were written.	All the process should be automated, and analysis of the workflow should be done in a timely manner. Installation process should be improved by the automation and problem must be recorded and eliminated by the particular team or person.	a) Timely evaluation of the process where updates and installation are checked. b) Dedicated team should analysis the process	1. All the process should be analyzed with a specific team. 2. Focus on reducing the installation time and saving the resources utilized by the development environment
Execution Execution is done by individual according to their own preferences. Machine setup done on individual no global policy in the case organization.	Machine setup process is executed with the help of software and automation script. All employees need to follow the same execution process for machine setup which is standardized and automated. Fast execution of machine setup process.	a) Problem free automation should be generated and if a problem occur that should be handled with the improvement in the configuration script. b) No human intervention is need while the machine setup process is being executed. c) Process execution should be quick and reliable.	1. Stakeholder suggested that machine setup execution should be fast and completely automated. 2. Stakeholder want that developer should run a simple command which executed all the needed steps and employee can focus on the development rather than setting up a machine. 3. Execution of the process should take least amount of resources i.e., CPU and memory.
Monitoring Processes are handled by individuals and no specific monitoring tools were used. Issues were identified by the employees itself and communicated among the team on personal label.	Machine setup process should be monitored, and logs must be recorded in the user machine. Logs can ship to the relevant team in case of failure. Updating the process once an error or bug has	a) Process monitoring tools should be used, so that process can work effectively. b) Tools like Jenkins should be used to check the resources and memory utilized by the process c) Load dashboards should be built for showing the	1. Process of machine setup should be monitored, and error or bugs should be recorded. 2. Software tools should be used for monitoring status of the process. 3. Machine should be continuously monitoring with the help of some dashboard and an alert should be given to user once a potential error in

	been identified in the process.	status of the resources utilized by the process	the process has been identified.
Optimization Lack of process optimization. Processes are redundant and same work has been repeated by every employee when installing the software needed for the machine setup.	Process has been automated and redundancy has been removed. Execution time can be reduced by removing the long steps	a) Process should not take more than 30 min in getting a machine ready. b) Process should be optimized if any potential delay which can be removed	1. Machine setup should be optimized in a way so that it can finalize a process in 30 min. 2. Fast execution of the process by optimizing and removing the unnecessary steps of installation. 3. Obsolete, unnecessary and outdated tools should be removed.

As shown in Table 5 above, the process of automation was missing in the current way of getting a machine ready, when a new employee joins the organization. To make the whole process quick, effective, and responsive, thesis identified few automation tools after researching for the problem few tools like ansible and puppet came to knowledge by which we can automate our process with single configuration setup. Same process of automation was discussed with stakeholders and other key persons in the organization which is described in Data 2 and they also approve the use of tools. However, stakeholders suggested some improvement or their expectation with the automation. Stakeholders propose to list the needed software once and put them into the configuration. So, configuration script need not to change regularly. Also, employees should find all the needed tools for the development from running the single command. Stakeholders emphasized collecting the software list from the developer and tester who has already faced challenges in getting their machine ready.

Next step is to improve the whole process of setting up the machine for development. So, to improve the process, as Analysis mentioned initially, it was found that in the current process there was not much possibility of analysis as there was no action recorded only way of analysis is to gather the information and experience of the person who has recently make their machine ready for the development. For the Analysis, key stakeholders suggest that in the case organization, timely evaluation of the scripts can be done so that software can be updated quarterly or half yearly.

Another stakeholder suggested that Analysis should be repeated over time i.e quarterly. Respondent 6 particularly suggested that

> "*Analysis should be done quarterly, which should show how the process has effected and a list of software along with their version should also be recorded*

> *and further analyses to improve the system. No software should be updated without the analysis". (Respondent 6)*

Another step in the process improvement is execution in the current process all the task execution is done by the individuals and according to their own preference. Hence, there was no standardization of the software or tools in any developer. When an individual developer was interviewed, he stated that

> "*I want to quickly set my machine and I would prefer to use the software and tools which I was using in my previous company as its easy for me to use the same software rather than learning a new tool." (Respondent 7)*

This Execution process result into the problem that everyone has their own setup, and no standardization was shown in the team which some time complicate the things and developers are not able to help each other. However, stakeholder proposes that all the machines should be identical and should not have no code in their local machine. A stakeholder stated that

> "*Our company has a policy that we should use the standard tools and software and we need to execute our process in such a way that everyone in the organization has an identical machine to each other". (Respondent 6)*

Next step in the process improvement is to Monitor the process, tools, and software for that stakeholder suggest using the software or web-based tools like Jenkins which company was using in another project.

Later on, process need to Optimize so that process can be faster and cost efficient. Optimization is a crucial step for making the system faster stakeholder set a benchmark for the machine setup for 30 min maximum. And also suggest optimizing it further.

5.3 Initial Proposal for One-click Development Environment

The Initial proposal came after evaluating the selected focus areas of the one-click development environment for getting the machine ready for the development.

Evaluating the challenges and needs of the users and the IT team (Data 1) and best practice by other companies (CF), the idea for the initial proposal was formulated by which a tool can be generated where a user can create their development environment with just running a simple command or with just a one click. These selected areas were divided into mainly two categories i.e. automation and business process improvement. In *Automation,* focus is on using the automation tools which can support setting up the environment automatically; and *Business process re-engineering* the focus is on building the process of selecting the tools and software which a user might be needing for their development environment.

In the first selected area, i.e. Automation, the focus in on the tools and reducing the human interaction for creating an environment for the developing code in an organization. In current state, the whole automation process was missing and with the existing knowledge we identify the tools that can be useful for automating our setting up environment process.

Int the later section, *Business process re-engineering,* the primary focus was on improving the process and that also has four section to work on those are (1) Analysis, (2) Monitoring, (3) Execution, (4) Optimization. The proposal describes in detail about how one can improve the process with analyzing the current process and identifying the main point of problem. Monitoring can detect the ongoing problems as well can be source of information for the further analysis and improvement. Execution is one of the important phases as it needs to be fast and repeatable with the automation tools. Monitoring the process, tools, and software can use the software or web-based tools like Jenkins which company was using in another project. Finally, Optimization of the process is a phase where one can start improving the ongoing process with the help of analysis, monitoring and the time consumed in execution.

5.3.1 Proposal for Automation

Process automation is a highly crucial and important step that uses various tools. Stakeholders have own preferences over the various tools as per their experience. There is a comparison table for various leading tools, narrowed down to three main choices, for setting up environment or automating the process of machine setup.

Table 6. Comparison of three automation tools (based on stakeholder's evaluation).

	Ansible	Puppet	Chef
Availability	Good	Good	Good
Management	Easy	Not very easy	Not very Easy
Ease of setup	Easy	Not very easy	Not very easy
Interoperability	High	High	High
Scalability	Highly Scalable	Highly Scalable	Highly Scalable
Pricing	$10,000 for 100 nodes	$11200 - 19900 for 100 nodes	$13700 for 100 nodes

From the above tools, a selection of tools has been made for the process of automation in which the organization has compared several tools based on their usage. After discussing with the stakeholders and existing team members, usage of the Ansible has been selected for the automation of the process. Here is the illustration how Ansible supports to setup one-click development environment.

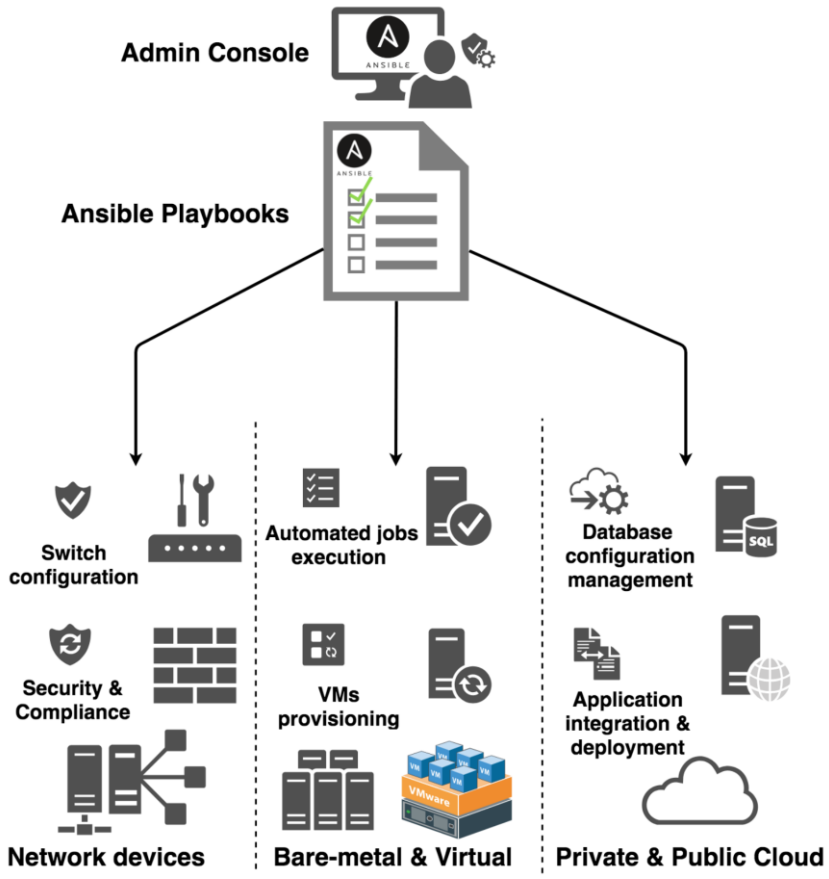

Figure 8. Ansible proposal for process automation (Subhi, 2023).

Figure 8 shows how Ansible console provide the solution of the automation for one-click development environment. Ansible playbook can be created to collect the information of the user device whether they are on a network, bare metal or in cloud. Ansible also supports the advanced security features as well which can bring additional feature to our proposed solution.

5.3.2 Proposal for Business process re-engineering

According to the logic of business process re-engineering, the proposed process was divided into the four steps i.e., *analysis, execution, monitoring* and *optimization*.

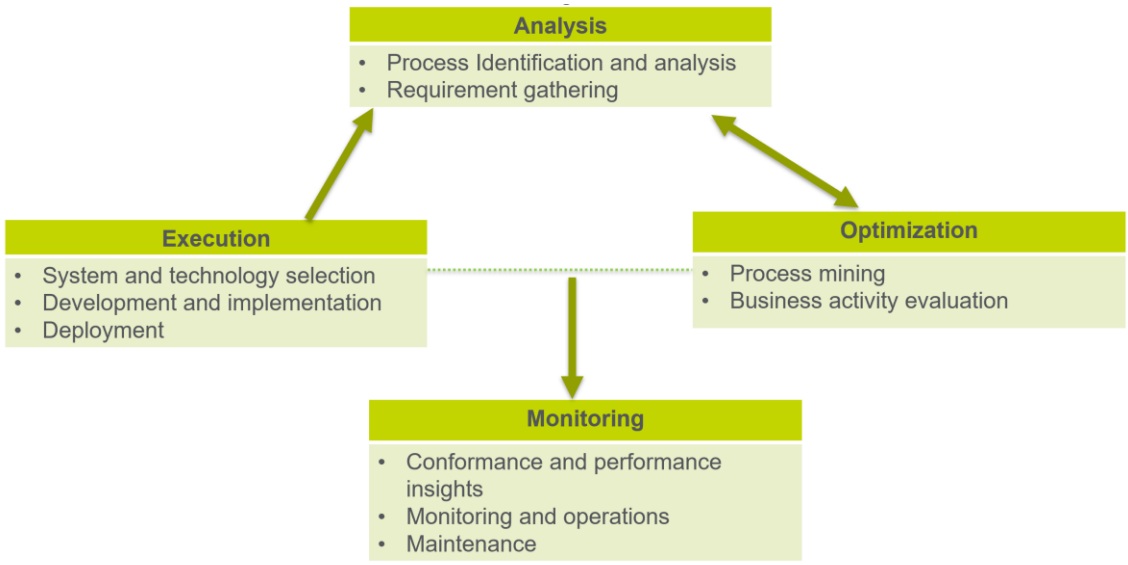

Figure 9. Four elements of the Business process re-engineering proposal for one-click environment.

As described in Figure 9, the proposed process was divided into four phases. In *the Analysis* phase, the process analyses the needs for setting up a machine for the user. Analysis of the process can be divided further. As mentioned in Figure 9, the Analysis of one-click development environment can be done by identifying or defining the goal, identifying the tools, and gathering the information needed for the environment setup.

In *the Execution* phase, selection of the technology is done, and selection of the tools and software list are putted into the Ansible playbook and instruction written into the internal wiki of the case company. When a new user wants to execute the process, they can find the information in the wiki and follow the steps in the Execution.

In *the Optimization* phase, process was monitored and redundant steps removed to make the process faster. In case of one-click development environment, optimization can be done by evaluating the list of software which are needed or not over time. Updating the version of the software and tools is also considered in optimization.

In *the Monitoring* stage, the solution should be monitored, and automated reports should be generated, so that evaluation of the overall process can be done. Process maintenance is also part of monitoring strategy. Such that if something broke or if there was some issue in any software tools, it can be identified by the process and can be corrected quickly.

5.4 Summary of the Proposal for One-click Development Environment

This Thesis proposes a solution for getting the machine ready with the automated process and improving the existing process of getting a machine ready for the development. In the proposal for one click development environment, a list of tools, participant and impact are covered.

Table 7. Proposal for the one-click development environment.

	Tools	**Participants**	**Impact**
Automation	• Ansible • Customized script	Dedicated team for developing one-click development environment	Removal of the manual process
Analysis	• Internal Wiki • Interview users quarterly	• User of One-click development environment • Stakeholders	Improve the existing system of building a new machine for development
Execution	• Scripts • Software tools • Integrated development environment	Development team of one-click development environment	Implementation time will be reduced and fail proof
Monitoring	• Internal Wiki • Interview users quarterly	• User of One-click development environment • Stakeholders	Improve the existing system of building a new machine for development
Optimization	• Interviews • Documentation	Users of one-click development environment	Redundant process can be eliminated

Table 7 summarizes the proposal for using the tools for the automation has been provided and Ansible and scripted need to generated to achieve the one-click development environment. Also, it describes its impact and covers the Analysis, Execution, Monitoring and Optimization steps of the process.

For *the Analysis*, internal document generated for one-click development environment are used and interviews can be conducted over a period of time to analysis the report,

stake holder and user can be participants of the analysis and analysis can suggest the improvement which can impact the performance of one-click development environment.

For *the Execution*, the IDEs and other software tools will be used, as they are being used by the development team, and it will fasten up the execution.

For *the Monitoring*, it proposes to use tools like Jenkins and Grafana dashboard for the alert development team of the one-click developer environment will be participant and its impact will be identification of the bugs in the system quickly and make system available all the time.

Similarly, *the Optimization* will be driven by the interviews of the users and recording their experiences and removing the redundancy from the process to impact the process optimization.

By the proposal of this thesis, the case organization can automate the process of getting the machine ready by simply clicking a button. With the help of proposed solution, all the account and access will be given, and the employee will be able to execute his work on the day one.

6 Validation of the Proposal

This section collects the results of validation of the initial proposal that was developed in Section 5. In this section, the validation of the initial proposal is executed. The recommendations provided by the stakeholders and other users are included into the proposal as Data 3. This section ends with the final proposal and further recommendation for the action plan for the execution of the proposal.

6.1 Overview of the Validation Stage

The purpose of this stage is to improve the one-click development process developed in Section 5. The initial proposal was shown to the stakeholders and various users i.e., developers, testers, and managers and ask for gathering their recommendations, suggestions and improvement ideas. A particular group of experts which included developer, tester and manager were interviewed more closely for the validation of the proposal for the one-click development environment.

The validation stage focused of the Automation and Business process re-engineering parts. In Automation, the tools and software were listed and discussed with the experts within the organization. Process re-engineering was discussed with managers. Other recommendations for the one-click development environment were collected, analysed, and recorded as Data 3. These recommendations were also considered for the final proposal of the one-click development environment process. Recommendation for automation and process re-engineering were discussed and evaluated in a few group discussions and meetings.

The validation was done in two group discussions; the first group discussion consisted of technical people i.e., developers and testers; while the second group discussion was organized for the manager to improve the current process. After the recommendations received from the discussion, additional stakeholders i.e., program manager was interviewed to get their views and recommendations.

The primary goal of first group discussion which was held with developers and tester was to identify the technical tools and software which they would need to use while working on the project. In this discussion, the tools which help developers to speed up their work

were listed. The Integrated development environment (IDE) was also discussed in this discussion.

The primary goal of second group discussion with the managers was to gather the improvement ideas for the process. Managers were shown the process and asked for their feedback about the improvement of the process, for example, how to make the process more reliable and appropriate. In both group discussion, removal of the redundant steps was on the main focus. Updating the tools, software and process were also widely discussed.

6.2 Development of the Proposal Based on Data 3

Data collection 3 focused on the providing the enhancement and development ideas that the case company stake holder has proposed while observing the initial proposal. Their views and feedback were collected in Data 3 for building the final proposal.

Table 8 summarizes the input collected in two group discussion and interviews with the stakeholders discussing the initial proposal. The proposal was primarily focused in those discussion and interviews which discussed two sections, Automation and Business process re-engineering, and their sub-processes.

Table 8. Improvements towards the Final proposal for one-click environment.

Elements of Initial proposal	Comments on Validation	Expert's comments	Initial proposal development
Automation	• Compare the tools and create a matrix of their performance.	Program manager suggest having a compression matrix so that the result can be compare and best automation tools can be selected	Record the compression matrix
	• Consider the tools which were used previously in the organization	Experts suggest having a look of the tools which we are using previously and list out the pros and cons of them.	Use the legacy component if possible.
Analysis	• Record the analysis in organization wiki and update it time to time	Everything which is analysis should be recorded into the organization internal wiki for the future record and evaluation.	Create a separate page where output from the analysis can be recorded

	• Discussion of the result of analysis with expert periodically	Results received from the analysis should be discussed with experts quarterly. So that proposed solution can be improved/implemented	List the Enhancement in the wiki and discuss them quarterly
Execution	• Automation of the execution with the help of scripts	Script should be written for the execution and manual process should eliminate	Mandatory scripts for removal manual execution.
	• Software tools should take care of execution rather than manual execution	Software should take responsibility of execution	Tools should be used to support the developer
	• Use of Integrated development environment. For the quick execution	IDE like code or Intellij should be used.	Development should be start using the integrated development environment
Monitoring	• Finding from monitoring should be recorded in internal wiki	Automated tools to be used for monitoring and result stored in company's wiki	Continuous monitoring of the process and environment
	• Monitoring should be done with the software tools available	Jenkins tools should be used for monitoring purpose	Alert the development team in case of identified problem instantly
Optimization	• Quarterly report should be analyzed and should be used for optimization	Line managers suggest booking the quarterly meeting already to get an automated reminder for analysis the report and optimizing the process	Continually evolving the process each quarter.

In Table 8, every key element received some development suggestions. General feedback from the stakeholder was that the process and polices are fine and the organization can go ahead in the implementation of the proposal. However, the Program manager state that

> *The proposal is innovative and can help us in hiring more consultant and they can execute their work from the day on of their joining. (Respondent 6)*

Below, the development suggestions received to each process are described separately.

6.2.1 Developments to Automation

Selection of the tools for the automation is seen as one of the critical steps, as the whole process of improvement is dependent on the selection of the tools. Tools need to be tested well. Initially, the Proposal relied on a list of tools and software from the existing knowledge but after a discussion with the stakeholder and expert of the field, it was proposed that the solution will have the tools which were previously used in the organization. The list of those tools is made along with their stable version. However, it was proposed from the stakeholders and experts that there will be matrices recorded for the performance of the different tools. After that, once the organization has enough evidence of the performance of those tools, they can be implemented into the automation list and be installed automatically when a new employee joins the organization. In an interview with a program manager and stakeholder, one developer said:

> "*Collected list of software tools is good and reliable. We don't need any additional license for that list but let's keep traces of the tools and software used outside the industry and keep track of their performance. We can have separate studies for those new tools". (Respondent 6)*

In the group discussion, it was noticed that the experts and management are willing to use the existing tools in the new solution as they are familiar with them and there is no additional cost involved in maintaining them. However, some people who recently joined the organization suggested some new tools, and it was considered and decided that the company will keep records of all the tools and keep a metrics for comparing their performance and the cost involved in using them. The analysis of those metrics is proven to be helpful and cost effective. As the Proposed solution evolves, new tools can be put into the automation list. The Analysis of those metrics should be done on a quarterly basis, which is also part of the enhancements of the process.

6.2.2 Developments of Business process re-engineering

In this section, the change of the process was described. This step is divided into the four sub-processes which are *analysis, execution, monitoring* and *optimization*. Once the automation tools and software list was finalised, the participants were able to formulate how to improve the process of adoption of those tools and support them with building of the solution.

For *the Analysis*, which is very important in the proposal, it was proposed to have an analysis of the solution quarterly and record the finding for the further enhancements to the solution. In a discussion with the group of developers, one expert stated that

> *"We have a good list of tools in our solution but sometimes they need to be updated or a new tool is better than what we are using. So, a proper analysis is done. To make this analysis a permanent process we need to fix the time for it may be once in a year, quarterly or half yearly". (Respondent 5)*

For *the Analysis,* the process and solution proposal were to record the evidence of the failure, and discuss the improvements quarterly. Many developers have differences in their view of having analysis yearly, half yearly or quarterly. Some of them want improvements to the solution as soon as a potential tool is found, but others have different opinions. So, with the voting it was decided that the process of analysis will be done quarterly, so no impact on the developer performance is made, and they don't need to update the solution quite often.

For *the Execution*, which plays an important role in making the things move faster and reliably, group discussion participants proposed that most of the Execution should be done with the help of scripts, so that it can be done quickly next time. In a group discussion one expert suggested:

> "We *need to focus on reducing the redundancy of our execution and that can be done with the help of customised scripts. These scripts will help us reducing the redundant work and we can more effect and quick". (Respondent 5)*

In the discussion, the Integrated development environment was also considered for the writing the code and installing the necessary plugins for the quick execution of the task. It was an important suggestion since the remote environment should be accessed with the help of those plugins and can promote the Execution faster.

For *the Monitoring*, which helps in making a solution faster, more reliable and improves the quality of the solution, the monitoring tools were discussed that are used to monitor the process. For this, the product monitoring organization has used Jenkins tools which can continually monitor the process. It was suggested that several pipelines can be

created which can monitor the performance. One stake holder said in the group discussion:

> *"We need to have a strict focus on the monitoring of the solution. We need the alarm system to notify when something broke and notify quickly to the developer or concern team. We have used previously used Jenkins in our organization which could be useful tools in this thesis proposal." (Respondent 5)*

For *Monitoring* the whole process, automated tools should be used. With the help of monitoring, continuous integration and development can be achieved.

For *the Optimization*, which is a process that is done after carefully analysing the process and removing the redundant parts from it, it was proposed to have quarterly report analysed, so that the process can be optimized from the outcome of the analysis. In group discussion, one developer suggested.

> *"Our process for developing the development environment is good. However, after several year it may have changes which could be redundant. For removing those redundant changes our process should be analysed properly and optimization should always consider in refining the process." (Respondent 4).*

Based on these inputs from the stakeholders, the Final proposal was refined and formulated as follows.

6.3 Final proposal

In this section, the thesis presents the final proposal which included all the enhancement ideas received from the validation section. In validation section, group discussion and interviews with the experts, testers, developers were conducted, where the ideas were received from the stakeholders and experts within the organization. Table 9 shows the final proposal.

Table 9. Final proposal for one-click environment.

Stages	Tools Selection	Process Improvement	Participant
Automation	Tools and software should be selected based on the previous experience.	Automation software and tools selection should be done with the help of experts and stakeholders	• Development team • Stakeholder • Experts
	Matrices for the performance should be evaluated quarterly	All the performance related issue should be recorded	• Development team • User of the one-click development environment
Analysis	Internal wiki	All the analysis should be recorded into organizational internal wiki and can be used for further analysis	• Development team
	Project Readme	All the technical documentation should be recorded into the project readme and should be available with the code within the project.	• Development team
Execution	Customized scripts should be created	Scripts should be created within the organization and reduce the manual execution of the process.	• Development team
	IDEs (integrated development environment) like Microsoft code and Intellij	IDs which can help developer and tester in removing the problems and suggestion the proper suggestion for code writing	• Development team
	Use of Integrated development environment. For the quick execution	IDE like code or Intellij should be used.	• Development should be start using the integrated development environment
Monitoring	Jenkins pipeline	For monitoring continuous workflow Jenkins pipeline should be setup	• Integration team
	Grafana	To provide the alert Grafana dashboard should be used to identify and investigate the problem occurred in the process	• Integration team
Optimization	Internal wiki And reports	Reports should be analysis with the help of expert to get the optimized process	• Experts • Development team • Integration team

Table 9 shows the final proposal for the one-click development. The *Automation* step describes the tools used for the automation, and it should be started by the development team, along with the expert and stakeholder suggestions.

Later in the table, the new process is described that is divided into four steps. *Analysis* is done based on the records stored within the organization internal wiki, and it should be done with the development team. Analysis will be done quarterly.

Execution is also planned to be done with the customised script, and code writing is to be done with the help of integrated development environment (IDEs). Initially it was proposed that the organisation will use Microsoft code as it suits the company's current purpose and role. However, later that IDE can be replaced with something more useable or suitable for developer. The use the Microsoft code was agreed with the experts, stakeholders and developers.

Monitoring the process is done with the help of the Jenkins pipeline, and Grafana dashboard will be created for getting the notification and alerts from the process. This task will be executed with the team which looks after the integration work within the organization.

Optimization will be done with the help of analysis of the report generated and collected in the internal wiki. Optimization will be done with the help of the expert suggestions and review and feedback form the user of the one-click development environment.

6.4 Action Plan

After validation of the proposal with the stakeholders and employees of the case organization, the Action plan was built with the intention of automating the process of machine development when a new user starts working on a project. For utilizing the final proposal made in Section 6.3, the Action plan was created in Table 9.

The Action plan suggests the potential responsible teams and employees for the implementation of the plan and its impact. In the Action plan, the steps such as analysis and optimization are described as those repeated regularly. The Action plan is the sequence of steps that should be executed in the way as described in Table 9.

In the proposed Action plan, teams, times and workload have been planned and indicated according to the team capacity and capability. The Action plan relies on the following teams or team members.

Development team: this is the team which is working on the project. Members of the team will develop the system and will use it too.

Experts: Experts are the selected people from the team with more than 20 years of experience. It also consists of architects which have ideas of whole projects and requirements.

Stakeholders: Stakeholders belong to the management team; these people also provide the funding to the project. Stakeholder have been asked for their feedback and suggestions.

Table 10 Action plan.

	Automation		Business process re-engineering		
			Analysis	**Execution**	**Monitoring**
Action	List of tools needed for creation of one-click development environment		Internal wiki will be analyzed in this process.	Customized scripts will be created for the execution	Jenkins pipel be setup for t monitoring th of software to
			Every fault, bug and performance identified in this phase will be recorded		Grafana dash should be cre for getting the of bugs found system
Time	June-July 2024		June- July 2024 and later Regularly every quarter	June -July 2024	August – Sep 2024
Who	• Development team • Stakeholder • Experts		• Development team • Experts	• Development team	• Integratio

In this table, the timeline of the process execution was discussed with the relevant team. In the table, different tasks - from tools selection to process re-engineering - are described and timeline is created for them.

In the *Automation* process, a list of software used in one-click development environment need to be created in July-August and it should be executed with the help of stakeholders and experts, and implemented by the development team.

In *the Business process-reengineering*, *the Analysis* is done in June-July and later it should be repeated every quarter. It is a good time to do the analysis after the release. The case organization has planned four releases in a year. *The Execution* of the initial plan needs to be done in July-August by the development team. *Monitoring* is a continuous process, and it should be done by the integration team it requires the implementation of the monitoring pipeline and dashboard for the alerts. Last section, *the Optimization*, is the step in which the analysis results into finding the redundant steps in the process and they are removed in Optimization. Optimization is a regular process which is to be done every quarter as suggested in the final proposal.

7 Conclusion

This section deals with the summary and key finding from this thesis. It concludes the proposal and its overview. This section contains the executive summary which shows the steps and the results of the study, and the outcome from the proposal of the thesis along with the lesson learnt during the process.

7.1 Executive Summary

Working on a new project brings challenges when onboarding a new SW developer. First things which a new employee performs is to get their PC machine ready which becomes a long process as it involves installation of multiple professional tools. This thesis proposes a solution of a one-click development environment as a remedy to this challenge. By automizing the process of getting their machine ready, a new employee can focus on the work to be done rather than setting up the environment.

The case organization is a global corporation with multiple new employees. So, it is very often that new people join the team or project and a huge time and resources are invested into the process of setting the environment for each of them individually. Hence, this thesis aimed to create a solution where a new user can join the team and their machine can be ready via the one-click development environment.

This thesis employed Applied action research and qualitative research methods. The current state analysis was conducted via a series of interviews and group discussion with stakeholders, developers, testers and mangers within the case organization, and the data collection was done in three data collection rounds. The current state focused on investigating the current practices of setting up the machine and environment in the case organization, and revealed the main pain points and obstacles. The current state analysis showcased the problem faced by the developers and testers when they try to set the environment for the development. After the current state of the process of getting machine ready for development was established, focus areas have been selected and for search among literature and best practice in the industry.

Next, in the literature review, best practice for atomization of the machine setup were studied. Literature and best practice showed available knowledge for automation and business process re-engineering.

Thirdly, thesis proposed a solution and validated it by evaluating it with various users and stakeholders from the case organization. The Final proposal created the key steps in the new process by which the case organization can automate their machine building process quickly and enhance the process with less pain and trouble. The thesis also provided the action plan for the implementation of the final proposal by which the case organization can achieve a one-click development environment.

The Thesis provides a quick solution for the implementation of the one-click environment including the software and tools to the user to perform their day-to-day work with minimum preparation time. By doing it, the thesis saves time of the newly hired developers and re-directs it towards performing their key responsibilities. One of obvious business benefits is that the solution can reduce the risk of delay in the starting of a new project.

7.2 Managerial Implications

The case organization has plan to implement the proposal speedily so that to take advantage from the proposal as new employees are joining the case organization every month and expanding intensively. In order to speedily implement the proposal the case organization needs

First, focus on the automation and using the reliable and open sources software as they can be cost-effective and easy to update.

Second, experts should be consulted before any update and implication of those update should be well studied in advance before implementation.

Third, the process must be protected by the higher management and feedback should be taken from the user of one-click development environment.

Fourth, as per the proposal, quarterly analysis needs to be done for the process regularly. This analysis can be done after the release and the documentation of the best practice and issues occurred during the execution of the process can be collected and analyzed.

Finally, Optimization should not be overlooked as it makes an important step of the process and it should be taken in consideration while analyzing the process regularly.

One-click development environment is good practice to achieve a high level of automation and executing things speedily which are the main focus area of the case organization. Use of one-click development environment will reduce the stress of getting a machine ready for the development and developers and testes can focus on learning new technology and can have more time for working on the product related issues. The Proposal will remove the redundancy from the process and make it more effective.

7.3 Thesis Evaluation

The objective of the thesis was to create a proposal for a solution which can automate the process of machine ready for development. The expected result from the thesis was to create a detail proposal which include all the step from current manual process to a fully automated process by which case organization can save the time of newly joined employee and allow them to focus on product development. With the ideas proposed in the final proposal, the case organized can improve its current process which is a manual process to the full automated process.

The research included pre-defined stages and data collection round. In the thesis, applied action research approach was used with qualitative and quantitative measures. For gathering the data, employees from the case organization were interviewed and some group discussion conducted where the collective feedback was received from the employees.

Existing knowledge and best practice provided knowledge of the tools for re-engineering and how to break a process into the small steps. In one-click development environment process, re-engineering was divided into four small step to make the process more effect and fault tolerant. Existing knowledge helped to propose the required changes in the process.

Initial proposal was proposed after interviews with the developers, testers, experts, and stakeholders to get feedback to the proposed solutions to the collective problems faced by individuals. The final proposal was built after the validation with stakeholders,

developers, testers, and experts. For the final proposal, several interview and two group discussion were conducted in which feedback on the initial proposal was received form the stakeholders, testers, developers, and experts. At the end, the thesis was able to propose a final solution with some enhancement ideas to the initial proposal.

The proposed solution brings the quality and cost-effectiveness to the process by the automation of the process. The final proposal solves the problem identified into the current state analysis and provide case organization extra time to focus on the product development.

7.4 Closing Words

The thesis focused on the automation of the process and removal of the redundancy form the process. One-click development environment is a tool which eliminate the redundant work and make process automated. By the proposed solution of the thesis a new employee can automatically create their environment and can focus on learning the core of the development rather than gathering information about the software and tools that they need to use for the product development.

One-click development environment brings the additional value to the organization as it promotes the automation of the process, monitoring the process and optimizing the process. One-click development simplifies the complex process of getting a machine ready with least cost as well as reduce the overhead workload from the new employee. It reduces the overhead arrangement of the details of the software which a new employee need to collect before starting the development in the organization. The solution is focusing on change in the process meaning that solution will be analyzed, monitored and optimized in the future as well.

The key elements in the proposal provide an overview of the software and tools to be used along with their changes in the process. Proposal of the thesis specifically talks about the changes in the process termed as “Business process re-engineering”. With this element, the process will evolve by the analysis and optimization. Monitoring the process also provide extra value to the solution as it gives the alert in case of potential bug found in the process. The Proposal was validated with the stakeholders and other key person which build the strong background and improvement of the proposal.

With the implementation of the proposal of one-click development environment, a fast and advanced process of system/machine development will be created for the company in a cost-effective manner, as the employee will gain more time to work and understand their core development. When implemented, the proposal will bring continuous improvement to the process which will make it useful for a long time.

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WRITTEN STATEMENT
on the use of AI-based tools in this thesis
by Shubham Bhardwaj, the student of BI Master´s Degree Programme
Thesis title: One click development environment.

According to the *"Guidance for addressing the use of AI-based tools in studies at Metropolia Business School (for written submissions)"* from August 2023, I make this statement on the use of AI-based tools in my submitted Master´s thesis.

1) Which AI-bases large language models or other AI-based tools I used

   None

2) In which parts of the thesis which tools were used, and for which tasks *(please make a list)*

   None

3) What portion of the text was helped with these tools, for each use

   None

4) Which prompts were asked, exactly *(please indicate the page number in the text where used)*

   None

5) Here, I describe what continues an ethical and reliable use of AI-based tools that I used *(use, for example, the recommended documents from "MBS Guidance" referred to above)*

   I have not used any AI-Based tool.

6) Here, I describe how ethically and reliably I used the AI-based tools in my thesis submission.

   I have not used any AI-Based tool.

This written statement makes part of my thesis and is done to help in evaluation and assessment.

12 Dec 2024, Helsinki

Shubham

Appendix 1. The Case Organization Employee Satisfaction Survey regarding the ongoing process of getting the machine ready for development.

User satisfaction survey

1. Would you like to recommend the way of setting up the environment for development

   Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Absolutely

2. Any additional comment about the process

   _____

3. Current way of getting the machine ready for the development should be improved

   Mark only one oval.

   - ◯ Strongly Disagree
   - ◯ Disagree
   - ◯ Neutral
   - ◯ Agree
   - ◯ Strongly Agree

4. Time consumed in getting the machine ready for the development

   Mark only one oval.

   - ◯ 1 day
   - ◯ 2 days
   - ◯ 3 Days
   - ◯ 5 Days

Appendix 2. The Case Organizations Interview structure for current state analysis (Data collection 1)

Interview Checklist for current state analysis

1. Introduction and background of master thesis

- [ ] Short introduction
- [ ] Reason for selection of topic

2. Collecting ideas and feedback for development

- [ ] How to get the information about the tools and software that need to installed
- [ ] What are the issue facing during the machine installation
- [ ] How much time it needed for machine setup

3. Handling the feedback and ideas

- [ ] How to give the feedback or report a problem related to a tool
- [ ] Strength and weakness in current way of getting the machine ready
- [ ] What improvement should be included in the process
- [ ] What is most time consuming thing in the whole process

4. Evaluation

- [ ] Best practice of current process
- [ ] Evaluation of proposal
- [ ] Input and refinement suggestion

Appendix 3. The Case Organizations Interview structure for Building the proposal (Data collection 2)

Interview Checklist

1. Introduction and background of master thesis

- [ ] Short introduction
- [ ] Reason for selection of topic

2. Collecting ideas and feedback for development

- [ ] Getting the documentation for machine setup
- [ ] Place where the document is place for machine setup
- [ ] Standard tool installation and time consumption in the process

3. Handling the feedback and ideas

- [ ] How to give the feedback or report a problem related to a tool
- [ ] Strength and weakness in current way of getting the machine ready
- [ ] What improvement should be included in the process
- [ ] What is most time consuming thing in the whole process

4. Evaluation

- [ ] Best practice of current process
- [ ] Evaluation of proposal
- [ ] Input and refinement suggestion