FACTORS AFFECTING THE IMPLEMENTATION OF SCRUM RISK MANAGEMENT PRACTICES IN SRI LANKAN SOFTWARE INDUSTRY

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ABSTRACT

The Software development industry is a leading industry in the world today. The success rate of software projects is highly dependent on the approaches used for managing them. There are multiple well-known software project management methodologies available. Agile Scrum is identified as the most commonly used project management approach in the current industry as it is capable of easily adapting to the changing business requirements. As a result of that, there is a rising trend in using Scrum as the project management approach in many software development projects.

The Scrum framework is a process that focuses more on customer satisfaction through collaboration and communication. There fore, Scrum is an approach with some informal characteristics, compared to the other project management methodologies.

Risk Management is key areas that most impact the success rate of Software development projects. Risk Management defines the ability to manage the project seamlessly in different situations. The Scrum framework does not clearly define any risk management capabilities in its' theories. The Scrum authors introduce Scrum as a risk driven approach that does not require any explicit risk management mechanisms. Based on that statement many studies has been taken place that proves the Scrum has inbuilt capabilities to manage risks in software projects. However, the software projects which follow Scrum still fails due to the inappropriate application of those risk management capabilities.

Therefore, this research aims to investigate the factors that are causing the implementation of those inbuilt risk management capabilities in the real-world context. To fulfill the aim of the research, based on a broad review of literature and thoughts of experienced Scrum users, a few factors were identified that are most impacting the successful implementation of risk management practices in Scrum projects such as customer interaction, team readiness, communication, organizational culture, and process readiness. A theoretical model and hypotheses were developed based on the factors identified. The hypothesized model was tested using some statistical techniques using the survey data collected from the software professionals with some insight about Scrum. The research findings reveal that team readiness, customer interaction, communication, have a high impact on the successful implementation of risk management practices while process readiness and organizational culture have a low impact on the implementation of risk management in Scrum.

Keywords: Agile, Risk Management practices, Scrum

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LIST OF ABBREVIATIONS

ANOVA	-	ANalysis Of VAriance
CSV	-	Project Management
IT	-	Software Development Life Cycle
PM	-	Project Management
PMP	-	Project Management professional
QA	-	Quality Assuarance
SDLC	-	Software Development Life Cycle

1. INTRODUCTION

1.1. Background

The software development industry has become one of the fast-growing sectors in the world today. With the development of the software industry, the success rate of a software project is becoming a very critical factor as most of the businesses around the world thoroughly rely on information systems. Information Systems lead to increased competition between software companies, and they need to manage their software projects effectively to achieve a competitive advantage in the industry.

Sri Lanka, as a developing country in the world, playing a significant role by operating more than 300+ Information technology companies managed as product and services based companies, creating a large number of employment opportunities, which is over 85,000 by the year 2017 and continuously increasing every year. (SLASSCOM, 2020)

Software projects can become complicated with their requirements and features, and they are particularly vulnerable to failure. (Breno Gontijo Tavares, da Silva, & de Souza, 2017) A large number of these software projects run off the budget are ended prematurely or fall far short without meeting user expectations and business functionalities.

In the software development industry, many project failures have occurred due to poor management in the budget, time, and cost. (Suresh & Dillibabu, 2018) Risk management is an essential step in project management processes to avoid this kind of failure. Many studies have shown that the lack of risk management activities or its inappropriate application is the reason for failures in software projects.

A software project risk can be defined as any type of incident or an event that disrupts the usual development process(Suresh & Dillibabu, 2018). Risk management concerns all necessary activities that need to be performed to avoid this kind of disruptions and reduce project failures happen due to delays in schedule, over-budget costs and low quality of the product (Sarigiannidis & Chatzoglou, 2011) and resource burnings.

In traditional software development methods, risk management is a key area that is documented and confined. (Mousaei & Javdani, 2018) Agile is a set of software development methodologies, which allows iterative development. Scrum is one of the widely used

lightweight process frameworks which comes under agile methods. This methodology gives more attention to functional requirements but less focus on managing risk. This leads to a higher rate of failures in scrum-based projects.

1.2. Motivation

With the increasing complexity and rapid changes in requirements for software projects, the projection and estimation of cost, time, and effort become a complicated task, which leads to increased adoption in Scrum project management methodology. Scrum provides more flexibility to deal with these rapidly changing environments in every aspect, such as technical, business, and managerial.

Software risks can be identified at any stage of the development process. Even though many traditional software development methodologies define proper risk management techniques, scrum is a methodology that is recognized as a methodology that does not specify risk management activities. Scrum authors or founders believe that the iterative, overt, and collaborative nature of Scrum methodology makes it easier to manage risks implicitly. While some of the Software professionals accept the inherent risk management capabilities in Scrum, some Agilists believe Scrum is not capable enough to handle some of the risks external to projects.

Because of this confusion, scrum users tend to follow different approaches with their experience to manage risks, which sometimes leads to break the agility and scrum principles, which are not recommended. As a result, some do not follow Scrum completely in their projects, and they tend to adopt only a few selective elements out of Scrum methodology without knowledge in which items are most important in risk management.

1.3. Research Scope

This research will be focusing on identifying factors that affect the implicit risk management practices in Scrum and find how much they affect the successful implementation of scrum risk practices.

This research will observe the risk management activities that are important in the software development scope and will compare them with the scrum practices that contribute to risk management.

1.4. Problem Statement

The software development industry is becoming an industry that is more vulnerable to failures due to the increasing complexities in business requirements and technologies. Project management is one of the important factors that can help in minimizing software development failures by controlling and managing every project task. Different project management bodies have introduced multiple project management solutions to tailor into different environments. The Scrum methodology is one of the most popular methods out of all.

According to some past literature, there is no proper risk management mechanism in Scrum, and it is being discussed as a significant issue that Scrum has. Contrarily to that, some Scrum users believe that Scrum has implicit risk management techniques, which could be achieved by following proper Scrum practices. In reality, Scrum users may not follow all the scrum practices due to various reasons, or they are following Scrum practices without considering the value of those practices.

This study is focusing on observing how scrum users manage risk situations with the help of existing scrum risk practices and identify which are critical factors that are affecting the successful implementation of them.

1.5. Research Objectives

This research mainly focuses on achieving the following objectives:

- Examine the inherent risk management practices in Scrum.
- Identify the factors that affect on implementing Scrum practices successfully.
- Identify how these factors impact successful Scrum risk management implementation
- Provide recommendation to improve scrum risk management in Scrum

1.6. Research Significance

This study focused on identifying mechanisms to improve risk management practices, which leads to effective scrum implementations in software projects. As a result of poor risk management, a software project will fail in delivering their products or services on time, within the budget, and as per the expected quality.

At the end of this research, we will be able to identify what are the reasons that affect the risk management capabilities in Scrum and among them which factors can mostly stimulus the inherent Scrum risk management practices. The main intention of doing research is to improve quality while reducing the budget and time overruns through proper risk practices.

1.7. Conclusion

At the beginning of this chapter, the problem background, the motivation for this research led to identifying the factors to improve consideration on Scrum risk management practices. This chapter describes the objectives that are planned to achieve in the study and the scope that is covered.

2. Literature Review

2.1. Risk Management

A Software Risk is defined as any type of uncertainty that can occur during a project, which impacts one or more objectives or goals of the project. The impact of a risk can be either positive, which creates an opportunity or negative, which interrupts the usual processes (IARM, 2014). Risks can be categorized in a very general form as static risks or dynamic risks. Most of the risks are identified as dynamic risks as their impact typically does vary with time and circumstances (Bukohwo, 2015).

Software is vulnerable to risks from the start of the project until the final acceptance of the software product throughout different phases in SDLC (Hizazi, Arshad, Mohamed, & Nor, 2014). With the increase in the complexity of software development, it has become critical to organizations to manage these risks involved in software projects. Hence, software risk management is an essential activity that needs to be carried out to complete a software project successfully.

According to project management theories, risk management is one of the ten knowledge areas that are important for a project to be successful (Sutherland & Ahmad, 2011).

Risk management is defined as a process of identifying, analyzing, and responding to the risks that can occur during the development life cycle of a software project. (Talal Alharbi & Jameel Qureshi, 2014) This process is responsible for assessing identified risks, evaluating them, and developing strategies to avoid or mitigate them in the interest of achieving project goals and objectives (Sarigiannidis & Chatzoglou, 2011).

Risk Management consists of five steps (Hammad & Inayat, 2019)

1. Identifying risks using several techniques to identify potential risks.
2. Assess risks by evaluating, estimating the identified risks.
3. Prioritize risks to be included in the prioritized product backlog.
4. Mitigate risks through the development of an appropriate strategy to deal with the threat.
5. Communicating the results from the first four steps to the relevant stakeholders and determining their perception regarding the uncertain events.

2.1.1. Importance of Risk Management

Risk management allows a software project to avoid issues related to the economic and operational aspects. Risk management is a proactive measure to improve project completion rates with fewer failures. (Hizazi et al., 2014) Risk management activities are required to quantify the risks, asses the probabilities of occurrence, and the impact of risks on project success. The group of software project risk management suggests that project managers should be able to identify and control risks to minimize the probability of project failures(Nogueira et al., 2016).

2.2. Scrum Project Management

Agile is a framework consisting of several methodologies such as Extreme Programming (XP), Crystal, DSDM Atern, Feature Driven Development, and Lean Software Development. Scrum method is one of the most widely used processes among all agile methodologies and adheres to agile manifesto. The founders (Schwaber & Sutherland, 2017) of Scrum methodology states that Scrum is a framework and not a methodology.

The Scrum approach is an iterative and incremental project management approach, which is shown in Figure 1, that helps a team to organize product development of large, complex projects efficiently. Scrum is an adaptive, flexible method to ensure transparency in communication and measure continuous progress. (Sachdeva, 2016)

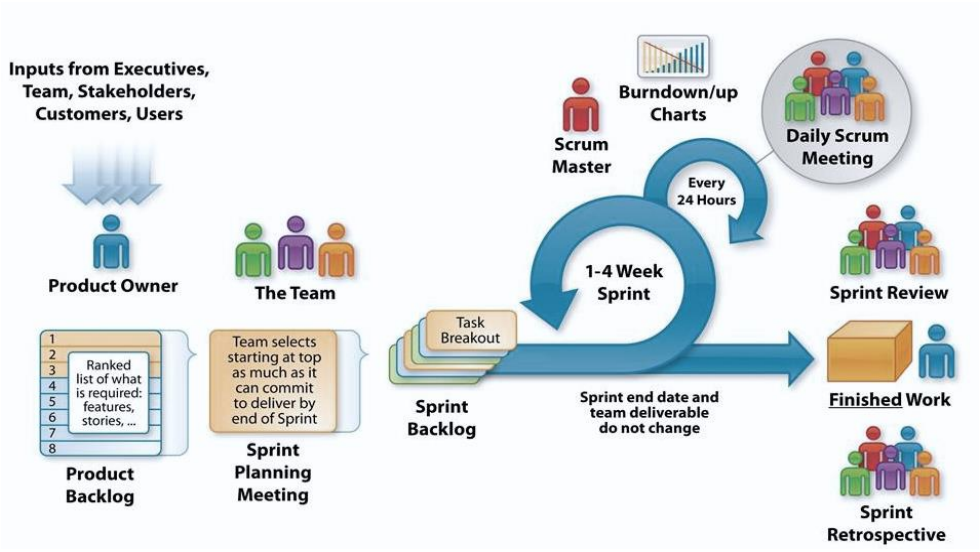

Figure 1: The Scrum Process

2.3. Scrum Components

Scrum methodology consists of a few main components, such as Scrum artifacts, events, roles, and rules as listed in Table 1. The Scrum methodology is a combination of components which are connected while helping to achieve the objective of Scrum. With these elements, scrum develops a structure in managing components in a project to make it a success. The Scrum components and their subcomponents can be categorized as below.

Table 1:Scrum Components

Components	**Sub Components**
Team	Product Owner
	Development Team
	Scrum Master
Events	Sprint
	Sprint Planning
	Daily Meeting
	Sprint Review
	Sprint Retrospective
Artifacts	Product Backlog
	Sprint Backlog
	Burndown charts

2.3.1. Scrum Artifacts

Scrum Artifacts are being designed and created while the project is development is in progress. Artifacts can be defined as any item that used to guide, understand, and monitor project details. An artifact can be created in different formats such as documents, test cases, monitoring charts, dashboards, or any other deliverables produced before the implementation of the system. Artifacts help to maximize the transparency of project information among the relevant parties.

- Product Backlog

The product backlog is a catalog listed with all the requirements with time estimations to complete implantation in a prioritized order. This list contains a small description of the

product feature. The product backlog is a living document, which helps to reduce the conflicts in the project scope and usually owned by the product owner.

- Sprint Backlog

The Sprint Backlog is another prioritized task list that describes the requirements with an estimation time, which limited to a duration of a single Scrum Sprint. The items for the sprint backlog are picked from the product backlog based on the priority. The sprint backlog is a plan for delivering a product at the end of Sprint duration. Hence, selecting the items for the sprint backlog should be carefully done.

- Burndown Chart

The Scrum uses the burndown charts as a graphical representation of the remaining tasks and the time left to complete those tasks. The burndown charts can be used to elaborate on the remaining tasks as product-wise or sprint wise. The burndown chart will help in keeping the product team running on the schedule

2.3.2. Scrum Ceremonies

Scrum ceremonies, also known as Scrum events, are some time-boxed meetings to gather team members to ensure the visibility or transparency of the project is maintained. (Schwaber & Sutherland, 2017) There are many pre-defined Scrum events such as sprint, sprint planning, sprint review meeting, daily scrum meeting, and retrospective meeting.

- Sprint

Sprint is a timeboxed iterative development cycle. Usually, a Sprint can be a duration of a minimum of two weeks to a maximum of four weeks. The Sprint usually begins with the occurrence of a Sprint Planning meeting and ends with a Sprint review meeting. During the time of Sprint, the development team works collaboratively to deliver a working component to the client, which is in a usable state.

- Sprint Planning

The sprint planning meeting is the kick-off meeting of a Sprint. The sprint planning meeting is a bit lengthy meeting that the whole team, including the scrum master, product owner, and the development team, should attend the planning meeting. This most important task of this

meeting is to define user stories, assign them to most suitable team members, estimate the time based on the capabilities and competencies of members in the team, and their availability. The whole team is to allow the team to ask questions and get a better understanding of the items assigned to them.

- Daily Scrum Meeting

The daily scrum meeting is the scrum meeting that has the shortest time box. Typically, the meeting stands for 15 to 30 minutes. The intention of having a daily scrum meeting is to allow the team members to describe work completed since the last meeting, the tasks that are planning to do before the next Standup meeting, and the difficulties you are facing at the moment. When a team member is facing an issue and unable to continue with the work, they can raise the problem and get help from other team members.

- Sprint Review Meetings

The main objective of having sprint review meetings is to showcase the deliverable items of that particular sprint to all interested parties, including product owners, customers, and all the members of the Scrum team. The stakeholders are allowed to provide their opinions on the product deliverables.

- Sprint Retrospective Meetings

The sprint retrospective meeting is a meeting that held once a sprint ends. The retrospective allows a team to asses their skills, identify potential pitfalls, mistakes, and finally discuss how they can be avoided. The participation of the development team, scrum masters, is required. The items presented in the sprint retrospective meeting will help in improving the productivity of the next sprint.

2.3.3. Scrum Roles

The Scrum process consists of three primary roles. scrum master, product owner, and the development team. (Hoda, 2011) Scrum teams are usually self-organizing teams with sufficient skills to manage the scrum work.

- Scrum Master

The scrum master role is vital in a Scrum project. A Scrum master is known as a facilitator who helps the team in improving team interactions, clearing obstacles, and conducting

meetings required. The scrum master is responsible for taking care of all inside and outside interruptions while the team focused on product development tasks. A scrum master does not always need to be a project manager by the designation, but a person with excellent personal interactive skills.

- Product Owner

Usually, the product owner is the key stakeholder in a software project. But the role can be delegated to a person from the scrum team, who can act as a proxy for the product owner. The key is the product owner should have a clear vision about the product being developed. The primary responsibility if the product owner role is to manage the product backlog, ensure the product backlog covers the required features, and the items are correctly prioritized.

- Development Team

A Scrum Team should always be a cross-functional team with all the competencies required for a successful software project implementation. The team must be a self-organizing team that works collaboratively to meet deadlines with quality deliverables. It is recommended that the number of participants in a scrum team should be less than seven members, to make it easier to manage the team and reduce the conflicts.

2.4. Risk Management in Scrum

Risk management is a critical factor for a project to be a success. Hence, the traditional development methods consider risk management as a separate knowledge area in the methodology definitions by itself. In the Scrum framework definitions, there is no such definition of risk management. Many researchers believe Scrum is not focused on risk management, and Scrum risk management is not as good as the other traditional project management methodologies. (Breno G. Tavares, Da Silva Eduardo, & De Souza, 2017) Some believe that Scrum is focusing only on risk identification techniques, but there is no proper mechanism to mitigate risks. (Reddaiah, Ravi, & Movva, 2013)

According to the authors of Scrum (Schwaber & Sutherland, 2017), Scrum is designed primarily to manage any software risks such as financial risks, business risks, and technical risks. Schwaber and Sutherland describe that most of the scrum elements are focusing on risk management activities, though it does not explicitly define them in the Scrum theories. Hence,

it is a bit challenging tasks for Scrum users to understand how scrum practices focus on risk management activities. Due to this reason, there was confusion raised among software professionals with experience in traditional methods. To address this issue, many researchers introduced different approaches to manages risks in Scrum with some additional documents, artifacts, frameworks, and blends with other conventional and agile methods (Uikey & Suman, 2015) (Talal Alharbi & Jameel Qureshi, 2014)(Suresh & Dillibabu, 2018) (Nelson, Taran, & De Lascurain Hinojosa, 2008). Experienced agile practitioners think that having explicit methods to manage risks in Scrum will ruin the core idea and the basic principles of Agile manifesto. Hence they recommend paying attention to implementing the Scrum practices in the way of reducing risks in software projects.

With the perception not to embed any explicit risk management capabilities into the Scrum method, researchers started to study the existing scrum practices and how those practices can help in risk management. As a result of that, there were many studies carried out recently to study implicit risk management practices. (Breno G. Tavares, Silva, & Souza, 2016) (Breno Gontijo Tavares, Da Silva, & De Souza, 2019)

Even though these studies explain the implicit risk practices, we see some organizations do not implement them all due to various reasons. Some of the software organizations have obstacles in implementing risk management, even though they are willing to implement risk practices in Scrum projects. These obstacles can be formed within the team or can occur when working with outsiders to the project team or the key stakeholders of the project.

This research will mainly focus on those obstacles that Scrum teams have to confront and analyze the level of impact of them based on the perspective of Scrum users.

2.5. Risk Management Approaches in Scrum

Many studies have been carried out in the past by analyzing the inherent risk practices in Scrum, introducing specific risk management activities, and applying them in Scrum working environments to check the effectiveness of them. This research is built upon the most related studies listed in Table 4.(Breno G. Tavares et al., 2016). There are many risk practices identified in past studies. The recognized risk practices can be listed as, short development cycles called Sprints, Prioritization of product backlog items and review them by the

customer, Brainstorming and collaborative work towards risk management activities, adhere to Scrum practices and conduct meetings with accordance to the principles, focus more on estimation process for every single task, Scrum Masters reviewing and monitoring tasks progress with scrum boards and burndown charts, having cross-functional teams with adequate skills, and a risk-preventive culture within the team and organization (Breno Gontijo Tavares et al., 2019).

2.6. Factors affecting the Implementation of Scrum Risk Management Practices

The implementation level of scrum practices will profoundly impact on the success rate of a Scrum project. (Overhage, Schlauderer, Birkmeier, & Miller, 2011) Hence, it is essential to implement Scrum practices in a way that it can help to reduce the risks and achieve the maximum expected advantages of the Scrum process. Scrum process should be enriched with some qualities such as better customer interaction, team readiness towards scrum risk management, degree of inward and outward communication, the assistance or the reinforcement imparted form the organization, and the inbuilt Scrum processes that expand the possibility of the reducing risks to make a project success.

The following sections will elaborate more on the factors that have more impact on the successful application of risk management.

2.6.1. Customer Interaction

A customer is an individual or an organization that purchases goods or services from another individual or a company. In the software industry, in most instances, the customer is an organization that expects a software service from another software development company to fulfill their requirements. Scrum teams always give priority to the customer and work towards improving customer satisfaction. (Kautz, 2009) Hence, the scrum team makes sure to engage with the customer more frequently when compared with the traditional methodologies. Based on the preference, customers are allowed to participate in the Scrum team as “Product Owner” or assign one person from the team itself as a customer representative who has a better understanding of the product requirements. Turner and Bohem (2004) state that customer representative needs to be “Collaborative, Representative, Authorised, Committed, & Knowledgeable” (CRACK).

In Scrum, having a better relationship with the customer is essential due to many reasons. Scrum always welcomes changes in the product, and the customer should closely monitor the changes. (Bass, 2015) The product backlog reviews, product demonstrations, and feedback sessions at the end of each Sprint will help in monitoring changes. Better interactions between the two parties will help to share the opinions and reduce confusion.

2.6.2. Team Readiness

A dedicated team is always a significant factor in the success of a project. Scrum is a framework that is built upon collaboration. (Hoda, 2011) A Scrum team usually is a cross-functional team built with many skills such as designers, developers, testers, and analysts. When considering the risk management in Scrum team members play a significant role. A Scrum team can be more prepared to manage risks if the team members are enriched with a positive attitude towards participation in the risk management activities, the risk awareness level of team members, capabilities and knowledge on scrum processes, and readiness for peer support when required are some key attributes that help to reduce the project-related risks. (Tanner & Von Willingh, 2014)Also, the Scrum Master role is critical in a Scrum team for better risk management. A skilled and experienced Scrum Master is a valuable resource for successful project delivery (Noll, Razzak, Bass, & Beecham, 2017). This factor will focus on covering the impact of team collaboration, risk and scrum awareness, and the competency level of scrum master towards the successful implementation of risk management in Scrum.

2.6.3. Communication

The Scrum method is designed to have fewer documents. Hence, verbal communication is a primary communication method used to share the required information. (Holzmann & Panizel, 2013)Team meetings namely Daily Scrum meeting, sprint planning, sprint review meeting, retrospective meetings are the scrum events that help in discussing risks and decide how to mitigate them during the sprint. The Scrum master should effectively handle team meetings to get the best outcome of the discussions. When a meeting is dragging too long, the team members will feel bored and will lose the attention to details. Face to face communications that allows more interactions is a way to improve the quality of the meetings. (Tanner & Von Willingh, 2014) It is an important fact that the team members get equal opportunities to communicate their ideas, ensure that every member of the team shares their perspectives on

risk management. Strong communication skills of team members are beneficial when participating in team meetings confidently.

2.6.4. Organizational Culture

Organizational culture is a shared belief system that influences the actions of people and workgroups. (Strode, Huff, & Tretiakov, 2009) Scrum is mostly known as a process that encourages informal communications and teamwork. Due to that, the culture and practices of an organization have a considerable impact on Scrum projects. (Paasivaara & Lassenius, 2016) An organization that values feedback and learning, social interactions help manage Scrum risks. When an organization is being flexible to allow team members to work in different time zones, team members to work comfortably in distributed environments. The Scrum experts believe that it is vital to have Scrum team members with good knowledge of Scrum theories and also should be well trained to work effectively within the team. The organization is responsible for providing appropriate professional training and soft skill training to the team members to improve their skills, which will lead to better risk management participation from all the team members. A Scrum team usually consists of members who hold different levels of designations. Having a flat cooperative culture will make the junior members in the group feel more comfortable to communicate with the senior members. (Tanner & Von Willingh, 2014) A scrum team should be a cross-functional team that covers all of the skills required in the software implementation process. Hence, the organization is responsible for providing human resources to the team based on demand.

2.6.5. Process Readiness

The Scrum Processes does not express much about official documentation that we usually use in traditional software methods. That does not mean that the scrum process ignores the documents, but they use very few throughout the implementation process. The project management tools like Jira, Rally is used to keep on tracking the progress, achievements, obstacles a team member encounter. (Myklebust, Stålhane, Hanssen, Wien, & Haugset, 2014)The business requirement document is one important document that is used in Scrum to elaborate business requirements clearly to the developers and all the other stakeholders to ensure that everyone agrees on the same set of features to implement. Burndown charts are typically used as a measurement tool of the progress, the remaining workload relating to the

time remaining. Eventually, as per the literature sources, Scrum risk management requires these documents or artifacts

2.7. Testing and Analysis Approaches

The researcher used a few testing and analysis methods during the data analysis phase. The strategies used will be discussed below.

2.7.1. Cronbach's Alpha Technique

Cronbach's alpha is a statistical technique used in research to measure if the tests and instruments constructed for the study fit for the purpose. (Taber, 2018) The value of alpha can describe the amount of internal consistency between the instruments used to measure one objective. Table 2 shows the standard values used by Cronbach's technique to interpret the reliability.

Table 2: Cronbach's Alpha Standards

Cronbach's alpha	**Strength of Association**
< 0.6	Poor
0.6 – 0.7	Moderate
0.7 – 0.8	Good
0.8 – 0.9	Very Good
> 0.9	Excellent

2.7.2. Descriptive Analysis

Descriptive analysis is a statistic that is used to describe data collected during a study. The descriptive analysis uses graphical outputs and summarizes quantitative data. Descriptive statistics are merely showing the trends and patterns that data shows. Descriptive statistics can be used to simplify a large number of data understandably. The most popular measurements are the mean, middle, mode, standard deviation. (Loeb et al., 2017) The result of the descriptive analysis can be interpreted in visual formats such as graphs, charts, and tables.

2.7.3. Pearson Correlation Coefficient

The Pearson Correlation Coefficient analysis is used to assess the statistical correlation between two defined variables. This will give information on the magnitude of the association between variables and the direction. (Adler & Parmryd, 2010) When the value of the correlation coefficient is close to ±1, then it describes that variables are highly correlated. If the value is in between ±0.5 and ±1, the variables are considered to have a strong correlation, values around ±0.39 and ± 0.5 are holding a medium level correlation and lesser amounts than that will interpret a weak correlation. At the same time, the 0 significance of association depicts there is no correlation between the selected variables. Table 3 shows the degree of correlation.

Table 3: Degree of Correlation

Correlation value (values are valid for both positive and negative)	**Interpretation**
0.9 - 1.0	Very high correlation
0.7- 0.9	High correlation
0.5- 0.7	Moderate correlation
0.3-0.5	Low correlation
0 -0.3	Negligible correlation

2.7.4. Inferential Analysis

Inferential Analysis is a technique that is used to predict the population by analyzing data gathered from a sample that represents the population. The inferential analysis enables us to observe data that is collected through a sample and make decisions about the whole population based on the output.

2.7.5. Linear Regression

Linear regression is the most commonly used Predictive analysis method (Humpage, 2000) This method basically will help in predicting what will happen to the outcome variable, which is the dependent variable based on the changes of the value of other variables also known as independent variables.

2.7.6. Hypothesis Analysis

A hypothesis can be defined as an assumption that a researcher makes which needs to be proved or disproved and tested based on data analysis. (Davis & Mukamal, 2006) Hypotheses describe a few desirable statements about the characteristics of the population. The researcher defines hypotheses to explore the relationship between independent and dependent variables. Association between variables can be directional, non-directional, or null hypotheses.

- Directional Hypothesis

The directional hypothesis is a relationship between two variables in the intention of observing what will happen to a variable when a positive or negative variation occurs in the other variable.

- Non-directional Hypothesis

A non-directional hypothesis will also be used to indicate the relationship between two variables but does not explicitly define the direction of the difference that can occur.

- Null Hypothesis

A null hypothesis is used to indicate there is no relationship between the two variables used in the analysis. The null hypothesis is usually shown as H_0.

2.8. Hypothesis Testing Methods

- **T-test**

The t-test can help to check the difference between the sample mean with a population mean, or it can be utilized to think about the methods for two sample sets. (Ugoni & Walker, 1995) It is valuable when the population isn't known, and when the sample measurement is little.

- **ANOVA test**

ANOVA test, which is known as Analysis of Variance, checks whether the experiment results of the survey are significant. (Sawyer, 2009) ANOVA hypothesis testing will be used to understand whether the survey result accepts the null hypothesis or the alternate hypothesis.

2.9. Discussion

Table 4 shows a review of the literature that is related to Scrum risk management.

Table 4:Summary of Factors

Reference	Customer interaction		Team Readiness		Communication		Org. Culture		Process Readiness	
	Active customer interactions	***Task prioritization***	***Risk Awareness/ team attitude/ commitment***	***Scrum Manager's competency***	***skills of the team members***	***Effective Meetings***	***Top Management Support***	***Organizational environment***	***Use of tracking tools & Documentation***	***use of Risk Register***
(Overhage et al., 2011)			×		×	×			×	
(Tanner & Von Willingh, 2014)	×		×					×	×	
(C. Lee, 2012)	×		×		×	×	×		×	
(Hanslo, Mnkandla, & Vahed, 2019)			×		×		×	×		
(Hossain, Babar, Paik, & Verner, 2009)			×		×	×		×	×	
(Talal Alharbi & Jameel Qureshi, 2014)	×		×						×	×
(Breno G. Tavares et al., 2016)	×	×		×		×				
(Hetti Arachcige Sanjeewa, 2013)	×		×	×	×		×	×	×	×
(Noll et al., 2017)				×						
(Perera & Perera, 2019)	×									
(Jabeen & Awan, 2016)	×									
(Schwindt & Zimmermann, 2015)			×				×	×		
(Azizyan, Magarian, & Kajko-Mattson, 2011)									×	

These literature sources were observed to identify the factors that might need focus when implementing risk management is Scrum projects. There were more than ten factors identified through literature and categorized into five main factors Customer interaction, Team readiness, communication, organizational culture, and process readiness.

Table 5 depicts some of the important literature sources and comparisons about the factors identified in those researches, advantages, and limitations of them. There are several Scrum risk practices identified through the literature sources.

Table 5 : Summary of Literature Sources

Reference	Method	Advantages	Disadvantages
(Breno G. Tavares et al., 2016)	A case study based analysis with the participation of Scrum Masters	This research has explored a lot of literature to explore how risk management can be achieved in Scrum.	The case study is focused only on identifying scrum practices which treat risk management activities, but not considered in practical applicability of them to manage risks
(Talal Alharbi & Jameel Qureshi, 2014)	A quantitative analysis to validate a risk management solutions to achieve CMMI	This study introduces a risk register to manage risks over sprints of the scrum development process while meeting CMMI requirements.	The solution is focused only on recording risks in the scrum process but not improving the other scrum ways of managing risks
(IARM, 2014)	An analysis of Scrum methodology and how addresses risk management	The researcher identified most influencing risk factors for a software project and tried to map the scrum activities with them.	This paper does not cover most of the scrum practices in the scrum and how each of them designed to manage risks in Scrum.
(Nelson et al., 2008)	This paper explores the inherent nature of risk management in agile processes.	Explicit management to improve risk management in agile is with experts' experience.	This paper generally speaks about agile risks but not specific to scrum practices. The case study is limited to one product team which follows agile.
(Breno G. Tavares et al., 2017)	A bibliometric analysis performed on risk management in Scrum	Bibliometric research is conducted to understand the risk management trends in the software industry	No quantitative analysis is presented in real scrum environments.
(Ranasinghe & Perera, 2015)	Quantitative research to analyze the use of scrum in global software development.	This research describes a few important factors that affect Scrum adoption and it’s successfulness.	The research is limited to the Sri Lankan software industry
(Andrat & Jaswal, 2016)	An analysis is conducted on Agile and Scrum methods to propose a new risk management method.	A matrix is proposed to prioritize some identified risks in Scrum projects.	This research does not depict any method of identifying and risk-mitigating mechanisms.
(Reddaiah et al., 2013)	The research is conduct as a qualitative analysis.	The research introduces a new set of role within the team to focus on risk management activities	This research does not speak about any practical implications or expert opinions on this proposed model.
(Hammad & Inayat, 2019)	Research was done by applying traditional risk management into the agile scrum.	Check the possibility of applying risk management in Scrum with the use of more documents and risk registers.	The population of this research is limited to undergraduate students.
(Gold & Vassell, 2016)	A qualitative research which analyses about risk in Agile.	The opinion of experts in the agile industry is gathered regarding risk management.	There were less than twenty agile experts have participated in the survey, which is not sufficient.

Table 6 depicts an elaboration on which identified factor will cover each Scrum risk practice.

Table 6: Summary of classification of Scrum Risk Practices by Factors

Scrum Risk Practice	**Classification of factor/s which covers the risk practices**
Shorter development cycles	Process Readiness
Prioritization of product backlog items and review them by the customer	Customer Interaction
Brainstorming and collaborative work towards risk management activities	Team Readiness, Communication, Organizational Culture
Adhere to Scrum practices and conduct meetings with accordance to the principles	Process Readiness, Communication
Focus more on estimation process for every single task	Process Readiness
Scrum Masters reviewing and monitoring tasks progress with scrum boards and burndown charts	Team Readiness, Process Readiness
Cross-functional teams with adequate skills	Team Readiness, Organizational Culture
The risk-preventive culture within the team and organization	Team Readiness, Organizational Culture

2.10. Conclusion

According to the related literature, it can be concluded that that is an affect from the identified factors to the risk management implementation in Scrum projects. By following the findings from previous researches, a comparison, analysis is presented in this research.

3. RESEARCH METHODOLOGY

3.1. Research Approach

The research used a quantitative approach to achieve the main objectives of this research using the data collected with a questionnaire distributed among the sample of employees in software companies in Sri Lanka. Likert scale was the numeric rating scale, which has been used for the survey to identify the perspective of participants. IBM SPSS statistics tool was used for analyzing the data collected and based on the results, set of guidelines recommended to follow on improving the implementation of risk management activities in Scrum projects.

The following diagram, Figure 2, describes the research approach step by step.

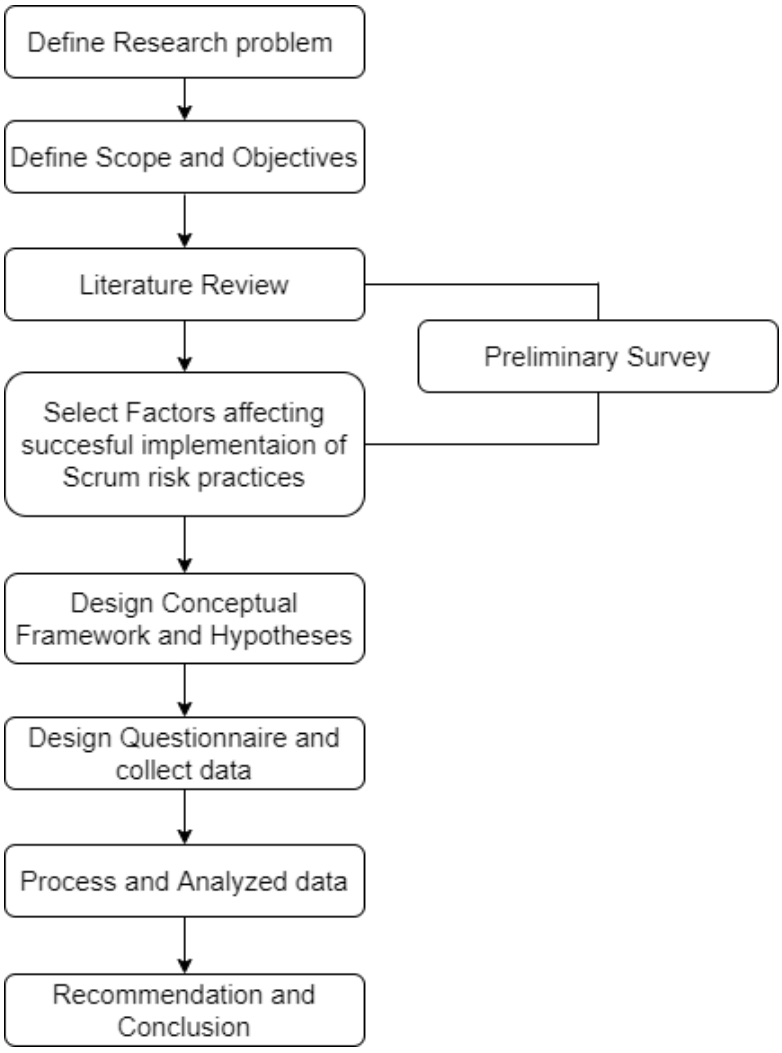

Figure 2: Research Methodology

The process starts with the problem identification and confining the scope and objectives for the research. Then literature review was conducted based on the defined goals and objectives. There were 50+ works of literature studied. As the outcome of that, 8+ individual factors that are affecting on scrum risk management was observed, which had different levels of attention in the previous studies. Then a preliminary survey was conducted to understand the applicability of these factors in the real world software industry within the Sri Lankan context. The number of factors was refined to 5, which are mostly impacting risk management activities in Scrum.

The identified factors were modeled in a conceptual framework as independent variables against the one dependent variable, which is the successful implementation of risk practices in Scrum. Hypotheses have been defined to explore the relationship between the variables, as described in Figure 3 (H1 to H5). The next step was to design a questionnaire that covers all the relationships between variables. This questionnaire was distributed among 380+ IT professionals in the software industry to obtain their perceptions.

The data collected through the online questionnaire will be used for concluding hypotheses that have been accepted. Based on the results retrieved from statistical data analysis, a set of recommendations was provided to boost the attention on adopting risk management tasks in Scrum projects.

3.2. Data Collection Methods

The data collection is playing a vital role in quantitative research, as results are highly dependent on the results given by the respondents. In the data collection process, it is essential to identify what data desired to be collected and from whom the data should be obtained. The data collected can be divided into primary data and secondary data.

Since the research was conducted as quantitative research, the primary data used was the data collected through the questionnaire. It is imperative to ensure that the designed questions contribute to all the identified factors.

Many literature sources were referred to as gain background knowledge through relevant researches done in the past. There were many studies carried out upon risk management

techniques in Scrum methodology, and they consist of already validated and analyzed data, which was used as the secondary data during this study.

3.3. Sample Design

The population and sample are the main items that the researcher should focus on when conducting quantitative research.

3.3.1. Population

The population of research describes the audience that the researcher focuses on when collecting data. The researcher should sufficiently understand and carefully decide the Population for the analysis as it affects the credibility of the results. (Asiamah, Mensah, & Oteng-Abayie, 2017).

The researcher identified software professionals who have a minimum of 1 year of experience in a Scrum environment as the population for this analysis.

3.3.2. Sample Size

A quantitative researcher may have to pick a small group of respondents that is fairly eligible from the population defined. (Asiamah et al., 2017) The selected group of people is considered as the "sample" of quantitative research.

The sample for the research is decided based on the convenient sampling method, which suggests collecting data from the conveniently available units. (Zikmund, Babin, Carr, & Griffin, 2012). According to Cochran's formula, with a confidence level of 95% and an error margin of 0.05, the representative sample size for this research is 385. (Clark, 1991) (Morse, 2000)

3.3.3. Research Instruments

The main research instrument used in this analysis is a questionnaire distributed among the selected sample of software professionals. The survey constructed with 37 questions in a Google Form, which scaled with a five-point Likert scale method. The first few questions in the questionnaire used to collect demographic information about the person responding to the survey, while the second section focuses on gathering the data relevant for the testing of hypotheses.

A few other research instruments, such as interviews and checklists, were used during the initial phase of the study. A few interviews with scrum specialists took place to identify the most relevant risk practices and the factors affecting the implementation of them in the industry.

3.4. Conceptual Design

A conceptual model is a framework that can explain the phenomenon to be studied. (Kamal, Dahiya, & Puri, 2012) This model is an interpretation of research findings and the relation between dependent and independent variables. (Dickson, Adu-Agyem, & Emad Kamil, 2018)The independent variable is a variable that is presumed to affect another variable while the dependent variable is a variable that depends on an independent variable in a certain way. (Flannelly, Flannelly, & Jankowski, 2014).

The researcher has identified five independent variables for this study with the help of a literature study and a preliminary survey such as customer interaction, team readiness, communication, organizational culture, and process readiness. The study consist of one dependent variable, which describes the purpose of the research.

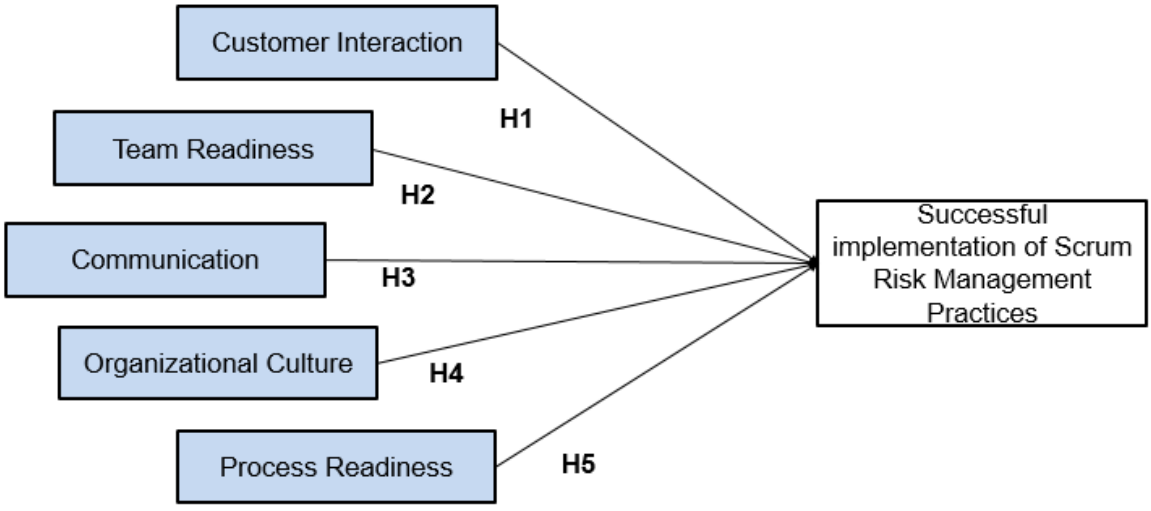

Figure 3: Conceptual Diagram

3.5. Hypotheses Development

The following hypotheses are developed and used by the researcher to measure the outcome.

Customer interaction

$H1_1$: There is a positive relationship between Customer Interaction and the Successful implementation of Scrum Risk Management Practices.

$H1_0$: There is no positive relationship between Customer Interaction and the Successful Implementation of Scrum Risk Management Practices.

Team Readiness

$H2_1$: There is a positive relationship between Team Readiness and the Successful Implementation of Scrum Risk Management Practices.

$H2_0$: There is no positive relationship between Team Readiness and the Successful Implementation of Scrum Risk Management Practices.

Communication

$H3_1$: There is a positive relationship between Communication and the Successful Implementation of Scrum Risk Management Practices.

$H3_0$: There is no positive relationship between Communication and the Successful Implementation of Scrum Risk Management Practices.

Organizational Culture

$H4_1$: There is a positive relationship between Organizational Culture and the Successful Implementation of Scrum Risk Management Practices.

$H4_0$: There is no positive relationship between Organizational Culture and the Successful Implementation of Scrum Risk Management Practices.

Process Readiness

$H5_1$: There is a positive relationship between Process Readiness and the Successful Implementation of Scrum Risk Management Practices.

$H5_0$: There is no positive relationship between Process Readiness and the Successful Implementation of Scrum Risk Management Practices.

3.6. Pilot Survey

The pilot survey is known as a strategy of testing research instruments such as questionnaires with a less no of responses. A pilot study is an essential stage in quantitative research, which can help to identify problems and deficiencies in the research protocol and its' instruments. The researcher conducted a pilot survey with the participation of 30 members from the population. The respondents for the pilot survey was carefully to obtain highly reliable answers to the questions.

3.6.1. Reliability Analysis

A reliability analysis is a method of checking whether there is an internal consistency between the instruments of a construct it is measuring. The research focused on performing a reliability analysis of the questions related to every variable. The questionnaire consisted of 5 items to reflect one variable, both independent and dependent variables. During the reliability analysis, the internal consistency of these items measured to ensure that the scale of the questions is in the same direction, which will result in accurate analytical output. The researcher used Cronbachs' alpha technique for measuring reliability among the items. After collecting data for the pilot survey, the Cronbach alpha reliability test is performed for every variable. The IBM SPSS Statistics Subscription tool used for the statistical analysis.

3.7. Questionnaire

The questionnaire used for the final survey consists of 38 questions divided into two main sections. The first section used for tracking the demographic data relevant to the respondents, which are essential for the analysis. The final questionnaire consists of 8 demographic questions. The second section includes the items used for the statistical analysis of the hypotheses defined.

3.7.1. Summary of Questionnaire

Table 7 summarizes the questions included in the final survey. The questionnaire is published as a Google Form, which is publically available and distribute among 500+ software professionals to get a maximum number of responses.

Table 7: Summary of Questionnaire

No.	Question	Customer Interaction	Team Readiness	Communic-ation	Organiza-tional Culture	Process Readiness	Implementing Scrum Risk practices
1	Constant monitoring in the product backlog items by the customer will help to mitigate project scope related risks. (e.g., prioritizing the tasks based on dependencies, understand reusability of components)	X					
2	Frequent demonstrations and feedback sessions with the customer will increase customer satisfaction	X					
3	In Scrum, customers can reach out to the developers and designers to give their feedback directly, which reduces the response time considerably.	X					
4	When the Customer acts as the "Product Owner" in the Scrum team, it will shorten the time spent on making important product decisions.	X					
5	Customer participation in the backlog review meetings will let them understand and oversee the budget variations upfront, which helps to reduce time on budget approvals.	X					
6	Ignoring customer feedback on demonstrations will make the customer dissatisfied. Hence, it is the responsibility of the team to give adequate attention to the feedback received.	X					
7	The team members can collaboratively participate in brainstorming sessions to contribute to identifying, analyzing, and mitigating risks such as misunderstandings in project requirements, technical skill gaps, etc.		X				
8	The active participation of the team members in the scrum event such as daily meetings, sprint planning meetings help to identify impediments and monitor them.		X				
9	The team should always hold the same understanding of the requirements, rules, and standards. (e.g., understanding of the definition of "Done" should be the same for all the members)		X				
10	The Scrum Master and all the team members should have an awareness about project risks, risk management techniques in software projects		X				
11	I believe it is important to have a well-organized, skilled Scrum master with experience, for the Scrum the processes to be followed with fewer failures.		X				
12	It is Scrum Master responsibility to make sure all the team members are not being ignored and influenced to participate in decision-making activities		X				

13	Taking part in lengthy meetings makes the team feel bored and less focused on the details.			X			
14	Scrum Masters should help the team to oversee the associated risks with quality and on-time delivery of a product.		X				
15	Strong communication skills and a common language between team members will help in reducing the conflicts and ambiguities.			X			
16	I believe that the team should get equal opportunities to express their ideas			X			
17	A collaborative culture placing a high value on face-to-face communication will help in reducing conflicts and make the team comfortable to communicate their ideas.			X	X		
18	My organization helps the team to improve their technical and soft skills through relevant training and development activities.				X		
19	The team maintains a risk burndown chart to understand risk census (information such as an impact, the probability, and the risk exposure) and their behavior when making project decisions.					X	
20	I believe having a business requirement document will help developers to read and understand the requirements properly.					X	
21	Daily meetings, Retrospective meetings are the scrum events that mostly allow to identify, analyze risks continuously in scrum projects.					X	
22	I believe that I will be encouraged to work collectively with distributed teams, in different time zones, if I am permitted to work flexible hours.				X		
23	The use of tools such as Jira, Rally helps me to track tasks, user stories, and the time spent on each of the tasks.					X	
24	Organizational environments which support the team on demand to reduce risk with external processes such as resource hiring, designing suitable working environments				X		
25	I believe that Scrum does not require any explicit scrum artifacts such as risk register to log risks.					X	
26	I believe the implementation of Scrum risk practices will help to control issues with increasing scopes.						X
27	I believe the implementation of Scrum risk practices will help to minimize risks of budget overruns						X
28	Implementation of implicit Scrum risk practices is sufficient for achieving quality targets.						X
29	Customer satisfaction will be improved with the implementation of scrum risk practices.						X
30	Managing Risks properly will be less stressful for the team members						X

3.8. Data Analysis

The responses collected through the form is exported and used for statistical analysis in SPSS tool. The Pearson Correlation techniques used for measuring the correlation between independent and dependent variables.

3.9. Conclusion

This chapter discusses the methodology that has been adapted to this particular research study. Also, this study focuses on the hypotheses, research instruments, population and sample for the analysis, and the data analysis approaches.

4. DATA ANALYSIS

4.1. Introduction

This chapter will discuss the analysis process of the collected data through the online survey. A descriptive analysis is conducted as the initial step of the analysis process, which will help to describe data that has been gathered from the sample population. Consequently, a statistical analysis was carried out to analyze the correlations between the variables, and the results are elaborated well.

4.2. Data Collection

The collection of research data started at the beginning of January 2020 and ended at the end of February 2020. Data was collected through an online survey, and the questionnaire was distributed as hard copies to get quick responses. The data collected through hard copies were manually entered into the CSV file to use them in the computational analysis. Around 380 responses were received by the end of February. Figure number 4 shows the pattern of data collection by the time. During the last week of February month, the researcher focused more on collecting data by sharing it through social media groups, email groups, which lead to a hike in the number of responses.

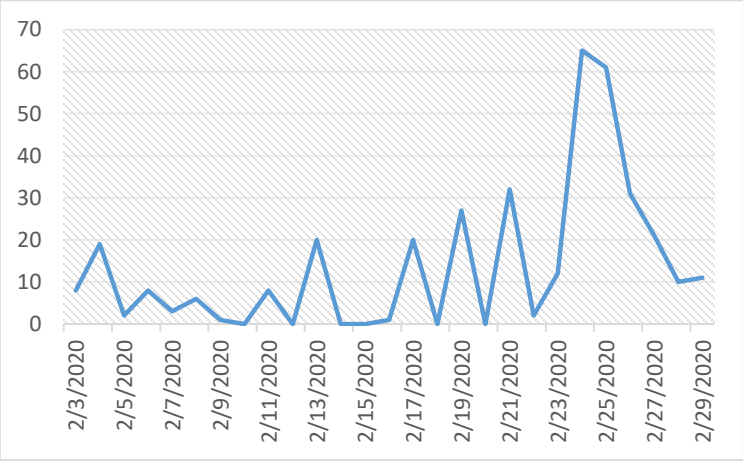

Figure 4: Pattern of Data Collection

4.3. Descriptive analysis of Demographic data

A descriptive analysis of the demographic data of the respondents is performed to elaborate more on the sample selected by the researcher. The results are presented using different types of charts and data tables.

4.3.1. Classification of the sample by different role categories in the software industry

This analysis is carried out to observe the participation of professionals from different job role categories in the software industry which is displayed in Figure 5. The job roles are categorized as a software developer, QA engineers, project manager, business analyst, and another option was provided to state their job roles, which differs from the above categories. The researcher analyzed the job roles stated in the other group and observed most of them are from the software development category. Hence those different categories were matched manually with the existing types when performing the analysis.

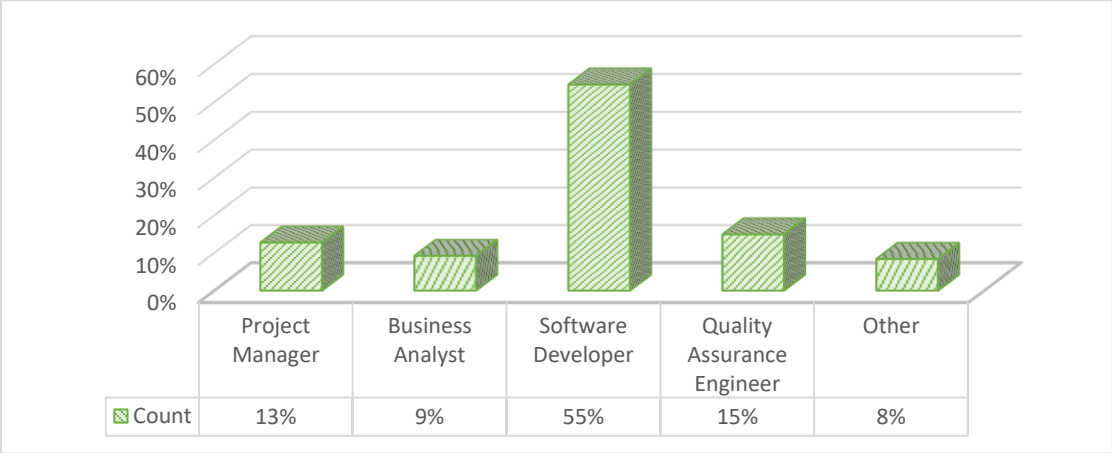

Figure 5: Classification by the Designation

There is a high number of respondents from the software developer category, which consist of designation ranged from associate software engineers to software architects, user interface developers, and mobile application developers.

The 31 respondents in the “other” category consist of multiple job roles such as IT manager, support engineer, and system engineer despite their designation, they have experience in Scrum projects. Figure 6 demonstrates the distribution of the respondents in the “other” category, by their designation.

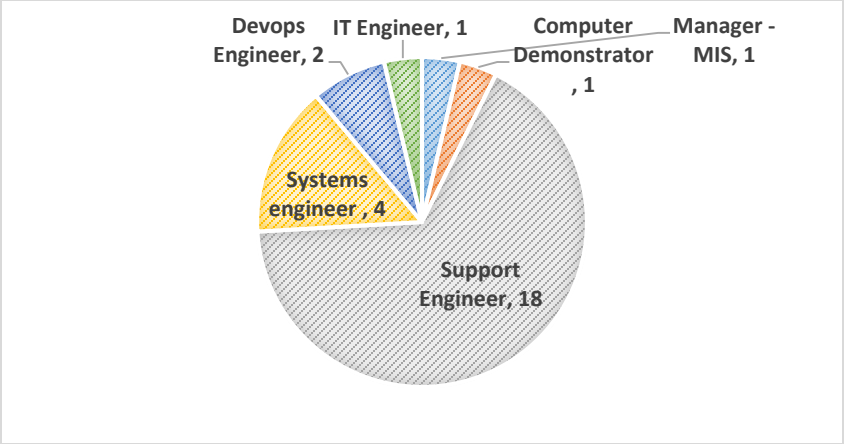

Figure 6: Demonstration of the Other job Category

4.3.2. Classification of the sample by experience in the Software Industry

The respondents are classified according to the experience level in the software industry with both traditional and Agile software management methodologies. The sample of respondents covers a majority of professionals who have experienced between 3 years to 10 years in the Software industry. Figure 7 graphically represents the sample based on the experience.

Table 8:Classificataion by Experience in Industry

Experience	Frequency	%
Below 3 years	75	20%
3 to 5 years	141	38%
5 to 10 years	120	33%
More than 10 years	32	9%

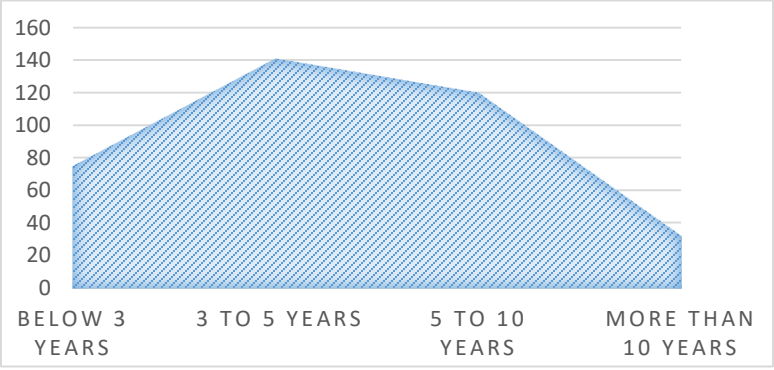

Figure 7: Classification by Experience in Industry

According to Table 8, 38% and 33% of the sample represent the number of respondents with 3 to 5 years and 5 to 10 years experience, respectively.

4.3.3. Classification by Scrum experience

The researcher believes this classification is one of the most important elaborations of the sample for this analysis since the study is based on Scrum risk management practices.

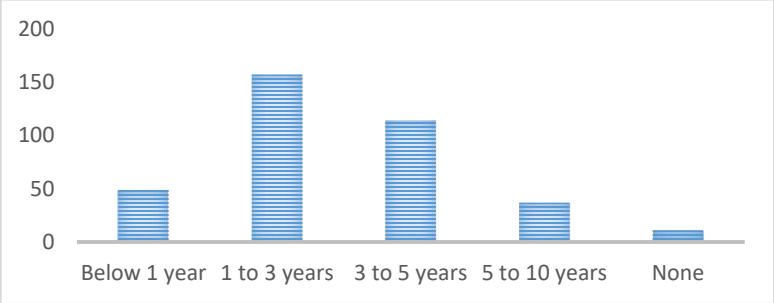

Figure 8:Classification by the Scrum experience

Table 9 shows that a considerable number out of the sample has sufficient experience to make statements about Scrum practices, which ranged from 1 to 5 years. With that demonstration on the sample, the efficacy of the results is considered high. The responses of the 3% of the respondents who do not have any experience in Scrum are considered as outliars and not included in the normalized data set used for further analysis.

Table 9: Classification of sample by Scrum Experience

Experience	Frequency	%
Below 1 year	49	13%
1 to 3 years	157	43%
3 to 5 years	114	31%
5 to 10 years	37	10%
None	11	3%

4.3.4. Classification by the project management certifications obtained

All the respondents who participated in the survey are IT software professionals who have obtained a minimum of graduate qualification from a reputed university which confirms that they have a considerable understanding of software development theories such as risk management and project management. The researcher assumes that having an additional educational background on the project management methodologies will also help to provide

better theoretical insights about Scrum risk management practices. Hence, the sample is described with the level of education related to project management methodologies.

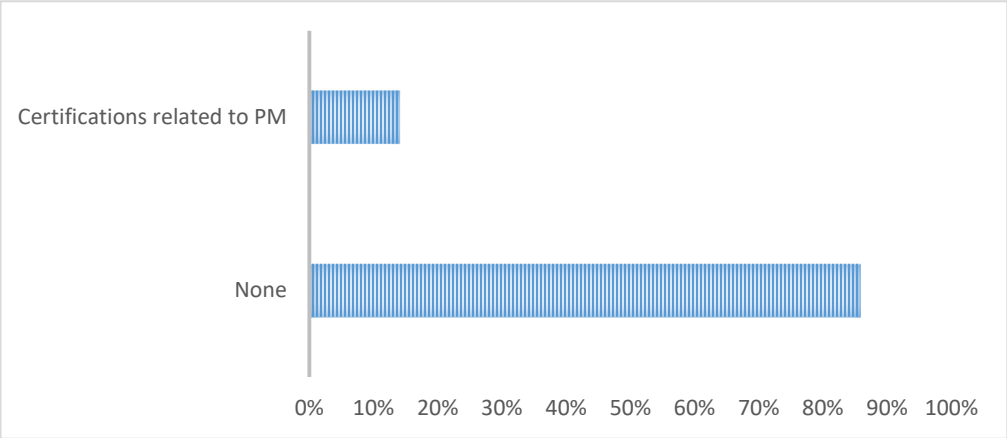

Figure 9: Project Management related Education Level

Figure 9 shows that 14% of the respondent has obtained project management related qualification which gives additional strength on result reliability.

As per the Figure10 demonstrates, 14% of respondents who have additional PM-related qualifications are holding different job designations and also has experience in Scrum Projects.

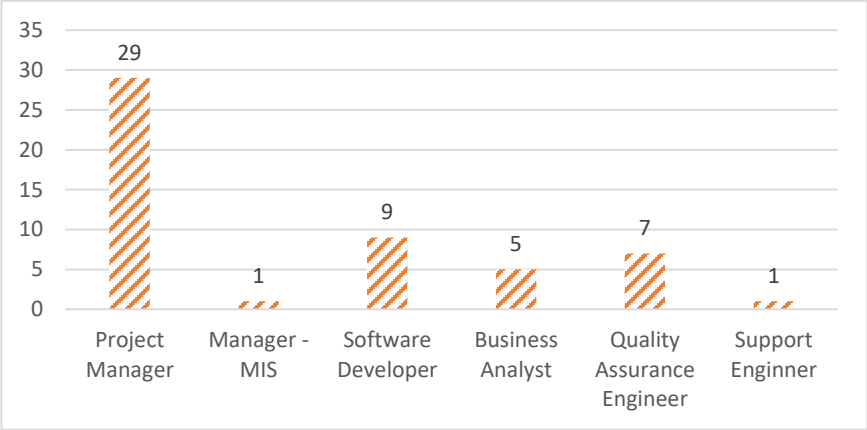

Figure 10: Classification of Certified Respondents by the Designation

4.4. Reliability Analysis

Reliability analysis was conducted to ensure the validity of the questionnaire used for the data collection. As per the Cronbach's alpha reliability test standards, a questionnaire is considered valid and reliable when the alpha value is more than 0.7.

Results for the reliability analysis for all the independent and dependent variables are listed below.

Customer Interaction

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.707	.712	6

Figure 11: Cronbach Alpha- Customer Interaction

The questionnaire for the pilot survey consisted of six questions for the independent variable "Customer Interaction." The reliability analysis resulted in a value of 0.707 as shown in Figure 11, which is a considerably good value.

Team Readiness

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.731	.729	7

Figure 12: Cronbach Alpha- Team Readiness

The independent variable, " Team Readiness" indicated a Cronbach value of 0.731 as shown in Figure 12, which shows good reliability between the seven items used to measure internal consistency.

Communication

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.734	.740	4

Figure 13: Cronbach Alpha- Communication

The initial questionnaire used for the pilot survey consisted of six items to measure the construct "Communication," The Cronbachs' alpha value resulted in a low number which, encouraged the researcher to make necessary modifications to the questionnaire, to increase the Cronbachs' alpha value to 0.734 as shown in Figure 13.

The questionnaire modified by combining a few questions, and the number of items was reduced to four. This modification resulted in a higher value for the reliability test. The modified questions were included in the final survey.

Organizational Culture

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.706	.703	4

Figure 14: Cronbach Alpha - Organizational Culture

The variable "Organizational Culture" resulted in a value of 0.706 which shown in Figure 14 as internal consistency between the questions used to measure the construct. This value indicates excellent reliability.

Process Readiness

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.709	.720	6

Figure 15: Cronbach Alpha - Process Readiness

The variable "Process readiness" shows better reliability with a Cronbach's alpha value of 0.709 as shown in Figure 15. Therefore, the internal consistency of the instruments used for measuring the construct is acceptable.

Implementation of Scrum Risk Management Practices

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.713	.706	5

Figure 16: Cronbach Alpha - Risk Management Implementation in Scrum

The dependent variable, "Implementation of Scrum Risk Management practices," also has ideal reliability with a Cronbach's' alpha value of 0.713 as shown in Figure 16, which indicates a better internal consistency between the five instruments used for measuring the construct.

Table 10 interprets a summary of the reliability analysis done for all independent and dependent variables. Based on the result, the questionnaire can be examined to have good internal consistency.

Table 10: Summary of Reliability Analysis

Variable	Cronbach's Alpha Value
Customer Interaction	0.707
Team Readiness	0.731
Communication	0.734
Organizational Culture	0.706
Process Readiness	0.709
Implementation of Scrum Risk management Practices	0.713

4.5. Inferential Analysis

After the analysis of the demographic features, an inferential analysis is performed to measure relationships between variables and analyze variations in the variables. Hence this inferential analysis was useful to reach a conclusion reading the data with the variables and complete the hypothesis testing by doing the correlation analysis and regression analysis.

4.5.1. Correlation Analysis of Variables for the Entire sample

Table 11: Summary of Correlations

Correlations							
		Customer interaction	Team Readiness	Communication	Organizational Culture	Process Readiness	Scrum Risk Mgt
Customer interaction	Pearson Correlation	1	0.584**	0.511**	0.263**	0.497**	0.501**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000
	N		368	368	368	368	368
Team Readiness	Pearson Correlation	0.584**	1	0.732**	0.467**	0.655**	0.706**
	Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000
	N	368		368	368	368	368
Communication	Pearson Correlation	0.511**	0.732**	1	0.546**	0.486**	0.500***
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000
	N	368	368		368	368	368
Organizational Culture	Pearson Correlation	0.263**	0.467**	0.546**	1	0.470**	0.373**
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000
	N	368	368	368		368	368
Process Readiness	Pearson Correlation	0.497**	0.655**	0.486**	0.470**	1	0.467**
	Sig.(2-tailed)	0.000	0.000	0.000	0.000		0.000
	N	368	368	368	368		368
Scrum Risk Mgt	Pearson Correlation	0.501**	0.706**	0.500**	0.373**	0.467**	1
	Sig.(2-tailed)	0.000	0.000	0.000	0.000	0.000	
	N	368	368	368	368	368	

Table 11 shows a summary of the correlation between dependent and all the independent variables. The correlation was calculated using the Pearson Bivariate correlation analysis.

This analysis uses customer interaction, team readiness, communication, organizational culture, and process readiness as independent variables, while the implementation of Scrum risk management practices is considered as the dependent variable.

According to the summary of the correlation, all the defined independent variables have a positive association with each other variables.

Independent variables customer interaction, team readiness, communication, organizational culture, and process readiness have positive associations with the dependent variable with values of 0. 501, 0. 706, 0.500, 0. 373, and 0. 467 respectively.

4.5.2. Hypothesis Testing

During the initial analysis stage of this research, the researcher built five main hypotheses, and the goal of carrying out this research is to test and validate the defined assumptions. The correlation analysis was performed to validate the hypotheses.

- **Hypothesis 1**

$H1_1$: There is a relationship between Customer interaction and the Successful Implementation of Scrum Risk Management Practices.

$H1_0$: There is no relationship between Customer interaction and the Successful Implementation of Scrum Risk Management Practices.

Correlations

		Customer_interaction	Scrum_risk_Mgt
Customer_interaction	Pearson Correlation	1	.501**
	Sig. (2-tailed)		.000
	N	368	368
Scrum_risk_Mgt	Pearson Correlation	.501**	1
	Sig. (2-tailed)	.000	
	N	368	368

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 17:Correlation analysis result for the variable Customer Interaction

According to Figure 17, the correlation analysis between the implementation of Scrum risk management practices and customer interaction is remarked as + 0.501, which is a moderate level correlation. The significant level is 0.000, which is lesser than 0.05. With this significant level, the null hypothesis was rejected and the alternative hypothesis that states there is a positive association between the dependent variable and customer interaction independent variable.

- **Hypothesis 2**

$H2_1$: There is a relationship between Team Readiness and the Successful Implementation of Scrum Risk Management Practices.

$H2_0$: There is no relationship between Team Readiness and the Successful Implementation of Scrum Risk Management Practices.

Figure 18 represents the correlation analysis result between the variable team readiness and the dependent variable. The result demonstrated that these two variables are having a 0.000 significance, which is again less than the value 0.05 and indicates the null hypothesis $H2_0$ is rejected while the alternative hypothesis has been accepted.

The alternative hypothesis is accepted with a positive association between the two variables, independent and dependent, with a value of 0.706, which is a high correlation level according to the standards.

Correlations

		Scrum_risk_Mgt	Team_readiness
Scrum_risk_Mgt	Pearson Correlation	1	.706**
	Sig. (2-tailed)		.000
	N	368	368
Team_readiness	Pearson Correlation	.706**	1
	Sig. (2-tailed)	.000	
	N	368	368

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 18: Correlation analysis result for the variable Team Readiness

- **Hypothesis 3**

$H3_1$: There is a relationship between Communication and the Successful Implementation of Scrum Risk Management Practices.

$H3_0$: There is no relationship between Communication and the Successful Implementation of Scrum Risk Management Practices.

Correlations

		Scrum_risk_Mgt	Communication
Scrum_risk_Mgt	Pearson Correlation	1	.500**
	Sig. (2-tailed)		.000
	N	368	368
Communication	Pearson Correlation	.500**	1
	Sig. (2-tailed)	.000	
	N	368	368

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 19:Correlation analysis result for the variable Communication

When considering the correlation for the above hypothesis, as mentioned in Figure 19, that relationship has 0.000 significant value, and it is less than 0.05. Then the researcher was able to ensure that the Null hypothesis $H3_0$ is rejected and the alternative hypothesis $H3_1$ is accepted. The correlation between the Communication variable and implementation of Scrum risk management practices is +0.500, which is a moderate positive correlation.

- **Hypothesis 4**

$H4_1$: There is a relationship between Organizational Culture and the Successful Implementation of Scrum Risk Management Practices.

$H4_0$: There is no relationship between Organizational Culture and the Successful Implementation of Scrum Risk Management Practices.

Correlations

		Scrum_risk_Mgt	Organizaional_culture
Scrum_risk_Mgt	Pearson Correlation	1	.373**
	Sig. (2-tailed)		.000
	N	368	368
Organizaional_culture	Pearson Correlation	.373**	1
	Sig. (2-tailed)	.000	
	N	368	368

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 20: Correlation analysis result for the variable Organizational Culture

Hypothesis number four is defined to test the association between the organizational culture variable and the implementation of Scrum risk management practices.

The correlation analysis test results are indicated in Figure 20. The significance value resulted in 0.000, which implies that the null hypothesis is being rejected in this scenario as well. The alternative hypothesis is accepted with the correlation value 0.373, which results in a low correlation between the two variables.

- **Hypothesis 5**

$H5_1$: There is a relationship between Process Readiness and the Successful Implementation of Scrum Risk Management Practices.

$H5_0$: There is no relationship between Process Readiness and the Successful Implementation of Scrum Risk Management Practices.

Correlations

		Scrum_risk_Mgt	Process_readiness
Scrum_risk_Mgt	Pearson Correlation	1	.467**
	Sig. (2-tailed)		.000
	N	368	368
Process_readiness	Pearson Correlation	.467**	1
	Sig. (2-tailed)	.000	
	N	368	368

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 21: Correlation analysis result for the variable Process Readiness

According to the correlation analysis result in Figure 21, the relationship between Process readiness and implementation Scrum risk management practices has 0.000 significant value, and it is less than 0.05. This value leads the researcher to accept the alternative hypothesis $H5_1$and reject the null hypothesis $H5_0$. The value of the correlation between the variables is positive. This positive value indicates a positive association between variables, but a lower level of strength is explained with a value of 0.467.

Summary of the Hypothesis Test

The Summary of the Hypothesis testing with Correlation analysis is concluded in Table 12.

Table 12: Summary of Correlation Analysis

Hypothesis statement	**Null Hypothesis $H\{X\}_0$**	**Alternative Hypothesis $H\{X\}_1$**	**Strength of correlation level**	**Direction**
There is a relationship between Customer interaction and the Successful Implementation of Scrum Risk Management Practices	Rejected	Accepted	Moderate	Positive
There is a relationship between Team Readiness and the Successful Implementation of Scrum Risk Management Practices	Rejected	Accepted	High	Positive
There is a relationship between Communication and the Successful Implementation of Scrum Risk Management Practices	Rejected	Accepted	Moderate	Positive
There is a relationship between Organizational Culture and the Successful Implementation of Scrum Risk Management Practices	Rejected	Accepted	Low	Positive
There is a relationship between Process Readiness and the Successful Implementation of Scrum Risk Management Practices	Rejected	Accepted	Low	Positive

4.6. Regression Analysis

Regression analysis is one of the techniques used to identify the relationship between dependent and independent variables. Regression analysis is capable of providing insights that some other methods are also capable of delivering. The advantage of using Regression analysis is that it can indicate whether two variables have a significant relationship, the strength of the relationship, and also helps in making predictions based on the analysis results. (Sarstedt M, Mooi, 2014)

4.6.1. Regression Analysis – Customer interaction

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.501[a]	.251	.249	.36403	.251	122.975	1	366	.000

a. Predictors: (Constant), Customer_interaction

b. Dependent Variable: Scrum_risk_Mgt

Figure 22: Model Summary for Customer Interaction

The Summary of regression analysis of the independent variable Customer Interaction with the dependent variable is shown in Figure 22. The correlation is presented with the R-value, which is 0.501. The R Square value for this analysis is 0.251, which indicates the variance of the dependent variable that can be explained with the changes in the Customer Interaction variable.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.296	1	16.296	122.975	.000[b]
	Residual	48.502	366	.133		
	Total	64.798	367			

a. Dependent Variable: Scrum_risk_Mgt

b. Predictors: (Constant), Customer_interaction

Figure 23: ANOVA result for Customer Interaction

Figure 23 displays the ANOVA test result, which proves the significance level is 0.000, and the alternate hypothesis should be accepted with no dispute.

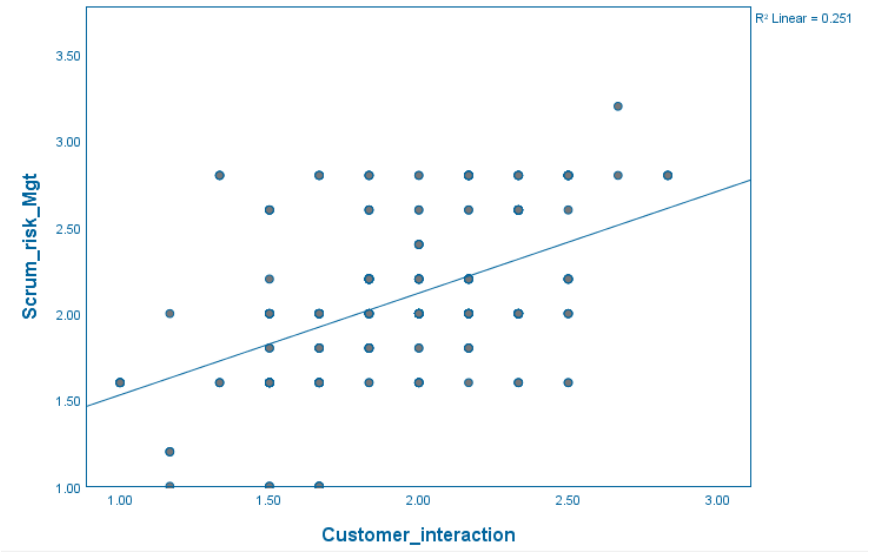

Figure 24: Scatter Plot for Customer Interaction

The Scatter plot diagram plotted a simple regression between two variables. According to Figure 24, few plots have a variance from the regression line.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.939	.106		8.848	.000
	Customer_interaction	.590	.053	.501	11.089	.000

a. Dependent Variable: Scrum_risk_Mgt

Figure 25: Coefficient Summary for Customer Interaction

As per the coefficient result in Figure 25, the standard error rate is 0.053, which is a very less value, which indicates high accuracy of the estimates. By analyzing the above table, the variance of the dependent variable implementation of Scrum risk management practices based on the value changes of Customer Interaction can be explained in an equation as below.

When the dependent variable is denoted as DV and Customer Interaction is denoted as CI,

$$DV = 0.939 + 0.590 \times CI$$

4.6.2. Regression Analysis – Team Readiness

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.706[a]	.498	.497	.29801	.498	363.632	1	366	.000

a. Predictors: (Constant), Team_readiness

b. Dependent Variable: Scrum_risk_Mgt

Figure 26:Model Summary for Team Readiness

The summary of regression analysis for the independent variable Team Readiness with the dependent variable, Implementation of Scrum Risk Management practices, is shown in Figure 26. The R-value represents the correlation value, which is 0.498. The R Square value for this analysis is 0.497, which indicates the variance of the dependent variable that can be explained with the changes in the Team Readiness variable.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	32.294	1	32.294	363.632	.000[b]
	Residual	32.504	366	.089		
	Total	64.798	367			

a. Dependent Variable: Scrum_risk_Mgt

b. Predictors: (Constant), Team_readiness

Figure 27: ANOVA result for Team Readiness

ANOVA test result for variable Team readiness is shown in Figure 27, which indicates a significance level of 0.000, and the alternate hypothesis should be accepted.

The dispersion of the values around the regression line of the dependent variable is presented in the scatter plot in Figure 28.

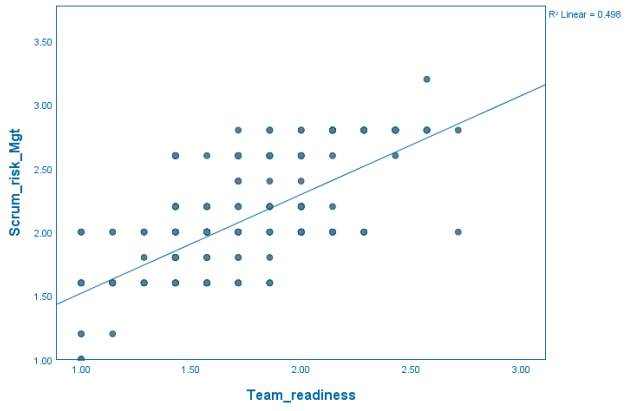

Figure 28: Scatter plot for Team Readiness

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.743	.073		10.216	.000
	Team_readiness	.776	.041	.706	19.069	.000

a. Dependent Variable: Scrum_risk_Mgt

Figure 29: Coefficient result for Team Readiness

In the coefficient result table shown in Figure 29, the standard error rate is 0.041, which mean the accuracy levels of the predictions is considerably good. By analyzing the above table, the variance of the dependent variable implementation of Scrum Risk Management practices based on the value changes of Team Readiness independent variable can be described in an equation as below.

When the dependent variable is denoted as DV and Team Readiness is denoted as TR,

$$DV = 0.743 + 0.776 \times TR$$

4.6.3. Regression Analysis – Communication

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	Change Statistics F Change	Change Statistics df1	Change Statistics df2	Change Statistics Sig. F Change
1	.500[a]	.250	.248	.36439	.250	122.000	1	366	.000

a. Predictors: (Constant), Communication

b. Dependent Variable: Scrum_risk_Mgt

Figure 30:Model Summary for Communication

The Model Summary table of Regression analysis for the independent variable Communication is displayed in Figure 30. The dependent variable, Implementation of Scrum Risk Management practices, has a positive correlation with the Communication variable with a correlation value of 0.500, which is represented as the R-value in the output of regression analysis. The R Square value for this analysis is 0.250, which indicates the variance in the values of the dependent variable based on the changes in the independent variable.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.200	1	16.200	122.000	.000[b]
	Residual	48.599	366	.133		
	Total	64.798	367			

a. Dependent Variable: Scrum_risk_Mgt

b. Predictors: (Constant), Communication

Figure 31: ANOVA result for Communication

Figure 31 shows the ANOVA test analysis for independent variable Communication. The table indicates there is a significant level of 0.000, and the alternate hypothesis should be accepted.

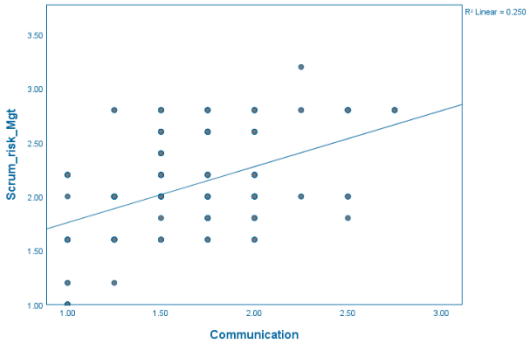

Figure 32: Scatter plot for Communication variable

Figure 32 explains the distribution of values around the regression line based on the value of the Communication variable.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1.240	.080		15.497	.000
	Communication	.518	.047	.500	11.045	.000

a. Dependent Variable: Scrum_risk_Mgt

Figure 33: Coefficient for Communication

According to the coefficient result in Figure 33, the standard error rate is 0.047, which is a very less value, which specifies higher accuracy of the predictions. By analyzing the table in Figure 33, the researcher can conclude that variance of the dependent variable implementation of Scrum Risk Management practices, distributed around the regression line, which can be explained with the equation below.

When the dependent variable is denoted as DV and Communication is denoted as CM,

$$DV = 1.240 + 0.518 \times CM$$

4.6.4. Regression Analysis – Organizational Culture

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.373[a]	.139	.137	.39040	.139	59.153	1	366	.000

a. Predictors: (Constant), Organizaional_culture

b. Dependent Variable: Scrum_risk_Mgt

Figure 34: Model Summary for Organizational Culture

The Regression result Summary table for the independent variable Organizational Culture is displayed in Figure 34. The dependent variable, Implementation of Scrum Risk Management practices, has a positive correlation with the Organizational Culture variable with a correlation value of 0.373, which is represented as the R-value in the output of regression analysis. The R Square value for this analysis is 0.139, which indicates the variance in the values of the dependent variable based on the changes in the independent variable, Organizational Culture.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.016	1	9.016	59.153	.000[b]
	Residual	55.783	366	.152		
	Total	64.798	367			

a. Dependent Variable: Scrum_risk_Mgt

b. Predictors: (Constant), Organizaional_culture

Figure 35: ANOVA result for Organizational Culture

Figure 35 shows the ANOVA test analysis for independent variable Organizational Culture. The table indicates there is a significant level of 0.000, and the alternate hypothesis should be accepted.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.380	.095		14.461	.000
	Organizaional_culture	.383	.050	.373	7.691	.000

a. Dependent Variable: Scrum_risk_Mgt

Figure 36: Coefficient for Organizational Culture

The coefficient result in Figure 36 for the independent variable Organizational Culture shows the standard error rate as 0.050, which is a small value, which implies a higher accuracy of the predictions.

By analyzing the table in Figure 36, the researcher can explain the variance of the dependent variable implementation of Scrum Risk Management practices around the regression line, based on changes in the independent variable Organizational Culture. The equation below explains the regression line for the given scenario.

When the dependent variable is denoted as DV and Organizational Culture is denoted as OC,

$$DV = 1.380 + 0.383 \times OC$$

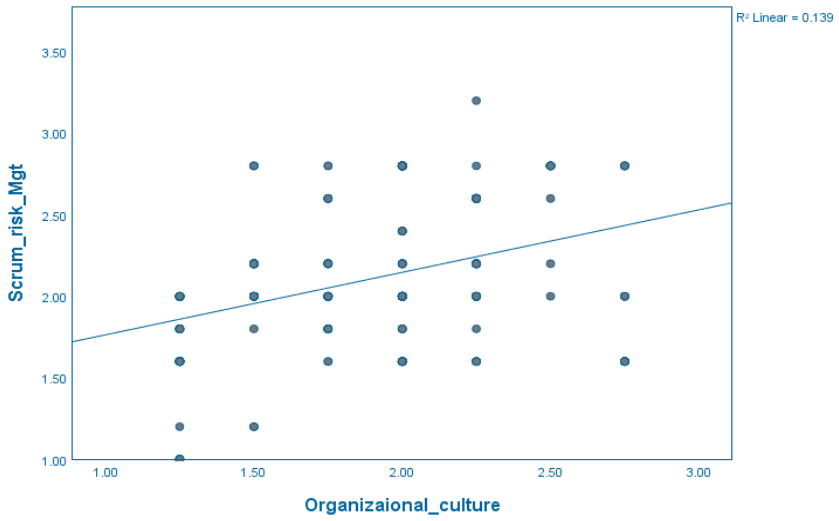

Figure 37: Scatter Plot for Organizational Culture

The Scatter plot also describes the dispersion of values around the regression line described with the above equation.

4.6.5. Regression Analysis – Process Readiness

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.467[a]	.218	.216	.37201	.218	102.212	1	366	.000

a. Predictors: (Constant), Process_readiness

b. Dependent Variable: Scrum_risk_Mgt

Figure 38:Model Summary for Process Readiness

The Summary of Regression analysis of the independent variable Process Readiness with the dependent variable is shown in Figure 38. The Correlation is presented with the R-value, which is 0.457. The R Square value for this analysis is 0.218, which indicates the variance of the dependent variable that can be explained with the changes in the Process Readiness variable.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.146	1	14.146	102.212	.000[b]
	Residual	50.653	366	.138		
	Total	64.798	367			

a. Dependent Variable: Scrum_risk_Mgt

b. Predictors: (Constant), Process_readiness

Figure 39: ANOVA result for Process Readiness

ANOVA test result for variable Team readiness is shown in Figure 39, which indicates a significance level of 0.000, and the alternate hypothesis should be accepted.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1.050	.105		9.953	.000
	Process_readiness	.548	.054	.467	10.110	.000

a. Dependent Variable: Scrum_risk_Mgt

Figure 40: Coefficient for Process Readiness

The coefficient result in Figure 40 for the independent variable Process Readiness shows the standard error rate as 0.054, which is a small value, which implies a higher accuracy of the predictions. By analyzing the table in Figure 40, the researcher can explain the variance of the dependent variable implementation of Scrum Risk Management practices around the regression line, based on changes in the independent variable Process Readiness. The equation below explains the regression line for the given scenario.

When the dependent variable is denoted as DV and Process Readiness is denoted as PR,

$$DV = 1.050 + 0.548 \times PR$$

Figure 41 explains the distribution of values around the regression line based on the value of the Process Readiness.

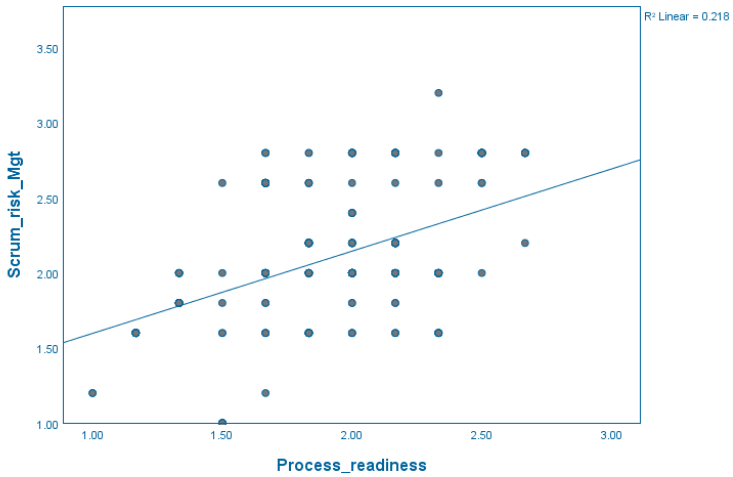

Figure 41: Scatter Plot for Process Readiness

4.7. Summary

This chapter summarizes the data analysis procedure followed when conducting the research. The analysis started with a reliability analysis, which is performed to ensure the internal consistency and validity of the instruments used in collecting data for the analysis. The collected data were then analyzed with correlation analysis and inferential analysis.

The correlation analysis was performed to decide whether which hypotheses can be described with the association of the variables, the direction of the association.

The inferential analysis was used to ensure whether independent and dependent variables are significant and to predict the behavior of the dependent variable based on the variations in independent variables.

By analyzing the data set collected from 368+ respondents, the researcher can conclude that all independent variables used in the current model, have positive correlations with the dependent variable, successful implementation of Scrum Risk Management practices. Figure 42 summarized the correlation strength of every independent variable with the dependent variable Successful implementation of Scrum Risk Management Practices.

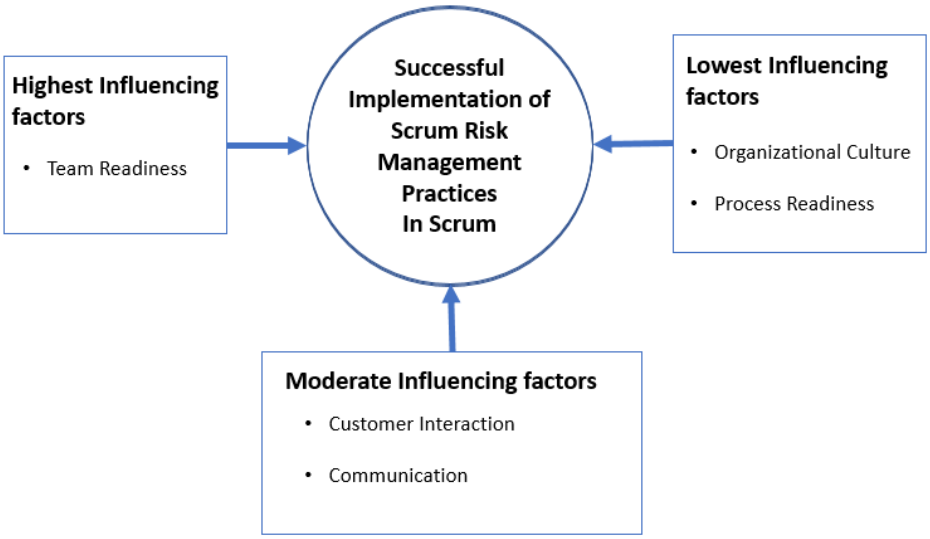

Figure 42: Summary of Factors affecting Successful implementation of Scrum Risk Management

5. RECOMMENDATION AND CONCLUSIONS

5.1. Summary of Research Outcome

5.1.1. Demographic Data Collection

Demographic analysis is used to elaborate on the respondent's characteristics. The researcher was able to collect data from around 370 software professionals. Out of the total respondents, 93% are from organizations where the software project development is their primary business. 7% of the respondents are currently not working in companies where software development is not the main activity.

As shown in Section 4.3.3, the sample consisted of a minimum of 97% of professionals who has at least a few months of experience in a Scrum project. Hence, the researcher can confirm that the majority of the respondents have a clear idea about the research area.

According to Section 4.3.1, out of the total respondents, 80% of the members are representing the development team in the Scrum projects, and 85% of them do not have any qualifications related to Scrum or any other project management methodologies demonstrated in Section 4.3.4. Though the majority of respondents do not have additional qualifications or do not represent managers, they still have a considerable amount of experience in Scrum to make decisions.

5.1.2. Research Outcome of Factor Analysis

As discussed in Section 4.6.1, the factors identified through the literature were performed a correlation analysis. The researcher found all of them are holding positive correlations with the implementation level of Scrum Risk Management.

Based on the analysis, the factor Team readiness has the most positive correlation with the implementation of Scrum risk management practices. Hence, the researcher can conclude that having a good team with sufficient skills, with a great attitude and teamwork mindset is very important for a Scrum team to implement Scrum Risk Management successfully.

Furthermore, Customer interaction, Communication, Process readiness, and organizational culture also has positive impacts on the implementation of Scrum Risk Management Practices at different levels.

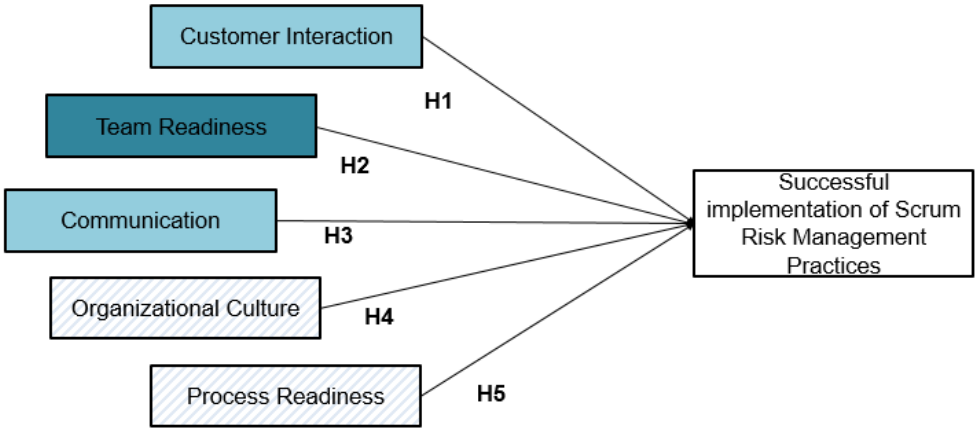

Figure 43:Correlation Levels of Hypotheses

Figure 43 elaborates on the strength of correlations of each factor with the dependent variable, the Successful implementation of Scrum Risk Management Practices. The colors indicate the strength of the factors where dark blue indicates a high correlation, light blue indicates a moderate correlation and light blue pattern indicates a low correlation.

5.2. Research Outcome Based on the Analysis

The primary target of this research is to identify the relationship of successful implementation of Scrum risk management with Customer Interaction level, Team readiness, Communication, Organizational Culture, and Process readiness which are the factors that most affect.

5.2.1. Hypothesis testing: Customer Interaction

$H1_1$: There is a positive relationship between Customer Interaction and the Successful implementation of Scrum Risk Management Practices.

According to the Bivariate Correlation analysis explained in Section 4.5.1, it is concluded that the factor Customer Interaction has a moderate correlation which holds a value of 0.501, with the implementation level of Scrum risk management practices. The 0.000 significance of the relationship describes there is a positive association always. Although it is a moderate correlation, Scrum teams need to consider customer interaction as an important factor to

implement or manage Risk Management. Frequent feedback sessions, reviews on backlog items are the most important actions to take customer interaction increased in a Scrum team which can lead to better risk management.

5.2.2. Hypothesis testing: Team Readiness

$H2_1$: There is a positive relationship between Team Readiness and the Successful Implementation of Scrum Risk Management Practices.

According to the Bivariate Correlation analysis described in Section 4.5.1, it is concluded that the factor Team Readiness has a high correlation which holds a value of 0.706, with the implementation level of Scrum risk management practices. The 0.000 significance of the relationship describes there is a positive association always. Since it holds a high correlation value, Scrum teams need to consider Team Readiness as an important factor to implement or manage Risk Management. Organizing brainstorming sessions within Scrum teams, assigning a skilled Scrum Master and active participation of all team members in risk management activities are the most important actions to take Team Readiness increased in a Scrum team which can lead to better risk management.

5.2.3. Hypothesis testing: Communication

$H3_1$: There is a positive relationship between Communication and the Successful Implementation of Scrum Risk Management Practices.

According to the Bivariate correlation analysis described in Section 4.5.1, it is concluded that factor Communication has a moderate correlation which holds a value of 0.500, with the implementation level of Scrum risk management practices. The 0.000 significance of the relationship describes there is a positive association always. Although it is a moderate correlation, Scrum teams need to consider Communication as an important factor to implement or manage Risk Management. Conducting effective and shorter meetings and allowing all members to express their ideas are the most important actions to take communication and collaboration increased in a Scrum team which can lead to better risk management.

5.2.4. Hypothesis testing: Organizational Culture

H41: There is a positive relationship between Organizational Culture and the Successful Implementation of Scrum Risk Management Practices.

According to the Bivariate Correlation analysis described in Section 4.5.1, it is concluded that the factor Organizational Culture has a low correlation which holds a value of 0.373, with the implementation level of Scrum risk management practices. The 0.000 significance of the relationship describes there is a positive association always. Although it is a low correlation, Scrum teams need to consider Organizational Culture as an important factor to implement or manage Risk Management. Organizing and conducting training sessions for team members to improve their technical and soft skills to work in a Scrum team, allowing Flexi work hours for team members who are working with distributed teams are most important actions to take communication and collaboration increased in a Scrum team which can lead to better risk management.

5.2.5. Hypothesis testing: Process Readiness

$H5_1$: There is a positive relationship between Process Readiness and the Successful Implementation of Scrum Risk Management Practices.

According to the Bivariate Correlation analysis described in Section 4.5.1, it is concluded that the factor Process Readiness has a low correlation which holds a value of 0.467, with the implementation level of Scrum risk management practices. The 0.000 significance of the relationship describes there is a positive association always. Although it is a low correlation, Scrum teams need to consider Process Readiness as an important factor to implement or manage Risk Management. Increase the understanding of tracking and monitoring tools like Jira or rally among team members, use of proper tools, and dashboards to make sure the project is on track are the most important actions to take communication and collaboration increased in a Scrum team which can lead to better risk management.

5.3. Recommendations

By analyzing the collected data and performing statistical analysis over them helped the researcher to identify factors that have an impact on the implementation of Scrum Risk Management practices. Based on the outcome, the researcher is providing some recommendations to improve the project success rate by increasing the level of implementation of risk management activities in Scrum projects.

- **Select a team with a collaborative attitude or increase the collaboration within the team**.

Based on Section 4.5.1, Team Readiness Factor holds the highest correlation strength with the dependent variable. Team collaboration to reduce risks in a project has a considerable impact on the factor Team readiness to have a high correlation strength against the dependent variable.

As it is shown in the Response Summary table in the Appendix C section, the more than 95% of respondents were responded with strongly agree or agree option for questions such as *"The team members can collaboratively participate in brainstorming sessions to contribute to identifying, analyzing, and mitigating risks such misunderstandings in project requirements, technical skill gaps etc.."* and *"The active participation of the team members in the scrum event such as daily meetings, sprint planning meetings help to identify impediments and monitor them".* This justifies that they are highly accepting the factor that a team should be collaborative to make a project success.

As a consequence of the collaboration of a team is one of the key areas for a scrum team to more prepared in facing project risks, the researcher state that it is important to improve the cooperation between the team members towards the project's success.

The Scrum Framework is one of the project management techniques which does not follow hard and fast rules but decide every task by discussing with all type of stakeholders in the project. Since the Scrum is built upon the ideas, opinions, and skills of stakeholders, the selection of team members is a critical task when implementing Scrum as the project management methodology. Once a cross-functional team is built to fulfill the project requirements, the team can focus on improving the collaboration team members which leads the project towards success.

Team collaboration is key to successful risk management in Scrum. When it comes to Risk Management, the researcher identified that having a team that can work collaboratively will support well in identifying risks of the project from different perspectives and can mitigate them with the help of all the team members. When the team is willing to work together, they will contribute with their maximum effort into making the project a success. Collaboration helps the team to participate in team meetings very actively and conduct brainstorming sessions easily that will reduce the conflicts between members and also reduces the effort that needs to resolve risk issues in projects.

The researcher recommends selecting a team not only considering the technical capabilities but also look for team working skills. Once the team is selected, the team itself can practice some activities to improve the collaboration that will make it easier to work together to achieve common goals. The team can improve collaboration between members by following few practices such as,

- Organizing team events,
- Setting team goals to achieve
- Ensure facilities for better communication between team members.

- **Improve the risk awareness level among the team members.**

Risk awareness is another key attribute that describes the readiness of the team to manage risks in a software project as indicated in Section 2.6.2 below the factor “team Readiness”. By analyzing the results of the statistical analysis in Section 4.5.1, the researcher proved that it is important for all the team members to know about risk management. In the real world situations of Scrum, the development teams are mostly focusing only on achieving the functional requirements, individual targets, and the quality of their codes, despite considering other aspects of the projects such as project risks. The reason for paying less attention to these risk factors is due to less awareness of software project risks.

Risk Management is a massive area that consists of risk identification, risk analysis, risk mitigation, risk control, and risk communication techniques. Since the Scrum framework is constructed with self-organizing teams, improving risk management awareness of team members will help them to understand risks and contribute to relevant risk management activities to mitigate or avoid them.

As mentioned in the response summary table in the Appendix C, the responses for the question *"The Scrum Master and all the team members should have an awareness about project risks, risk management techniques in software projects."*, almost 85% o the responses were covering strongly agree and agree where no respondents had disagreed the statement.

Based on that the researcher recommends considering improving risk awareness level of team members by giving relevant training sessions and conducting brainstorming sessions with experts in scrum risk management.

Improving the risk awareness level can be achieved by,

- Increasing the level of theoretical knowledge in Risk Management
- Trying to make all the team members participate in responding to different situations a project faces allowing them to improve the practical knowledge on project risks.
- Increase technical and soft skills with the help of training sessions

- **Assign a skilled Scrum Master**

As explained in Section 4.5.1, the factor which has the most impact on Scrum risk management is Team readiness. The competency level of a Scrum is also one of the main aspects that strengthen the readiness of a Scrum team to confront different risk situations. Every team needs to have assigned a well-skilled person to completely focus and drive the team in the right direction. Scrum master is the main facilitator of a Scrum-based project. It is Scrum Master's responsibility to make sure the project is going on the estimated plans and right direction. Scrum Master is responsible for conducting effective meetings and make sure that risk management activities are taken into the discussion, and necessary actions to minimize risks, are finalized during meetings.

Also according to the responses received, the questions such as *"I believe it is important to have a well-organized, skilled Scrum master with experience, for the Scrum the processes to be followed with less failures ."*, *"It is Scrum Master responsibility to make sure all the team members are not being ignored and influenced to participate in decision-making activities"* and *"Scrum Masters should help the team to oversee the associated risks with quality and on*

time delivery of a product. " 80% of the respondents believe that scrum master should be well capable of handling different aspects of a scrum project.

Hence, the researcher believes Scrum Master is the key role in Scrum to manage risks efficiently. It is recommended to engage professionals with people management skills and communication skills with the ability to proactively taking measures to avoid or minimize risks. The organization can be certain on the skills of the Scrum Masters by,

- Encouraging them to obtain Scrum Master Certifications
- Make them participate in people management skill training sessions

- **Improve interaction with the End Customer**

According to the results obtained from the data analysis, the factor Customer interaction is one of the factors that most impact the implementation of Scrum Risk Management practices which is having the second highest correlation of 0.501.

The main objective of the Scrum framework is to improve customer satisfaction through collaborative work.

With reference to the response summary table in the Appendix C section, more than 90% were agreed on the statement such as *"Ignoring the customer feedback on demonstrations will make the customer dissatisfied. Hence, it is the responsibility of the team to give adequate attention to the feedback received."* and *"Frequent demonstrations and feedback sessions with the customer to increase the customer satisfaction."*

By looking at the outcome of the analysis, it is demonstrated that customer engagement in most of the scrum elements such as creating and reviewing Product backlog, Sprint planning, and review meetings with product demonstration sessions. The Scrum framework will lead to success only if the client engagement in these activities are managed at a good level.

Hence, the researcher recommends having customers actively engaging in scrum activities as the Product Owner. In some of the situations where the customer is not willing or not frequently involve in Scrum activities, the team can assign a product owner from the team itself who has direct and frequent access to the customer.

Also, the team can practice some skills to improve the interaction level with customers such as,

- Being conscientious
- Asking and Acting on Customer feedback
- Being transparent and Communicative with stakeholders.

5.4. Limitations

The researcher identified a few limitations in the current study. The current research is performed, focusing only on the Sri Lankan software industry to narrow down the scope. But scrum is used all over the world in many different fields. The opinion that Sri Lankan Software professionals hold about Scrum Risk Management practices could be different when considering the global population.

Also, the sample used in the research to collect data consists of the majority of software developers, which can lead to biases in result outcomes bias.

Since the questionnaire contains 37 questions, sometimes respondents would feel tedious in the middle of the questionnaire, and they would fill it without paying much attention.

5.5. Future Research Direction

This study can be extended in several ways. As mentioned in the limitations, this research is based on a population sample, where most of them are representing the development teams. In the future, the same research could be carried out with a different population representing different perspectives of a Scrum team.

Also, the study could be extended to observe risk management practices carried out in a real Scrum environment where the teams are distributed across several locations in the world and identify the factors that most impact on risk management activities while running the Scrum.

5.6. Conclusion

As per the detailed analysis and discussion, it is evident that the Scrum does not specifically define any risk management practices, but it is designed in a way that risks can be handled by the iterative approach in Scrum. Even though there were many kinds of research done in the past to identify risk management practices in Scrum, Scrum teams find it difficult to manage

risks in Scrum environments. This study was focusing on identifying the reasons that cause the difficulties in implementing Scrum Risk Management practices and provides recommendations to minimize those difficulties with some statistical evidence.

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APPENDIX

APPENDIX A- PRELIMINARY SURVEY

Interview Questions

1. Could you describe the Risk Management approach used in the Scrum framework?
2. Could you describe what has been changed from the Risk Management approach in the previous project management methodologies compared to Scrum?
3. What are the responsibilities in Risk Management in the Scrum team?
4. How do think the risk analysis should be conducted?
5. Is there any tool available? If yes, could you explain the usability of it?
6. Do you think the follow-up and response to the risks during the sprints are adequate?
7. As per your idea who should be leading the Risk process, and how?
8. How is the communication about the Risk Management process done among the members of the project?
9. Do you think the involvement of team members in the Risk Management processes adequate?
10. Do you think that requirements/stories should be analyzed against the possible risks? In that case, how and who is involved in the analysis process?
11. Do you think Risk Analysis outcomes can be used for preparations of Business plans, management of projects?

APPENDIX B - QUESTIONNAIRE

Survey on Factors affecting Scrum Risk management practices

Survey Questionnaire

Dear Sir/Madam,

I am a postgraduate student of the Department of Computer Science and Engineering, University of Moratuwa. As partial fulfillment of the Master of Business Administration (MBA in IT) program, currently, I am engaged in a research study on;

"FACTORS AFFECTING IMPLEMENTATION OF SCRUM RISK MANAGEMENT PRACTICES IN SRI LANKAN SOFTWARE INDUSTRY."

Therefore, I would appreciate it if you could spare a few minutes of your precious time to complete and submit the below questionnaire.

All the information you provide will remain completely confidential and will be used solely for academic purposes only.

Thank You,

Madhavi Upeksha | madhavi.18@cse.mrt.ac.lk

*Required

Demographic Questions

Please select the most suitable answer

1. Your Name (optional)

2. Designation *
   - ☐ Project Manager
   - ☐ Software Developer
   - ☐ Quality Assurance Engineer
   - ☐ Business Analyst
   - ☐ Other:

3. Is Software development is the main activity in your organization? *

- ☐ Yes
- ☐ No

4 .How many years of experience do you have in the software industry?

- ☐ Below 3 years
- ☐ 3 to 5 years
- ☐ 5 to 10 years
- ☐ More than 10 years

5. How long have you been working in Scrum Projects

- ☐ Below 1 year
- ☐ 1 to 3 years
- ☐ 3 to 5 years
- ☐ 5 to 10 years
- ☐ none

6. What is your role in the scrum team?

- ☐ Development Team
- ☐ Scrum Master
- ☐ Product Owner
- ☐ Other:

7. Have you obtained any certifications related to project management methodologies?

- ☐ PMP
- ☐ PRINCE2
- ☐ Certified Scrum Master
- ☐ None
- ☐ Other:

Scrum Risk Management

Scrum software development, because of its iterative nature, implicitly makes risk management part of the project life cycle. The objective of these questions is to measure the factors which mostly affect successful risk implementation in Scrum projects.

8. Constant monitoring in the product backlog items by the customer will help to mitigate project scope related risks. (e.g., prioritizing the tasks based on dependencies, understand reusability of components) *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

9. Frequent demonstrations and feedback sessions with the customer will increase customer satisfaction. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

10. In Scrum, customers can reach out to the developers and designers to give their feedback directly, which reduces the response time considerably. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

11. When the Customer acts as the "Product Owner" in the Scrum team, it will shorten the time spent on making important product decisions. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

12. Customer participation in the backlog review meetings will let them understand and oversee the budget variations upfront, which helps to reduce time on budget approvals. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

13. Ignoring customer feedback on demonstrations will make the customer dissatisfied. Hence, it is the responsibility of the team to give adequate attention to the feedback received. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

14. The team members can collaboratively participate in brainstorming sessions to contribute to identifying, analyzing, and mitigating risks such as misunderstandings in project requirements, technical skill gaps, etc.. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

15. The active participation of the team members in the scrum event such as daily meetings, sprint planning meetings help to identify impediments and monitor them. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

16. The team should always hold the same understanding of the requirements, rules, and standards. (e.g., understanding of the definition of "Done" should be the same for all the members) *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

17. The Scrum Master and all the team members should have an awareness about project risks, risk management techniques in software projects *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

18. I believe it is important to have a well-organized, skilled Scrum master with experience, for the Scrum the processes to be followed with fewer failures. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

19. It is Scrum Master's responsibility to make sure all the team members are not being ignored and influenced to participate in decision-making activities *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

20. Taking part in lengthy meetings makes the team feel bored and less focused on the details. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

21. Scrum Masters should help the team to oversee the associated risks with quality and on-time delivery of a product. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

22. Strong communication skills and a common language between team members will help in reducing the conflicts and ambiguities. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

23. I believe that the team should get equal opportunities to express their ideas *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

24. A collaborative culture placing a high value on face-to-face communication will help in reducing conflicts and make the team comfortable to communicate their ideas. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

25. My organization helps the team to improve their technical and soft skills through relevant training and development activities. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

26. The team maintains a risk burndown chart to understand risk census (information such as an impact, the probability, and the risk exposure) and their behavior when making project decisions. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

27. I believe having a business requirement document will help developers to read and understand the requirements properly. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

28. Daily meetings, Retrospective meetings are the scrum events that mostly allow to identify, analyze risks continuously in scrum projects. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

29. I believe that I will be encouraged to work collectively with distributed teams, in different time zones, if I am permitted to work flexible hours. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

30. The use of tools such as Jira, Rally helps me to track tasks, user stories, and the time spent on each of the tasks. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

31. Organizational environments that support the team on demand to reduce risk with external processes such as resource hiring, designing suitable working environments *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

32. I believe that Scrum does not require any explicit scrum artifacts such as risk register to log risks. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

33. I believe the implementation of Scrum risk practices will help to control issues with increasing scopes. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

34. I believe the implementation of Scrum risk practices will help to minimize risks of budget overruns. *.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

35. Implementation of implicit Scrum risk practices is sufficient for achieving quality targets. *

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

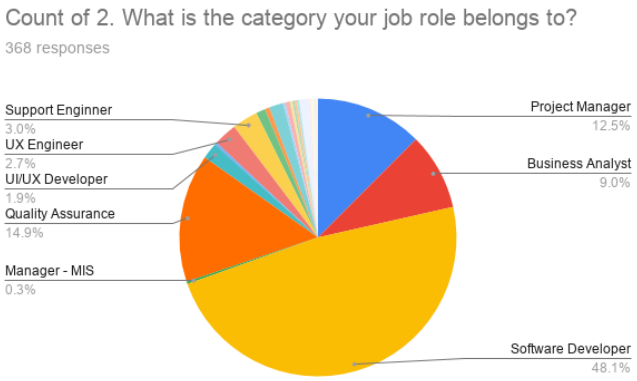
36. Customer satisfaction will be improved with the implementation of scrum risk practices. *

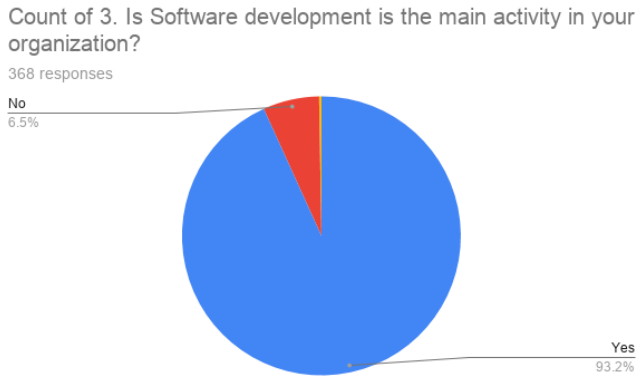
☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

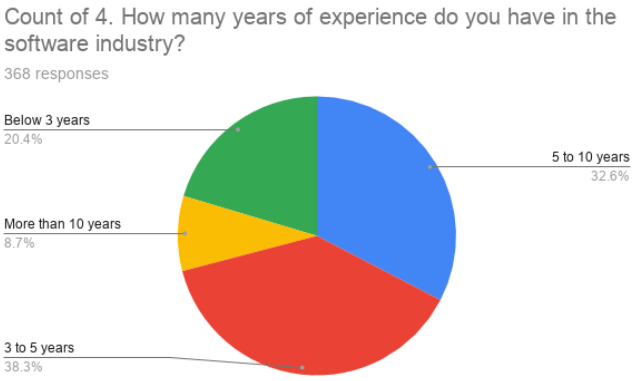
37. Managing Risks properly will be less stressful for the team members *

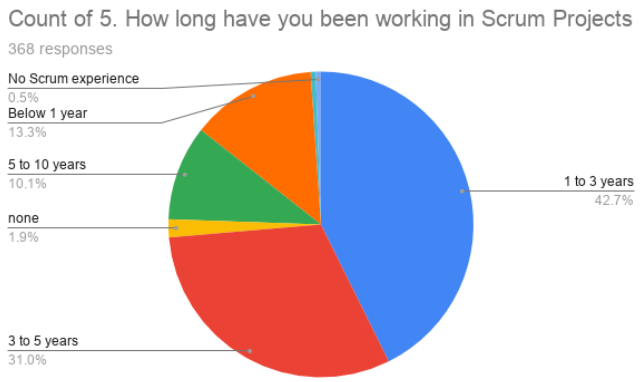
☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

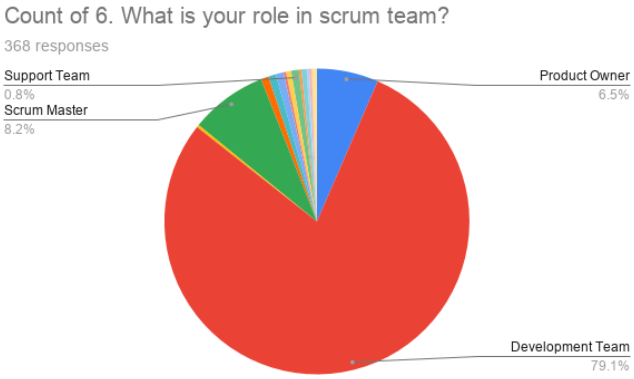
APPENDIX C –SUMMARY OF SURVEY RESULTS

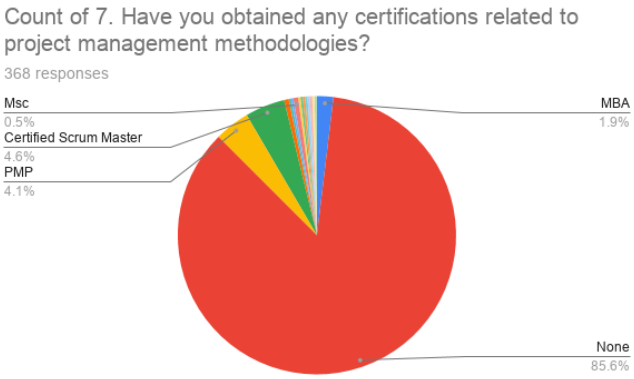


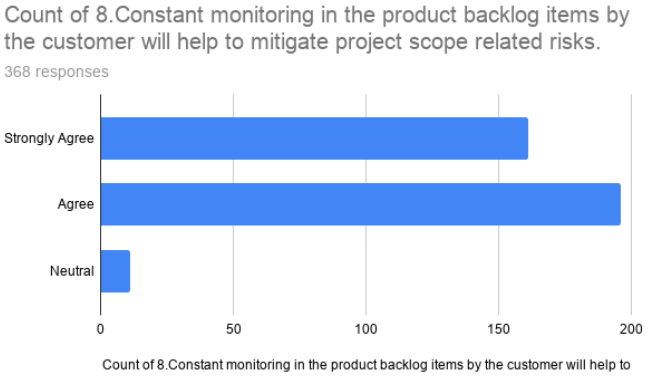


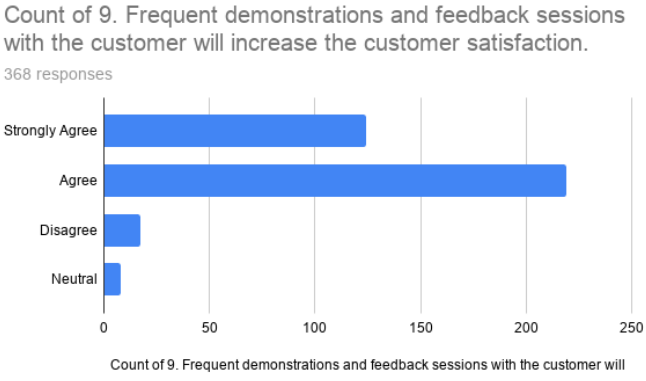





Count of 6. What is your role in scrum team?
368 responses
Support Team
0.8%
Scrum Master
8.2%
Product Owner
6.5%
Development Team
79.1%

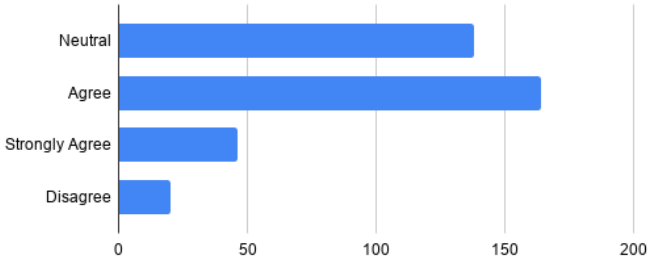

Count of 7. Have you obtained any certifications related to project management methodologies?
368 responses
Msc
0.5%
Certified Scrum Master
4.6%
PMP
4.1%
MBA
1.9%
None
85.6%


Count of 8.Constant monitoring in the product backlog items by the customer will help to mitigate project scope related risks.
368 responses
Strongly Agree
Agree
Neutral
0
50
100
150
200
Count of 8.Constant monitoring in the product backlog items by the customer will help to


Count of 9. Frequent demonstrations and feedback sessions with the customer will increase the customer satisfaction.
368 responses
Strongly Agree
Agree
Disagree
Neutral
0
50
100
150
200
250
Count of 9. Frequent demonstrations and feedback sessions with the customer will

Count of 10. In Scrum, customers can reach out to

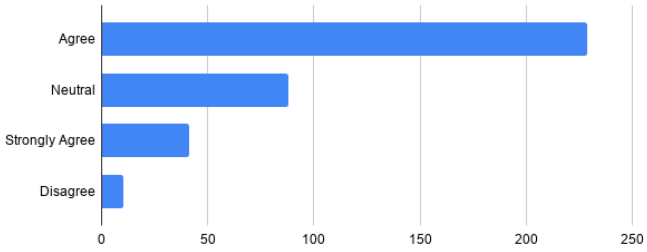
368 responses



Count of 10. In Scrum, customers can reach out to the developers and

Count of 11. When the Customer acts as the "Product Owner" in the Scrum team, it will shorten the time spent on making

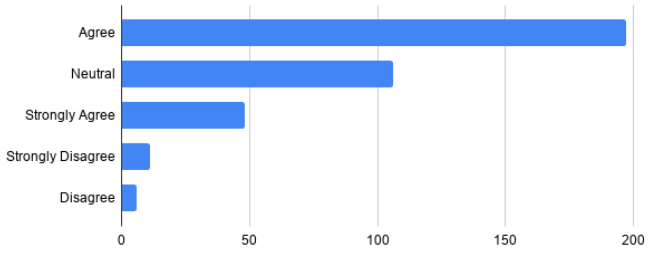
368 responses



Count of 11. When the Customer acts as the "Product Owner" in the Scrum team, it will

Count of 12. Customer participation in the backlog review meetings will let them understand and oversee the budget

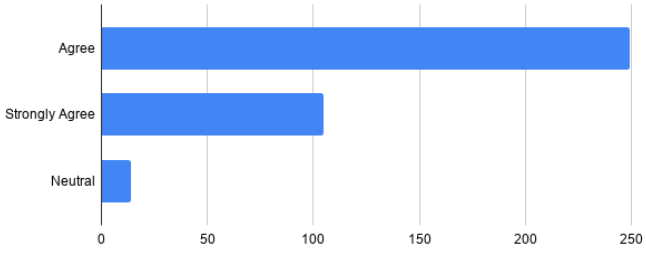
368 responses



Count of 12. Customer participation in the backlog review meetings will let them

Count of 13. Ignoring the customer feedback on demonstrations will make the customer dissatisfied. Hence, it is

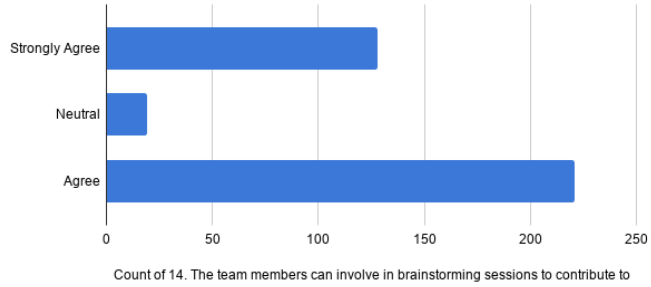
368 responses



Count of 13. Ignoring the customer feedback on demonstrations will make the customer

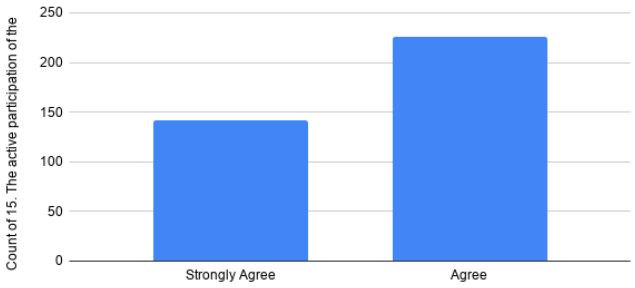
Count of 14. The team members can involve in brainstorming sessions to contribute to identifying, analyzing, and mitigating

368 responses



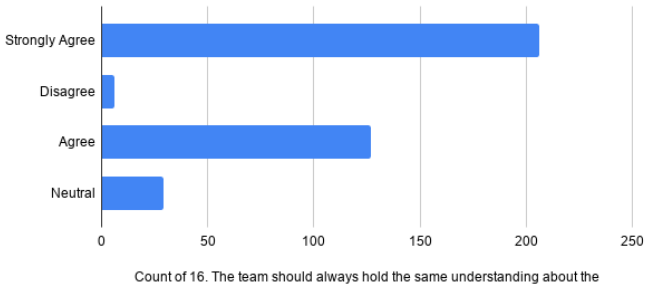
Count of 15. The active participation of the team members in the scrum event such as daily meetings, sprint planning

368 responses



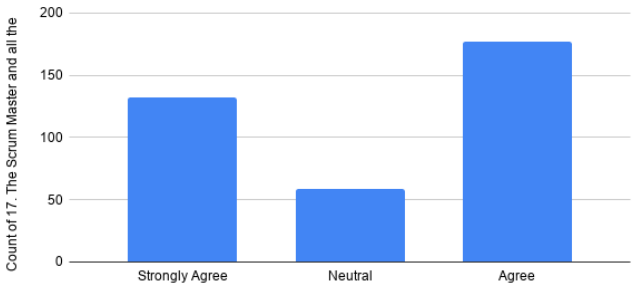
Count of 16. The team should always hold the same understanding about the requirements, rules and standards.

368 responses



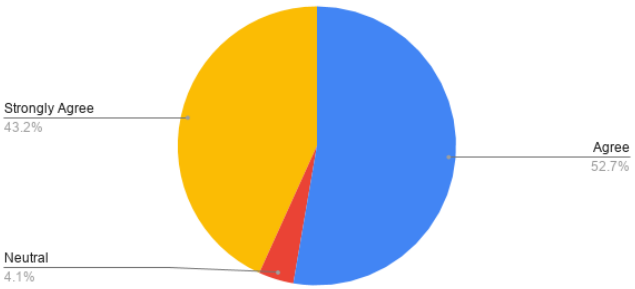
Count of 17. The Scrum Master and all the team members should have an awareness about project risks, risk

368 responses



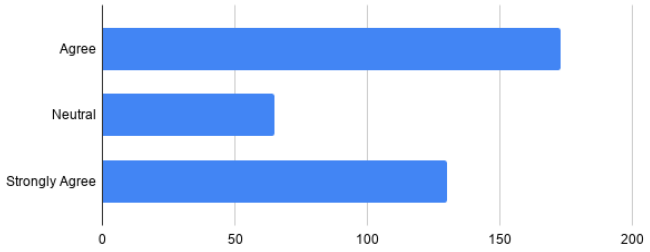
Count of 18. I believe it is important to have a well-organized, skilled Scrum master with experience, for the Scrum the

368 responses



Count of 19. It is Scrum Master responsibility to make sure all the team members are not being ignored and influenced to

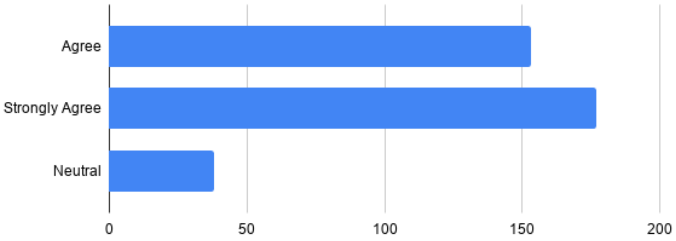
368 responses



Count of 19. It is Scrum Master responsibility to make sure all the team members are not

Count of 20. Taking part in lengthy meetings make the team feel bored and less focus on the details.

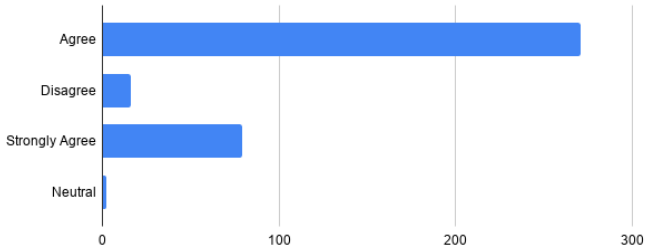
368 responses



Count of 20. Taking part in lengthy meetings make the team feel bored and less

Count of 21. Scrum Masters should help the team to oversee the associated risks with quality and on time delivery of a

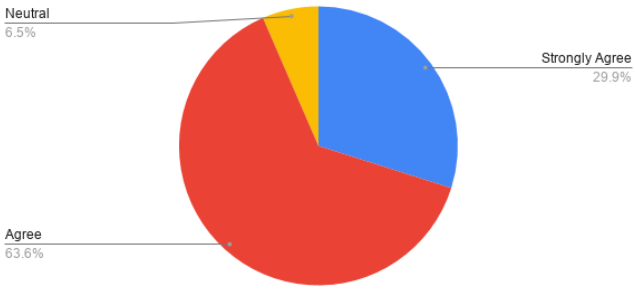
368 responses



Count of 21. Scrum Masters should help the team to oversee the associated risks with

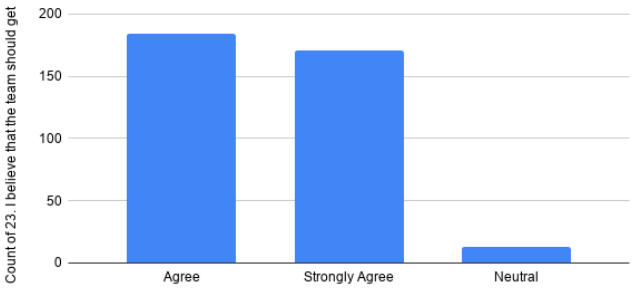
Count of 22. Strong communication skills and a common language between team members will help in reducing the

368 responses



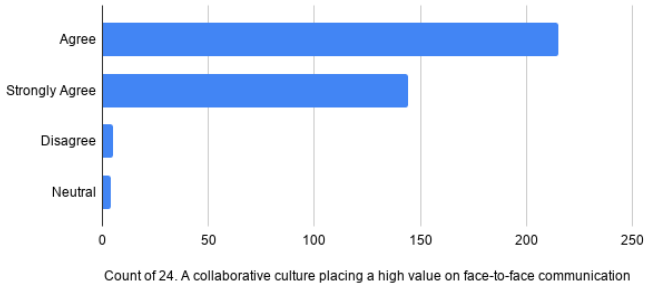
Count of 23. I believe that the team should get equal opportunities to express their ideas

368 responses



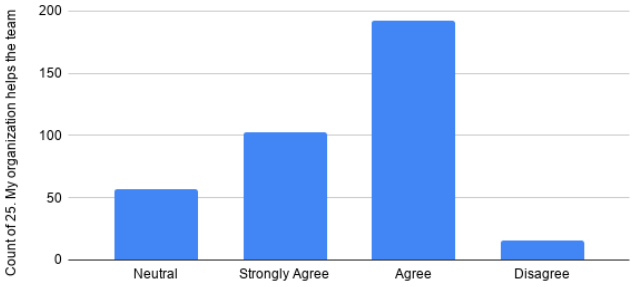
Count of 24. A collaborative culture placing a high value on face-to-face communication will help in reducing conflicts and

368 responses



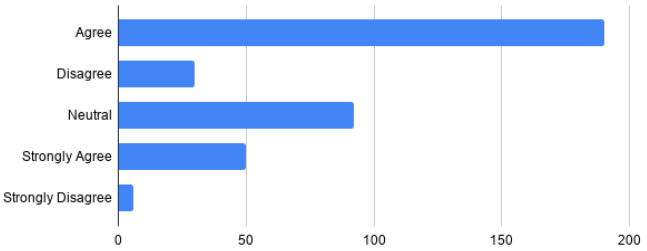
Count of 25. My organization helps the team to improve their technical and soft skills through relevant training and

368 responses



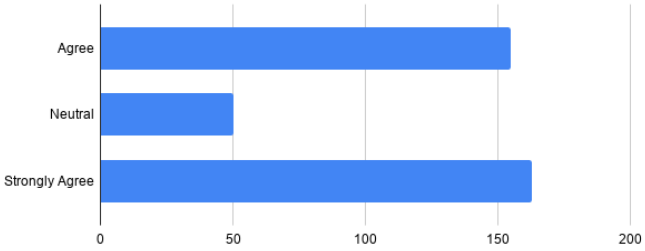
Count of 26. The team maintains a risk burndown chart to understand risk census (information such as an impact, the

368 responses



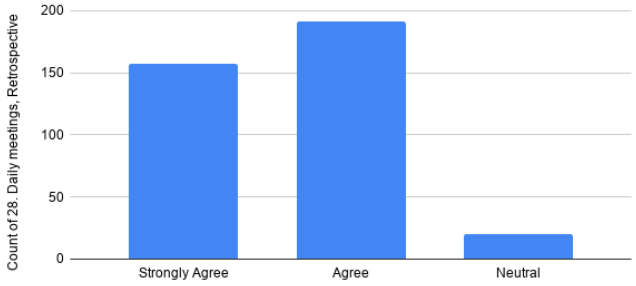
Count of 27. I believe having a business requirement document will help developers to read and understand the requirements

368 responses



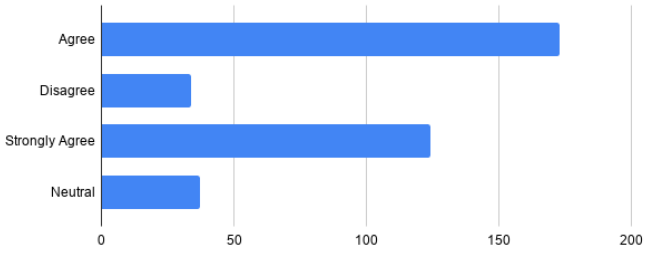
Count of 28. Daily meetings, Retrospective meetings are the scrum events that mostly allow to identify, analyze risks

368 responses



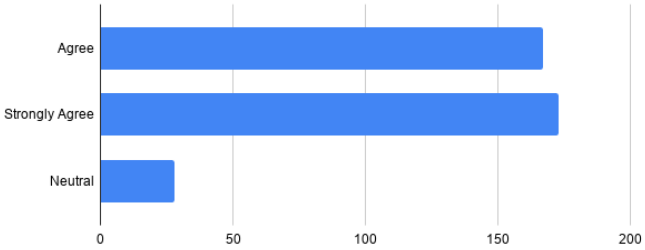
Count of 29. I believe that I will be encouraged to work collectively with distributed teams, in different time zones, if I

368 responses



Count of 30. The use of tools such like Jira, Rally helps me to track tasks, user-stories and the time spent on each of the

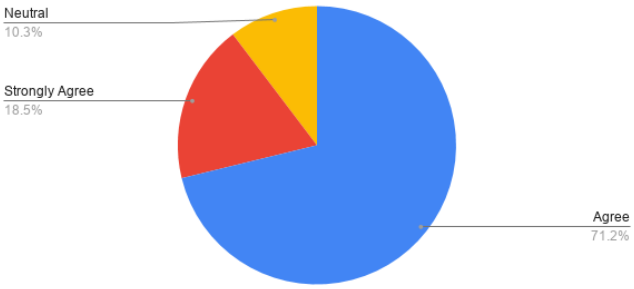
368 responses



Count of 30. The use of tools such like Jira, Rally helps me to track tasks, user-stories

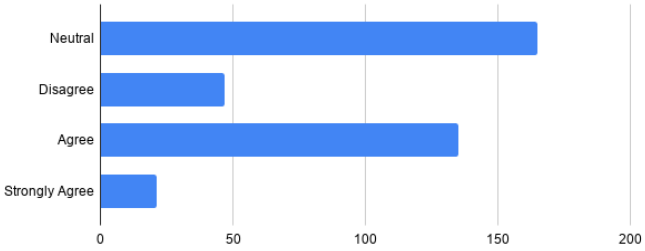
Count of 31. Organizational environments which support the team on demand to reduce risk with external processes such

368 responses



Count of 32. I believe that Scrum does not require any explicit scrum artifacts such as risk register to log risks.

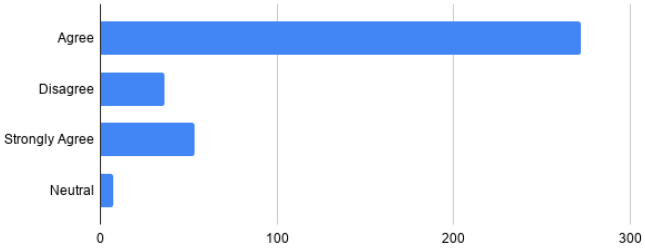
368 responses



Count of 32. I believe that Scrum does not require any explicit scrum artifacts such as

Count of 33. I believe the implementation of Scrum risk practices will help to control issues with increasing scopes.

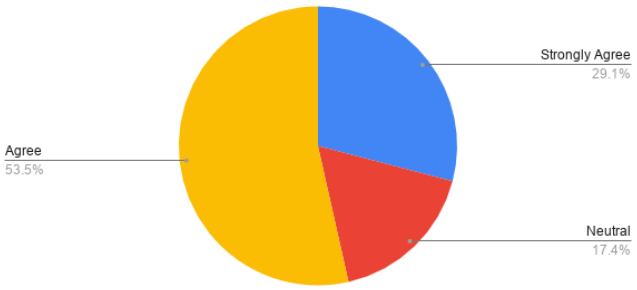
368 responses



Count of 33. I believe the implementation of Scrum risk practices will help to control

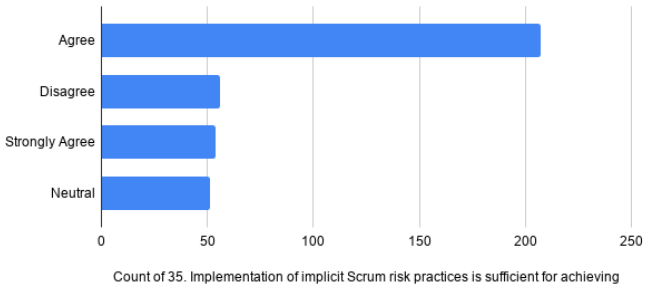
Count of 34. I believe the implementation of Scrum risk practices will help to minimize risks of budget overruns.

368 responses



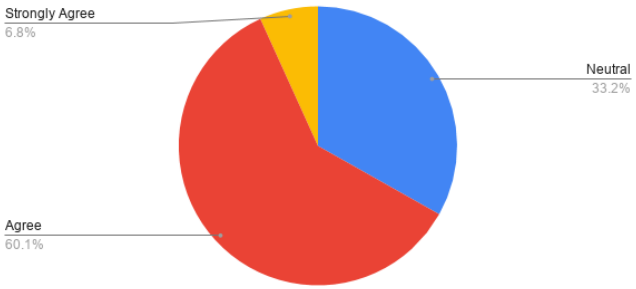
Count of 35. Implementation of implicit Scrum risk practices is sufficient for achieving quality targets.

368 responses



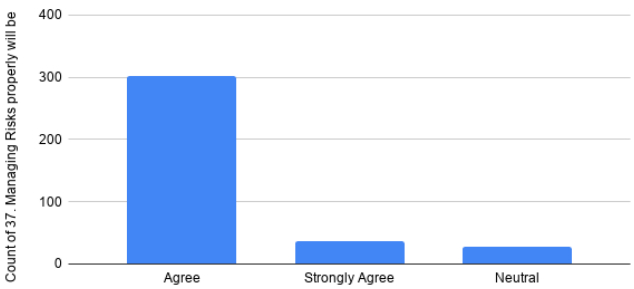
Count of 36. Customer satisfaction will be improved with the implementation of scrum risk practices.

368 responses



Count of 37. Managing Risks properly will be less stressful for the team members

368 responses



Response summary of the Questionnaire

Variable	Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Customer Interaction	Constant monitoring in the product backlog items by the customer will help to mitigate project scope related risks. (e.g: prioritizing the tasks based on dependencies, understand reusability of components.	43.75%	53.26%	2.99%	0.00%	0.00%
	Frequent demonstrations and feedback sessions with the customer to increase the customer satisfaction.	33.70%	59.51%	2.17%	4.62%	0.00%
	In scrum, customers can reach out to the developers and designers to give their feedback directly, which reduces the actioning time considerably.	12.50%	44.57%	37.50%	5.43%	0.00%
	When the Customer acts as the "Product Owner" in the Scrum team, it will shorten the time spent on making important product decisions.	11.14%	62.23%	23.91%	2.72%	0.00%
	Customer participation in the backlog review meetings will let them understand and oversee the budget variations upfront, which helps to reduce time on budget approvals.	13.04%	53.53%	28.80%	1.63%	2.99%
	Ignoring the customer feedback on demonstrations will make the customer dissatisfied. Hence, it is the responsibility of the team to give adequate attention to the feedback received.	28.53%	67.66%	3.80%	0.00%	0.00%
Team Readiness	The team members can collaboratively participate in brainstorming sessions to contribute to identifying, analyzing, and mitigating risks such misunderstandings in project requirements, technical skill gaps etc..	34.78%	60.05%	5.16%	0.00%	0.00%
	The active participation of the team members in the scrum event such as daily meetings, sprint planning meetings help to identify impediments and monitor them.	38.59%	61.41%	0.00%	0.00%	0.00%
	The team should always hold the same understanding about the requirements, rules and standards. (e.g: understanding on the definition of "Done" should be same for all the members)	55.98%	34.51%	7.88%	1.63%	0.00%
	The Scrum Master and all the team members should have an awareness about project risks, risk management techniques in software projects.	35.87%	48.10%	16.03%	0.00%	0.00%

	I believe it is important to have a well-organized, skilled Scrum master with experience, for the Scrum the processes to be followed with less failures .	43.21%	52.72%	4.08%	0.00%	0.00%
	It is Scrum Master responsibility to make sure all the team members are not being ignored and influenced to participate in decision-making activities	35.33%	47.01%	17.66%	0.00%	0.00%
	Scrum Masters should help the team to oversee the associated risks with quality and on time delivery of a product.	21.47%	73.64%	0.54%	4.35%	0.00%
Communication	Taking part in lengthy meetings make the team feel bored and less focus on the details.	48.10%	41.58%	10.33%	0.00%	0.00%
	Strong communication skills and a common language between team members will help in reducing the conflicts and ambiguities.	29.89%	63.59%	6.52%	0.00%	0.00%
	I believe that the team should get equal opportunities to express their ideas	46.47%	50.00%	3.53%	0.00%	0.00%
	A collaborative culture placing a high value on face-to-face communication will help in reducing conflicts and make the team comfortable to communicate their ideas.	39.13%	58.42%	1.09%	1.36%	0.00%
Organizational Culture	A collaborative culture placing a high value on face-to-face communication will help in reducing conflicts and make the team comfortable to communicate their ideas.	39.13%	58.42%	1.09%	1.36%	0.00%
	My organization helps the team to improve their technical and soft skills through relevant training and development activities.	27.99%	52.17%	15.49%	4.35%	0.00%
	I believe that I will be encouraged to work collectively with distributed teams, in different time zones, if I am permitted to work flexible hours.	33.70%	47.01%	10.05%	9.24%	0.00%
	Organizational environments which support the team on demand to reduce risk with external processes such as resource hiring, designing suitable working environments	18.48%	71.20%	10.33%	0.00%	0.00%
Process Readiness	The active participation of the team members in the scrum event such as daily meetings, sprint planning meetings help to identify impediments and monitor them.	38.59%	61.41%	0.00%	0.00%	0.00%
	The team maintains a risk burndown chart to understand risk census (information such has impact, the probability, and the risk exposure) and their behavior when making project decisions.	13.59%	51.63%	25.00%	8.15%	1.63%
	I believe having a business requirement document will help developers to read and understand the requirements properly.	44.29%	42.12%	13.59%	0.00%	0.00%

	Daily meetings, Retrospective meetings are the scrum events that mostly allows to identify, analyze risks continuously in a scrum projects	42.66%	51.90%	5.43%	0.00%	0.00%
	The use of tools such like Jira, Rally helps me to track tasks, user-stories and the time spent on each of the task.	47.01%	45.38%	7.61%	0.00%	0.00%
	I believe that Scrum does not require any explicit scrum artifacts such as risk register to log tisks.	5.71%	36.68%	44.84%	12.77%	0.00%
Implementation of Scrum Practices	I believe implementation of Scrum risk practices will help to control issues with increasing scopes.	14.40%	73.91%	1.90%	9.78%	0.00%
	I believe implementation of Scrum risk practices will help to minimize risks of budget overruns.	29.08%	53.53%	17.39%	0.00%	0.00%
	Implementation of implicit Scrum risk practices are sufficient for achieving quality targets.	14.67%	56.25%	13.86%	15.22%	0.00%
	Customer satisfaction will be improved with the implementation of scrum risk practices.	6.79%	60.05%	33.15%	0.00%	0.00%
	Risks properly will be less stressful for the team members	10.05%	82.34%	7.61%	0.00%	0.00%

APPENDIX D – COMPANY LIST

#	Company Name
1	Virtusa (Pvt) Ltd
2	Zone 24x7 (Pvt) Ltd
3	Pearson Lanka (Pvt) Ltd
4	John Keells Computer Services (Pvt) Ltd
5	IFS R and D International (Pvt) Ltd
6	Ebeyonds (Pvt) Ltd
7	Efutures (Pvt) Ltd
8	Millenium InformationTechnologies (Pvt) Ltd
9	99x Technology Ltd
10	WSO2 (Pvt) Ltd
11	Persistence Systems (Pvt) Ltd
12	Codegen International (Pvt) Ltd
13	EFutures Private Limited
14	99X Technology (Pvt) Ltd
15	Tiqri (Pvt) Ltd
16	ISM APAC (Pvt) Ltd
17	Axiata Digital Labs
18	SimCentric Technologies
19	Bileeta (Pvt) Ltd
20	Mitra Innovations
21	Sysco Labs (Pvt) Ltd
22	Geveo Australasia (Pvt) Ltd
23	NEM Constructions

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