

# Combining Hard and Soft Aspects in Project Performance Measurement

# A Qualitative Research Undertaken in an Agile Software Development Project Scenario

Master's Thesis in the Master's Programme International Project Management and Quality and Operations Management

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#### ABSTRACT

Generally, in agile software development projects, project performance is measured using Key Performance Indicators that are focused exclusively on the project's deliverables to the customer. The softer aspects concerning the smooth functioning of agile teams are usually understood in the traditional manner through meetings, group discussions and surveys and there is an air of informality around it like every other method. But with increasing project complexity, team sizes have increased and projects have been pursued with virtual teams located across the world. Even in such scenarios, the way hard and soft aspects are dealt with has not undergone a change. The research aims to qualitatively explore the possibilities of combining hard and soft aspects as KPIs in such environments to measure project performance more effectively. The research is an abductive case study of a complex agile software development project in the automotive sector. Interviews and questionnaires were conducted, ably supported by participant observations with two levels of the project organization and internal data from the organization. The study aims to link the findings with existing theory in agile methodology and project performance measurements. The gaps existing in agile methodology are viewed through the lens of project performance and the final findings are arrived at.

The most striking finding was about managers knowing the need of soft aspects for project performance but assumed the informal meetings brought up these issues. On the contrary, the operational level employees voiced their concern about many soft issues which had not been escalated before. The findings uncovered a gap in agile methodology regarding the balance between focus on the external customer and getting internal stakeholders committed to that purpose. The researchers have attempted to visualize the combination of these two aspects, through the use of the GQM model. It was possible to conclude that in complex project environments governed by a short and engaging planning cycle, project performance cannot be fully understood based on the deliveries made to the customer. The soft aspects of the project team should also be viewed in a formalized way as KPIs to get a complete idea about project performance.

Key words: project performance measurement; agile methodology; software development; scrum; Kanban; feature driven development; hard aspects; soft aspects; key performance indicators; agile performance measurement; communication; team dynamics; complex agile project

### PARINYAPORN ARPASUTEERAT

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## Preface

The project was pursued for six months at Delphi Automotive Systems AB in Gothenburg, Sweden. The research commenced as a part of Delphi's realization of the scope for improvement in project management and the project management world moving towards research concerning soft aspects. In this study, the data has been collected through semi-structured interviews, questionnaire, observations and company project management systems.

The research was performed under the supervision of Petra Bosch, professor at Chalmers University of Technology. The work at the company was done under the supervision of Marcus Hedberg, program manager, engineering division, at Delphi Sweden.

We would like to extend our gratitude to our supervisors for trusting us with a very new topic and an exploratory conceptual research and engaging in the reviews with full intent. The discussions undertaken were very valuable and many ideas and insights sprouted from those discussions. Also, we would like to thank them for their continuous and active involvement throughout the project and their great contribution in ensuring our progress was along the right directions.

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# 1 Introduction

## 1.1 Background

Projects have been a domain that has constantly increased in complexity over time. Variation in external factors like shortened product life cycles, narrow product launch windows, increasingly complex and technical products, emergence of global markets and an economic period marked by low inflation, as identified by Pinto (2013), have largely contributed to the evolution of projects. Drob (2009) outlines the evolution from being a practice where management theories were used, to a concept based on which fresh principles, practices and tools have been developed. Evaristo and van Fenema (1999) outline how the idea of operating a single project has extrapolated into managing multiple projects in many locations in a globalized business simultaneously.

This evolution is very evident in the software industry. Software development is challenging because traditionally software has been perceived as a product that arises completely from innovation without constraints (Tomayko and Hallman, 1989). Traditional management models have focused on keeping software development rigid. But since software development projects encounter changes throughout the lifecycle, such an approach would encourage loopbacks and hinder quick progress (Stoica et al, 2013). The complex issue of building a strong customer focus into software and adapting effectively to constant change, gave rise to agile methodology. In the recent past agile has had widespread impact on software development enabling companies to be flexible and respond quickly to customer requirements.

One of the highlights of agile projects is that the iterative cycles create a fast-paced environment. In such an environment, project performance measurement needs more factors than traditional methods. With increased speed of work and constant engagement with the customer, soft factors are to be given more priority than when compared to the same in traditional performance measurement methods. According to Maximini (2015), Pries and Quigley (2011) and Cobb (2011), performance in agile projects is generally measured in terms of how coherent the customer deliveries are with the expected delivery plan. There have been indications that agile comes short in its ability to combine this external customer focus with the internal stakeholder attention in terms of of project performance measurement. In a time-boxed, iterative planning cycle that spans for a short period, these factors emerge as key constituents of performance measurement. Therefore, to track the progress of a project efficiently, a need has arisen to focus not only on hard aspects like delivery accuracy, business value created and trend of customer complaints but also on soft aspects like effectiveness of communication, accountability, team climate, team growth etc.

The current KPIs in agile serve the purpose of monitoring project performance based only on the quantifiable hard facts and deals with soft aspects in the traditional manner of face-to-face meetings, surveys and other informal means at a company level (Lauras et al, 2010). Researchers in the past have thrown light on the stressful nature of an agile software development project and have asserted on the importance of soft aspects. But there have been very less investigations into the combined use of hard and soft aspects as KPIs in project performance measurement.

## 1.2 Objective

The master thesis is aimed at exploring the possibilities of improving project performance measurement in agile software development projects by combining hard and soft aspects as measurement metrics.

The research is undertaken as a single case study and is based on a software development project undertaken at Delphi Automotive Systems Sweden AB. The organization had just adopted agile methodology and had undertaken a pilot project in software development. The company is heading towards stabilization of the agile way of working and this provided the opportunity for the research team to see shortcomings with more clarity. Hence, the project scenario paved way for an qualitative research, based on the following question.

- How can hard and soft aspects of project performance be combined as Key Performance Indicators in agile software development projects?
  - What are the issues with the current system of KPIs used to measure project performance in agile software development?
  - How can this system be developed to provide more insight into agile software project performance?

The research dwells in this domain by taking into consideration two major examples of soft aspects, communication and team dynamics, and attempts to combine them with the hard KPIs existing in the company to answer the main research question. However, the overall idea is to highlight and structurally merge soft aspects with the hard aspects in performance measurement.

## **1.3** Scope and Limitations

It is very important to fix the boundaries of the research and specify its scope (Dubois and Gadde, 2002). The research is confined to an intensive study of a single case, which means that all empirical data sources and findings have been based on the specific case. The focus of the research is on the agile project performance measurement in general and hence, the system KPIs used in agile form the core of this investigation. The research group clearly perceives hard KPIs as indicators that have its roots in actual quantifiable facts and soft KPIs as metrics that emerge from more qualitative assessment. Although the project is entitled to four countries, cultural aspects have not been included within the research. The corporate culture has been adopted as the cultural foundation of the organization and the scope has been narrowed to establish specific focus on project performance measurement from a systems perspective. Although project performance is the main research area, the study does not venture into financial performance metrics due to ethical reasons of confidentiality.

## 2 Theoretical Framework

## 2.1 Agile Methodology

Agile methodology, as the name suggests, can be viewed as a software project management approach that works based on the underlying principle of keeping the project planning horizon short (Canty, 2015). Further, agile differs from the processbased project management approach in that, the approach is highly based on values and principles (Canty, 2015). With software development facing continuous changes in terms of customer requests, agile would suit the scenario due to its inherent adaptability and short and iterative planning cycles (Canty, 2015). As Chin (2004) explains, "agile environments are those that exhibit internal or external uncertainty, may require some unique expertise and high urgency". The author classifies uncertainties as internal (occurring within the project umbrella) and external (occurring due to the company's position in the market) and outlines the need for innovativeness and a unique way of thinking to counter these uncertainties quickly, thus improving the agility of the project. The core philosophies of creating value for the customer and promoting respect for individuals has been fully adopted into software development (Canty, 2015). On the other hand, continuous improvement in agile methodology is based on collective reflections through retrospection with minimal documentation and follow-ups (Canty, 2015).

The overall business targets and project goals are specified right at the beginning as a vision and that is translated into different time-bound sub-objectives at succeeding planning levels (Cobb, 2011). The adaptability of agile methodology to changing customer requirements is evident right from project planning. Continuous and iterative project plans are established as late as possible and only till a required point, aiding a quick start to the project and fast response to change (ibid). There are several process frameworks which are popularly used to implement agile project management in practice. Three of them were seen to be used in the case of this research and hence they have been explained briefly below.

### 2.1.1 Feature-Driven Development

According to Scott Ambler (2014), "Feature-Driven Development (FDD) is a clientcentric, architecture-centric, and pragmatic software process. The term "client" in FDD is used to represent the project stakeholders". FDD is a method that is focused on establishing agility in large project organizations and it also works in an iterative manner (Ambler, 2014).



Figure 2.1.1.1 Feature-Driven Development project life cycle (Ambler, 2014, p.1).

FDD is basically governed on features or statements that outline the customer requirements that needs to be delivered and all the planning for the project is done based on these features (ibid). From knowing the fundamentals of the project, the features are sorted into a Features list based on similarities in their domains (ibid). Planning is done based on the feature and when it can be developed and shipped to the customer and based on this plan, the resources are allocated for the iteration as shown in Figure 2.1.1.1 (ibid). Designing and Building the feature engulf the bulk of the tasks like modeling, programming, testing, and packaging of the system (ibid).

Because of the small size and measurability of features, the component teams dealing with them are also small, usually three to six members (Palmer and Felsing, 2002). Feature driven development has a main feature of class and code ownership where software developers and programmers are made accountable for a set of codes in the feature (ibid). This gives them a representation within the class and innovations and modifications in the code are reminiscent of their expertise in that code set (ibid). The collection of all the classes in one feature comes under the class owner and the class owners from all the features report back to the feature owner (ibid).

#### 2.1.2 Scrum

Scrum is an agile framework that facilitates implementation agile projects. The project is broken down into iterative segments called 'sprints' as depicted in Figure 2.1.2.1 and they include planning to deliver to the customer, building what was planned, testing it for defects and then potentially creating a shippable requirement (Maximini, 2015). It is not mandatory that at the end of every sprint there should be a release and a delivery can span over two or three sprints as well depending on the size of the requirement (ibid).



Figure 2.1.2.1 Scrum project management framework (Cobb, 2015 p.39).

In scrum the customer requirements are defined as user stories, a high-level statement defining needs in a simplified manner to facilitate the estimation of effort to be put in (Cobb, 2015). During cases of complexity, requirements encompass a wide variety of functions or tasks that cut across disciplines and in this case, the requirements are defined as 'epics' and then are further broken down into 'user stories' (ibid). The effort to be put into each user story is estimated collectively by a team, and is represented as 'story points' (ibid). A team can estimate the effort put into a user story based on the size of the story, complexity of tasks involved and time taken to accomplish them (Maximini, 2015). The user stories are further broken down and translated into more technical tasks and are executed in sprints based on their priority levels (Cobb, 2015).

Since agile cuts down on documentation, scrum aims to cover this through three main attributes. The 'product backlog' is a list of features that is expected to go into the product and houses the information as user stories (Maximini, 2015). The 'sprint backlog' contains the prioritized list of user stories that are to be completed within the sprint since agile, being customer focused, aims to complete the most important requirement of the customer as early as possible (ibid). The rate at which a user story is nearing completion or in other words the work during the sprint is progressing, is known from the 'burndown' chart (ibid).

A scrum team typically has a product owner, the scrum master and the development team (Pries and Quigley, 2011). The 'product owner' takes responsibility for the product to be as per the customer requirements (ibid). The product owner is therefore a bridge between the project team's progress and the company's requirements and should transfer any form of value-adding business drivers into the project (Chin, 2004). The 'Scrum Master' is responsible for the efficient functioning of the team, and ensuring its compliance to the scrum process. Since the ideology of scrum is to promote team consensus and shared responsibilities, the Scrum Master adopts the role of a facilitator rather than a director (ibid). The Scrum Master facilitates a development team that is highly cross-functional and consists of testers, programmers, architects and engineers (ibid). The team shares responsibilities based either on

individual competencies or on across competence but the goal of the team is to get the work planned for the iteration done as efficiently as possible (Pries and Quigley, 2011). However, in complex projects many of such teams would exist with individually assigned Scrum Masters and Product Owners, who are collectively supervised with the involvement of a higher management (Cobb, 2011).

Scrum teams meet at the beginning for a sprint planning or release planning, and develops the plan for the concerned user stories, the competencies required for it and the estimated time and effort required for its completion (Pries and Quigley, 2011). Then, the team engages in daily stand-up meetings to discuss the work completed, work to be done and hindrances to the tasks (ibid). At the end of the sprint, a sprint review and retrospective meeting is conducted to summarize the success factors and shortcomings in the sprint and how to work with them in the next iteration (ibid).

#### 2.1.3 Kanban

Kanban focuses on delivering software just-in-time by adapting the work schedule to create customer value (Liker and Meier, 2006). In the words of Al-Baik and Miller (2015, p.1862):

"David Anderson differentiates the Kanban method from kanban—the pull system by capitalizing the word Kanban. He identifies five elements to the successful implementation of the Kanban method: 1) visualize the workflow, 2) limit work-inprogress (WIP), 3) manage flow, 4) make policies explicit, and 5) implement feedback loops."



Figure 2.1.3.1 Kanban workflow (Peterson.D, 2015, p. 1).

Workflow as displayed in Figure 2.1.3.1 is visualized using a Kanban board and is divided based on level of completion as to-do works, in-progress works and works done (ibid). Different steps of converting a requirement into an increment in a software product are listed on a Kanban board and for each step there is the work division based on the completion levels (Ortiz, 2016). To cross from one stage to the other, a set of rules are defined by the project team as criteria for validating the end of a stage (ibid). A final increment in the product is delivered for implementation when a requirement has crossed all the stages of the Kanban board (ibid). Liker and Meier (2006) see the Kanban board as a culture that facilitates a 'pull' form of workflow rather than a strategy for agility, which means that the board takes the role of a

facilitator. The visualization of work is provided by the board itself and hence, unlike Scrum, the need for a specific facilitator is not mandatory (Al-Baik and Miller, 2015). The team engages in review meetings and daily meetings to discuss sharing of responsibilities, hindrances and collective decision making (Ortiz, 2016). The visualization of work, simplicity of the system and reduced strictness of adherence to process means that the need for a role synonymous to that of a Scrum master is not mandatory (Ortiz, 2016).

In this way, the Work-In-Progress is minimized and workflow is optimized creating room for agility in the team and the quick ability to focus on new things (Liker and Meier, 2006). Because of the improved agility and shifting focus on newer things the idle time for a team is lesser ensuring peak resource utilization (Al-Baik and Miller, 2015). Kanban also facilitates continuous delivery of software through incremental and iterative way of working (ibid). Since the tasks from a Kanban board are basically pulled by the people working on them, the work only happens when there is a requirement and in this way overproduction and resource wastage is monitored (Liker and Meier, 2006).

Although agile contributed immensely to software project management, many researchers have worked on uncovering the limitations of agile. Typically, agile is suitable for larger organization since the risks associated with the project and level of unpredictability involved in the project are very high (Bertrand, 2014). Agile methodology has communication, collaboration, engagement and satisfaction as some of its primary features but this is addressed through many meetings but the follow-up from these meetings is not a formalized process (Agarwal et al, 2015). Bertrand suggests this as well and hints at deficiencies in understanding a project's progress in unpredictable circumstances. Agile, being a fast-paced methodology, favors lesser documentation and follow-up due to the product-based approach and this hinders continuous improvement and knowledge management according to (Nerur et al, 2012). The lesser documentation, also hinders upfront planning for a long term agile project and the project can easily go off track if short iterations are not backed by an overall project plan (Agarwal et al, 2015). Agile requires intense training to be implemented properly as method, being based on short planning cycles can easily cause losses to the project team (Agarwal et al, 2015).

# 2.1.4 The Impact of Agile Methodology against Organizational Principles

Pinto (2013), in his definition sees projects as a set of processes governed by organizational values, that are developed to achieve customer-focused objectives and targets. Projects executed through agile methodology also has its own principles, practices and tools as discussed in the previous sections and comparing them with a traditional model makes it valid to interpret the shortcomings of the methodology from an organizational point of view. Since the values and principles of an organizational system directs the development of processes and tools for that system (Bergman and Klefsjo, 2010), it can be expected that the shortcomings of agile methodology will reflect on the process of project performance measurement in agile software development projects.

To uncover the drawbacks of agile methodology, it is possible to compare the core principles of the approach with that of the Cornerstone Model as described by Bergman and Klefsjo (2010). The Cornerstone Model is apt in the sense that it broadly categorizes organizational principles into its different cornerstones in general and makes it easy to apply the thought in a real environment (ibid).



## **Top Management Commitment**

Figure 2.1.4.1 The Cornerstone model (Bergman and Klefsjo, 2010, p. 38).

As shown in the Figure 2.1.4.1, the central focus of all organizations is its external customer and their satisfaction but the model also outlines the need to strongly focus on the four cornerstones of fact-based decision making, commitment of internal stakeholders, drive to improve continuously and attention to processes to be able to successfully satisfy the customer (ibid). The model also insists the need for strong initiation and commitment from the top management to be able to contribute to the stability of all cornerstones and consequently customer satisfaction (ibid).

Looking at agile methodology through the eyes of the Cornerstone model exploits some of its shortcomings. Typically, agile is suitable for larger organizations with the unpredictable environment opening doors for more risks and continuous deliveries demanding a large requirement of resources for successful execution (Bertrand, 2014). Agile requires intense training to be implemented properly as method, being based on short planning cycles can easily cause losses to the project team (Agarwal et al, 2015).

Agile methodology has communication, collaboration, engagement and satisfaction as some of its primary features and this is addressed through many meetings but the follow-up from these meetings is not a formalized process (Agarwal et al, 2015). According to Bergman and Klefsjo (2010), it is important that the employees handling responsibilities should be qualified in terms of their soft skills, and due attention should be paid to these skill sets. Bertrand (2014) also hints along these lines and also points at deficiencies in fully understanding a project's progress in unpredictable circumstances. Organizations work in an environment of evolving complexity and changing customer requirements, and this causes principles, processes, tools and products to keep growing (Bergman and Klefsjö, 2010). Hence, information that is relevant to the context should be collected and analyzed to drive improvement efforts (ibid). Agile, being a fast-paced methodology, favors lesser documentation and follow-up due to the product-based approach, with project performance based only on quantifiable metrics that is focused on deliveries (Nerur et al, 2012). Every issues that occur in an agile project are discussed either during the review meetings, stand-up

meetings or retrospective meetings but a formalized way of documenting this information is still lacking (ibid). Generally, high levels of proactivity of project managers is needed to take neutral, balanced and fact-based steps forward (Bergman and Klefsjo, 2010). However in agile projects, less documentation hinders upfront planning for a long term agile project and the project can easily be reactive in nature if short iterations are not backed by an overall project plan (Agarwal et al, 2015).

## 2.2 **Project Performance Measurement**

Project managers need to ensure that the projects are being on track, closely monitored, and are going into the right direction (Kerzner, 2013). According to Kelsey et al. (2006), the project performance is normally measured in terms of time, cost and quality. The performance measurement is interpreted based on the cost incurred and resources spent, compliance to delivering on schedule and delivering products or services without defects (Alleman et al., 2014). However, the traditional approach of measuring project performance by considering only time, cost and quality has become considerably ineffective as projects cannot be delivered successful without managing stakeholders (Mir and Pinnington, 2014). Stakeholders are often difficult to manage due to their resistance sometimes from commercial pressures (Maylor, 2001).

In order to measure project performance, the critical metrics are needed to be identified so that the stakeholders can understand how well the project has been performing (Kerzner, 2013). Defining the correct metrics or Key Performance Indicators (KPIs) is significantly important as they serve as an early warning sign if an unfavorable situation arises in the project, and hence, they give a clear picture of what necessary actions are to be taken (Kerzner, 2013). Therefore, it is highly important to include the stakeholder requirements as the basis for performance metrics, especially agile software project management, in order to provide the holistic view by having better focus on team achievement and more flexibility to change which consequences to customers' deliverables (Gilb, 2004).

### 2.2.1 Key Performance Indicators

Kerzner (2013) describes a KPI as a part of measurable objectives that can change over the life of a project and from one project to another. According to Kerzner (2013, pp.123) the term 'Key Performance Indicator' can be anatomized as the following:

- "*Key*: A major contributor to the success or failure of the project. A KPI metric is therefore only "key" when it can make or break the project.
- *Performance*: A metric that can be measured, quantified, adjusted and controlled. The metric must be controllable to improve performance.
- Indicator: Reasonable representation of present and future performance".

Eckerson (2006, p. 294) defines a KPI as a metric measuring "how well the organization or individual performs an operational, tactical, or strategic activity that is critical for the current and future success of the organization". Bauer (2004) also explains that KPIs are metrics which indicate the performance of an organization in achieving its goals as they reflect strategic value drivers.

Metrics can be used as motivation to measure what has been done till a certain period of time in the project. Otherwise it is hard to understand, control and improve the project processes and performances (Kupiainen et al., 2015). The common needs for metrics are for decision making, communication support, project planning and estimation, project management and tracking, understanding quality and business goals, and improvement software development processes and tools (Kupiainen et al., 2015). In addition, Kerzner (2013) also states that KPIs would provide the useful information to facilitate decision making and reduce uncertainty by managing risk; however, they cannot precisely predict that the project will succeed or fail. Instead, KPIs present more explicit data about what would happen in the future if the existing trends continue. Importantly, the selection of performance indicators should be related to the project's strategy and linked to its business vision, mission and goals (Parmenter, 2010).

#### 2.2.2 Classification of KPIs

Due to the unknown situations, rapid changes, aggressive competition, and dealing with new products and/or services, the project performance cannot be seen only through the hard paradigm involving efficiency, expert-led delivery, and control against predetermined goals, but the soft paradigm needs to be considered such as participation, practical use of learning, etc. (Tadeu de Oliveira Lacerda et al., 2011).

The term 'hard' paradigm is commonly referred to deductive reasoning and quantitative attributes associated with objectivity or in other words, it is likely to emphasize on efficient delivery, control against the identified goals (Pollack, 2007). The 'soft' paradigm is often associated with inductive reasoning, exploratory, qualitative techniques which can be considered to aspects of learning, participation, and underlying social process (ibid). The term 'soft' also indicates focusing on people or intangibles which shed light on human relationships like communication and interaction (Pollack, 2007).

There are two major groups of performance indicators which are financial metrics and non-financial metrics (Ishaq Bhatti et al., 2014). The hard aspects like financial, quality, time, and delivery reliability are primarily applied as performance indicators, whereas the soft dimensions as employee factors, productivity, and internal process become pervasively use as performance measurement perspectives (White, 1996, Sinclair and Zairi, 1995, Parmenter, 2010). In order to evaluate the overall project performance, the following categories are identified by Ishaq Bhatti et al. (2014).

*Quality:* Quality is the key to success of every business as it is the basic criteria to deliver products and/or services to the customers (Ishaq Bhatti et al., 2014). Features, reliability, durability, and number of customer complaints are the examples of quality measurement (White, 1996).

*Flexibility:* Zhang et al. (2003) defines flexibility as the ability of firms to execute multiple tasks with given amount of resources. The organization can measure the level of flexibility based on product modification flexibility, process modification flexibility and ability to perform multiple tasks efficiently (Ishaq Bhatti et al., 2014).

*Time:* Time is an unavoidable determinant of performance as it is an important factor and has been a primary criterion for developing products (De Toni and Tonchia, 2001). To assess performance with respect to time, the delivery lead time, due date performance, percentage on-time for rush jobs, and average time to resolve defects can be applied (De Toni and Tonchia, 2001).

*Financial performance:* Financial aspect is the heart of performance measurement for every company as it is considered as the core engine to keep business running. The suggested financial measurements of the organization are total sales, net income, return on equity, sales by products, return on assets, and return on capital employed (Ishaq Bhatti et al., 2014).

*Employee satisfaction:* Parmenter (2010) has mentioned that employee satisfaction is one of the key success factors to drive the organization and it impacts the whole organizational performance. The analysis of employees' complaints resolution effectiveness, and percentage of staff working flexible hours are the sample measures to check how much employees are satisfied with contributing to the project goals (Parmenter, 2010).

*Delivery reliability:* The delivery reliability can be evaluated from the percentage of on-time deliveries, due date adherence, promises met, schedule attainment, and percentage of orders with incorrect amount (Ishaq Bhatti et al., 2014).

### 2.2.3 KPIs in Agile Software Project

The success of managing agile software projects depends on the monitoring and control mechanisms as Cheng et al. (2009) has found. Many software development managers are commonly unaware of the holistic set of monitoring and control mechanisms and subsequently lead to unsuccessful outcomes (ibid). A key principle to manage the agile project successfully is the ability to communicate progress to stakeholders and include their needs and expectation in agile metrics (Broadus Iii, 2013).

Therefore, it is important to measure several aspects during the software development process for the management team to manage, control, and handle the project properly. Cheng et al. (2009) has categorized KPIs into team, task and quality as displayed in Table 2.2.3.1.

Aspects	Key Performance Indicators
	Team total available hours
	Team total effective available hours
Team	Team effort remaining
Team	Team effectiveness
	Team velocity
	Total available capacity
	Number of completed tasks
Task	Number of remaining tasks
	Remaining task effort

Table 2.2.3.1 List of KPIs (Adapted from Cheng et al., 2009, p.31).

Hours spent on task	
	Working software delivery success rate
	Total reported bugs
	Number of critical bugs
	Outstanding bugs
Quality	Fixed/solved bugs
Quanty	Bugs coming from previous release
	Hours spent on bug
	Test success rate
	Test failure rate

Regarding Table 2.2.3.1, Cheng et al. (2009) explains that knowing team performance enables the managers to do accurate planning as they can identify the capabilities, productivity and availability of the teams. The managers can improve the teams by assigning another team, for example, which has spare capacity to organize the meetings to discuss progress, figure out the problems, and evaluate the past iteration (ibid). According to Maximini et al. (2015), team velocity is useful metric to create team planning as the team can estimate their effort to be put in to complete a task from a previous iteration. Regarding the tasks, the KPIs can display the progress of planned tasks and how much time is being spent, so the managers will be able to notice whether the estimated plan was accurate and get the big picture of how much the project goals are achieved (Cheng et al., 2009). Generally, the tasks which cannot be completed within a sprint or delivery are moved to the next iteration and sometimes tasks are blocked due to the critical bugs opening from the customers. The teams need to fix those bugs before resuming their tasks (Cheng et al., 2009). Lastly, the quality aspect is significantly vital for software development project as it is the primary concern for the customers (Cheng et al., 2009). Maximini et al. (2015) found that the total number of open bugs has been useful to ensure the quality of software implemented by the teams and can also be used to set quality targets of the team. KPIs indicating the number of bugs would help improve the software quality as the number of bugs per development team can motivate the developers to be aware of their code quality and reduce the number of defects (Cheng et al., 2009).

According to agile principles like iterative development, accepted change, and adjustable requirements, the agile metrics are analyzed more frequently and require some set of tailor-made metrics rather than metrics used in traditional project monitoring (Broadus Iii, 2013). Table 2.2.3.2 displays the suggested agile metrics by Broadus Iii (2013).

Metrics	Meaning
Velocity	The number of features a team can deliver during a
	sprint
Burn Up	How many features the team has promised to deliver
Burn Down	How many features it has completed
Running Tested Features	How many features in each sprint have passed
(RTF)	acceptance tests

Table 2.2.3.2 Suggested Agile Metrics (Adapted from Broadus Iii, 2013, p. 52-53).

Defect Density	How many defects in each sprint

According to Broadus Iii (2013), Velocity enables the teams to predict and estimate the planned progress which helps keep track of schedule and budget. Burn Up and Burn Down can empower the motivation of team members as they can see clearly when they are expected to finish the project (Broadus Iii, 2013). Running Tested Features (RTF) and Defect Density can encourage the development teams to produce better quality of code and ensure that the final product is shippable without bugs (Broadus Iii, 2013). The earlier metrics would gain interest and involvement from team members as they are working in the daily efforts regarding planning, development, testing and deliver software, whereas the senior-level leadership are primarily focusing on time, cost and quality relating to adding value to the customer (ibid).

As most of agile metrics demonstrated in Table 2.2.3.1 and Table 2.2.3.2 are mainly focused on value-added to the customers which result to measure based on customer deliverables against time, cost and quality. These metrics are perceived as hard dimension because of quantitative attributes (Pollack, 2007). However, With rapid change of project management nowadays, the actual project status cannot be measured from just only hard aspect, but there are some soft aspect which also need to be considered. For instance, a customer satisfaction KPI can be a combination of time, cost, quality and effective communication (Kerzner, 2013).

## 2.3 Soft Aspects in Project Performance Measurement

To successfully manage projects, hard aspects such as financial, schedule, and quality do not provide a holistic view of project performance (Ravindranath, 2016). There are soft dimensions like working with people, communication, team engagement, cohesion within the team etc. which are also very important (ibid). Therefore, measuring performance in software development projects covers two aspects, production performance based on the product that is delivered to the customer and process performance based on the efficiency in handling the process of software development (Liang et al., 2007).

With the rapid evolution of software development field, people have become the fundamental concern of project success or failure since there is high level of teamwork and communication (Purna Sudhakar et al., 2011). Researches indicate that there is a correlation between team interaction, regarding team communication and collaboration, and team performance which affects the overall project performance (Yang et al., 2012). There is a need for increased focus on communication, cooperation and collaboration in the project organization to improve project performance (Yiu et al., 2013).

#### 2.3.1 Communication

#### 2.3.1.1 Role of Communication in Project

Communication in the project is as extremely crucial because it affects the relation between and targets of the tasks within the project organization (Wang and Hu, 2012). An effective communication is seen to increase the level of trust among project members (Cheung et al., 2013). Church (1996) defines good communication as "some

combination of being open, honest, participative or direct with others." In addition, Ravindranath (2016) has mentioned that effective communication is the main area to drive projects successfully where people are involved, particularly in the software development area. Hence, project managers need to be able to communicate complicated ideas easily, express their expectations clearly and allow team members to talk openly and honestly. Smidts et al. (2001) mentions that the content of communication may enable employees to identify themselves within the process through goals, values, and accomplishments and the communication climate also impacts the employees' willingness to contribute, be open, supportive and actively take part in decision making.

Communication issues result in misleading and unclear information transfer and it plays a crucial role in bringing team members sharing information (Yiu et al., 2013). Communication can make team members to express their viewpoints and concerns because they have obtained more knowledge from the others (Jarvenpaa and Leidner, 1999). Poor communication has led to project failures since managing projects requires a lot of people interacting, allocating, monitoring, and organizing activities driven by communication (Pinto and Pinto, 1990).

#### 2.3.1.2 Type of Communication

Communication can be distinguished based the hierarchical position of the sender and the recipient, the direction of communication and the content and form of it transferred (Bartels et al., 2010, Postmes et al., 2001, Smidts et al., 2001). Regarding the content and form, communication climate in terms of adequacy and timeliness of information, openness communication, participation in decision-making, and support from top management is needed to take into consideration (Bartels et al., 2010). The performance of the team has derived from team communication and interaction (Yang et al., 2012). The perception of information adequacy, acceptance, and its relationship of all directional flow have strongly effected to people commitment in the organization (Guzley, 1992). The information accuracy is due to the quality and reliability of information (ibid). In addition, Agarwal (2009) explains that the significant of receiving information as it is at present is highly crucial as the team can make decision and estimate their work in a better outcome.

There are three basic types of communication which are verbal communication, written communication and nonverbal communication (Carpenter et al., 2010). Verbal communication is the way people communicate via talking and listening. The message is conveyed through oral form and takes place in real time, whereas the written communication is often asynchronous and occurs through a printed message such as e-mail, memos, training manuals, etc. (Carpenter et al., 2010). Nonverbal communication is typically associated with body languages, facial expressions, and tone of voice. People perceive different meanings for messages based on different tones and expressions. The effectiveness of communication also depends on body languages and tone of voice of the sender to the receiver (Carpenter et al., 2010). Gillard and Johansen (2004) mention that verbal and nonverbal communications have an impact on communication system in which it is related to formulating, transferring, and receiving the messages.

Communication patterns are influenced by the organizational structure within the company and the pattern of relationships between various disciplines of the

organization (Lunenburg, 2010). In order to examine the effective of communication in terms of information flow, the direction of communication is selected to investigate against the organizational structure. Typically, the organizational chart also shows the direction of communication as it represents lines of authority displaying who must answer to whom. Each person is accountable for answering the person at the next higher level whereas they are also responsible for those who are below them (Lunenburg, 2010). When it comes to the direction of communication, it can be divided into vertical and horizontal communication as shown in Figure 2.3.1.2.1 (Bartels et al., 2010, Lunenburg, 2010).



Figure 2.3.1.2.1 The direction of communication (Lunenburg, 2010, p.2).

#### Vertical Communication

Vertical communication is information transfer between different levels of the hierarchy; for example, between top management and the employees (Bartels et al., 2010). As shown in Figure 2.3.1.2.1, the vertical communication flow can be perceived both in downward and upward direction.

The information which is conveyed from top to bottom level of the organizational members is considered as downward flow of communication (Lunenburg, 2010). Still, the information is passed from one person to another which can result in the distortion and loss of information if it travels from the sender to the furthest receiver down in the organizational structure (ibid). With downward communication, goals, strategies, procedures and processes can be conveyed to the whole organization (ibid). Moreover, Bartels et al. (2010) explains that the downward approach includes the aspects of communication climate such as the adequacy of information anticipation, support and reliability from top management.

On the other hand, bottom-up or upward communication concerns information transferred from the employees in the lower hierarchical levels, to the management level (Bartels et al., 2010). Information is transferred in the upward direction according to Lunenburg (2010). Upward communication provides the room for staff to escalate critical problems, abnormalities in their routine jobs, complaints and conflicts to make their managers aware and request support from them (ibid). Suggestions and ideas from the staff for improving tasks would benefit the organization as they would know the problems in detail (ibid). In addition, the upward communication provides the platform for employees to voice their opinions and participate and influence decision-making (Bartels et al., 2010).

Vertical communication, both upward and downward, has its own importance in the organization. It can reduce uncertainty about organizational scenario (Postmes et al., 2001). It can increase employee engagement by allowing the management to be transparent and provide information in a timely manner (Lunenburg, 2010).

#### Horizontal Communication

Bartels et al. (2010) explains that horizontal communication is the direction of the communication between employees in the same hierarchical level. The sharing of information related to tasks like the project's status and improvement of activities is classified as task-related communication, while the employees' casual conversations about certain private matters is called as informal communication (Postmes et al., 2001). Also, Lunenburg (2010) and Liberman (2010) refer to horizontal communication as the exchange of information in the lateral or diagonal directions for coordination both between members of the same department or those who are in different departments with the same hierarchical position as depicted in Figure 2.3.1.2.1.

Horizontal communication strengthens collaboration since the flow of messages is guaranteed and this allows different units to work with each other (Lunenburg, 2010). There is a relationship between the quality of tasks accomplished and the cooperation between teams when different functional teams work together. This cooperation is important to bridge interdependent functions to ensure their contributions match with the overall goals of the organization (Pinto and Pinto, 1990). According to Patrashkova-Volzdoska et al. (2003), communication is salient for team performance and it is highly essential for cross-functional teams to communicate with each other. Project teams have their niche of knowledge and perspectives and cross-communication would support knowledge sharing between teams with different competencies and expertise (ibid).

Alternatively, the horizontal communication can be perceived as information sharing occurring in within a team or department and majority of the discussion is related to the tasks and responsibilities of the group (Postmes et al., 2001). Research has shown that the communication within the team has strongly affected the climate and collaboration of the team (Levine and Moreland, 1990). Moreover, close communication among team members typically creates a leverage for attachment, cohesion and commitment of individuals in the group (Kim et al., 2016). This implies that the more the team members positively appraise the communication climate within their own workgroups, the more significantly they connect to their teammates which results in higher commitment, engagement and stronger bonding (ibid). Similarly, Kim et al. (2016) sees this stronger bonding resulting in swiftness in conflict resolution, which means that teams which communicate well among themselves solve problems quickly through open communication. Researches show that the effective communications within teams conclusively affect the dynamics of the teams and also have a relation to the collaboration levels among group members (Kim et al., 2016).

#### 2.3.2 Team Dynamics

As mentioned earlier, one of the critical factors that impact project performance is how smoothly the team functions to deliver to the project goals, in terms of the interaction and dynamics. Yang et al. (2012) says that team dynamics or team cohesion plays a major role in team performance and this affects the overall project performance because the success of teams can be developed from their interaction. This means that the effectiveness of team performance can also be understood from level of their collaboration and communication within teams. According to Kim et al. (2016), team dynamics is often called "team chemistry" and it is a significant implication of team success which is linked to the most valuable outcome of team satisfaction. Researches have shown that the more cohesive a team is, the better the team performs (Barrick et al., 2007). Likewise, the consequence of this congruence of the teams and related accomplishments is evidently visible in the project finances, delivery quality and level of compliance to the project plan (Bole et al., 2016).

Agile software development projects need communication and collaboration and requires teams to share ideas and opinions without barriers, actively listen to what other members in the team are saying and solve problems in a timely manner (Dorairaj et al., 2012). Interpersonal interaction, group communication, and task commitment are highly desirable factors for agile methodology as suggested by Franz et al. (2017). Chachere et al. (2009) describes timeliness of communication as the perception based on which team members can say if they receive information punctually or not. Even cohesion is seen to be a perception about the commitment of team members to the project goals and deliverables (Franz et al., 2017). Unhindered support from team members is an important precursor of commitment (Bartels et al., 2010). Team chemistry is described as "the perception of compatibility among team members, arising from differences in personalities including past and present relationships" by Konchar (1997). Level of formality in communication indicates the cognitive extent to which team members engage and interact with each other, or in other words, the perceived closeness of a team (Franz et al., 2017). Some studies show that having informal communication also enhances team members to exchange information interactively without scheduled meetings, with adequate progress in collaborative relationships among team members (Kraut et al., 1990).

Trust and transparency are other factors which impact team performance and have strong linkages to commitment (Searle et al., 2011). Trust allows the individuals to interact with each other without constraints and this in turn affects project performance (Buvik and Tvedt, 2016). The climate of the team is linked to trust among team members which implies that members who trust each other are more likely to have productive interactions and show good teamwork (Buvik and Tvedt, 2016). Thus, team dynamics and performance of the project are significantly interlinked to each other, particularly in the agile project environment which places a huge demand on teams to interact and contribute.

### 2.4 GQM Model

In order to develop software project progress measurement frame, a GQM (Goal Question Metric) is one of the popular measurement models which has pervasively used in software measurement model to develop the measurement indicators (Yahong et al., 2013). The GQM model stands on the objective to derive measurement metrics from project goals (Shull et al, 2006). The model provides a platform to align the data collected to what is required to be known and serves as a framework to interpret quantified data (Shull et al, 2006). The measurement goal is screened into different dimensions of the problem as questions and metrics are derived from these

questions to support measurement of these problems (Basili et al, 1994) as displayed in Figure 2.4.1.



Figure 2.4.1 The GQM model (Basili et al, 1994, p.529).

There are two levels of goals in GQM model as per Solingen and Berghout (1999). The initial improvement goal, which is the more abstract and organizational, describes a required improvement from a strategic perspective (ibid). They are arrived at based on preliminary indications or analysis of data and plans to proceed with the GQM model are developed at this stage (ibid). The improvement goals are then translated into measurement goals, which dwell into the specificity of the problem and represent quantifiable components of the improvement goals (ibid). The questions offer the bridge between the goals and metrics. They basically are used to translate an abstract goal representing a specific problem to operational level metrics that are needed to be measured to quantify the problem (Basili et al, 1994). The questions are formulated in such a way that there is a balance in the level of abstraction (Solingen and Berghout, 1999). This is to avoid the questions being either too broad or too specific, both of which can result in the wrong metrics (ibid). The questions are answered based on quantifiable data that are represented through metrics (Basili et al, 1994). They identify metrics to be both objective (which is purely based on the object being measured) and subjective (which considers the perceptions regarding the object) (ibid).

## 3 Research Methodology

## 3.1 Research Strategy

The investigation has been undertaken in a qualitative manner and is driven by data that is primarily not measurable (Bryman and Bell, 2015). According to them, importance is given to people's interpretation of reality and the fact that the space within which the research is being conducted continuously varies, is acknowledged in qualitative research. This further is in line with the research design being chosen as a case study of a single project. It would be appropriate to say that case studies provide the best platform to understand the nature of a specific context in the real world and draw subsequent inferences (Dubois and Gadde, 2002). With the requirement of constant support of theory for interpretations of the empirical data, an abductive approach was chosen to guide the research towards successful findings (ibid). The back and forth movement between theory and observations to arrive at the most likely outcome as the conclusion was synchronous with the exploratory nature of the research (Bryman and Bell, 2015). The major strongpoint of this type of reasoning is the realization that the validation of theory is not complete until empirical data indicates the same and vice versa (Dubois and Gadde, 2002).

To bring together the research strategy, design and approach is difficult, especially when they uphold certain some mutually exclusive ideologies. Lipscomb (2012) in his article concerning nursing philosophy raises concerns about the fallible nature of abduction in research and stresses on the probability of biases getting into the findings when the most likely outcome is arrived at from subjective data.

When an intensive analysis is performed on a particular case, the quality of empirical data obtained and level of generalization of outcomes is always a question (Bryman and Bell, 2015). Therefore, while pursuing a case study through abduction, an organized integration is needed to help relate different constituents of the research (Dubois and Gadde, 2002).

The research takes inspiration from systematic combining. In the words of Dubois and Gadde (2002, p.554)

"Systematic combining is a process where theoretical framework, empirical fieldwork, and case analysis evolve simultaneously, and it is particularly useful for development of new theories".



Figure 3.1.1 The systematic combining framework (Dubois and Gadde, 2002, p.555).

This research also aims to question the concept of agile methodology dealing with soft aspects and foreseeing a possibility of theoretical evolution coupled with the evolution of the findings in the case made the choice of such an approach significant. As per the Figure 3.1.1 shown, the process of systematic combining dwells on two major foundations, namely matching and direction and redirection (ibid). While matching exists between what the theory has identified, what the case displays and the theoretical frameworks used to analyze the data sources, a continuous direction and redirection throughout data collection and data analysis gives enhances the alignment of findings from the inquiry (ibid).

The research should be structured within confinements and not in a scenario where boundaries are well defined (ibid). The boundaries shape the applicability of the research and even a small deviation from confinements can result in the loss of the ability to generalize the research (ibid). With the analytical framework providing the space for adding sensibility to the interpretation of data collected, the theory reassures the direction of research through continuous comparisons with the empirical world to pick out similarities and contradictions (ibid). The authors also suggest the evolution of a case from being a tool to being a product. The way the research is executed (that is how the data is collected, what data is collected, how it is analyzed and what conclusions are drawn) turns the case into a product where no points of confusion are evident (Bryman and Bell, 2015).

### 3.2 Research Approach

By following the above framework, the research was carried out and appropriate methods and practices were chosen as shown in Table 3.2.1. The literature study was situation specific, that is, when a new finding was made, an effort was made to discover supporting theory and to see how deep the finding has been researched. The process of data collection and analysis was simultaneous and there was constant direction of the research guided by what the company internal data suggested and what the interviews and questionnaires highlighted, with constant reference to theory. The analytical frameworks were used in alignment and due to this, an oscillatory movement between them was required to achieve stable and valid matching.

Cornerstones of Systematic Combining	Methods Adopted
Theory	Cornerstone model, GQM model
Analytical Framework	Thematic networks approach for interviews, questionnaires and participant observations
The Empirical World	Delimitations concerning the boundaries of the project
The Case	Interviews, questionnaires, observations, internal data about the project

Table 3.2.1 Application of systematic combining in the research scenario.

#### 3.2.1 Case Data

The organization's project management tools, digital dashboards and knowledge management systems were utilized as data sources to understand the current measurement system. There had to be clarity about the context within which the case existed, and for this purpose, organizational data was collected to understand the vision, mission and corporate strategy that binds the company.

#### **3.2.2** Participant Observations

The group attended three sprint meetings as covert observers. The choice of covert observation was made to not affect the research environment with presence of the research group and to avoid fabrication of the observed sample (Bryman and Bell, 2015). One of the research group members attended team meetings of a team as a covert observer to see how the team functions and the problems that arise within the concerned domain. The observations helped study the overall climate of the sprint meetings and project teams, the content discussed and the tactics used to motivate employees to deliver their best. Along with this, the group was placed within the company premises. This facilitated day-to-day observations and interaction with people involved in the project through online communication, formal meetings and informal discussions.

#### 3.2.3 Interviews

Interviews were performed with five participants from the top management level of the project organization to understand their perspectives about the current project performance measurement system. The problem had to be seen through different shades within the top management and for this purpose the interviewees were chosen with diversity in hierarchical positions and levels of experience as the primary criteria. All the interviewees had to be previously exposed to the KPI system in Delphi and some of them even had experience dealing with the soft aspects from a company perspective. The questions were aimed at being more explorative and openended, and thus the interviews were conducted in a more semi-structured way (Bryman and Bell, 2015). This further allowed follow-up questions to establish clarity of answers and non-divergent responses (Bryman and Bell, 2015). The interview questions were formulated based on the initial introduction to the problem, observations and preliminary understanding of company data as shown in Appendix 10.2. It was also required to understand the top management's interest towards using both hard and soft aspects as KPIs to measure project performance. The questions provided the interviewees an opportunity to reflect on the ways of measurement in the project, personal experiences with KPIs, shortcomings of the system, possibilities of improvement and the importance of soft factors for a better understanding of project performance.

### 3.2.4 Questionnaires

The problems highlighted by the top management were used as the basis for the survey. Ten product owners of component teams within the project were subject to this survey to get their opinions on the issues raised. Since it was possible to validate information about hard KPIs through the company data, the questionnaire primarily focused on understanding the softer side at the team level. It was chosen to opt for a questionnaire instead of an interview due to time constraints and accessibility issues. Ten product owners participated and the number was too low to be analyzed quantitatively. The survey was designed for product owners in charge of teams with different sizes and different levels of experience within the project as they were a group of people who bridge between the management and operational levels. The questionnaire as per Appendix 10.3 began with close ended questions to see how frequent the communication was in upward, downward and horizontal directions. The rest of the questions went deeper into these three dimensions in the form of a Likert scale (Bryman and Bell, 2015). The attendees were expected to display their level of agreement to statements provided. The rating scale was used to eliminate ambiguity in their choices and obtain clear data (Bryman and Bell, 2015). The last section of the questionnaire dealt about the climate within the teams. Team dynamics was covered both from the angles of planning, clarity of roles and responsibilities, knowledge sharing, and from work environment, management style, motivation and conflict resolution. The questions in the questionnaire were converted into sentences and the answers were converted into statements, to use the data qualitatively.

#### 3.2.5 Data Analysis

To analyze the obtained data, the research group employed thematic networks to map the data back to what was discussed in the literature. According to Stirling (2001), the network is aimed to raise the significance of an area or an issue by mapping qualitative data and grouping them. In this context, the area of combining hard and soft aspects needs to be raised as a significant issue and hence, the choice of this framework is justified. However the deviation this particular research takes is to use existing theory to group the data into clusters so as to see what are the shortcomings in agile methodology and why those shortcomings are significant.

The basic idea of a thematic network is to generalize qualitative data through iterative grouping into a universal phenomenon (Stirling, 2001). As Figure 3.2.5.1, the smallest units of the network are called basic themes and they encompass the information from the qualitative data that is obtained (ibid). Basic themes pointing towards similar issues and conclusions are group into organizing themes, which provide a higher level of abstraction and enhance the argument towards the actual problem according to the data (ibid). A group of these organizing themes together constitute global themes and they represent the principle represented by the data in the given environment subject to analysis (ibid).


Figure 3.2.5.1 Thematic network approach (Stirling, 2001, p.388).

The thematic network approach is highly relevant in this case considering that the research deals with something new and needs theoretical support. Although, this approach is used mostly for theory creation, the actual philosophy of the model is applicable to mapping data back to existing theory as well. Information from interviews and questionnaires were sorted, coded, linked with observations and converted into basic themes as shown in the coding framework in Appendix 10.1, Table 10.1.1. The basic themes represented the findings from the empirical case highlighting the shortcomings in project performance measurement. The case specific basic themes are further grouped as organized themes and subsequent global themes with adequate reference to existing theory in Appendix 10.1, Table 10.1.2 and Table 10.1.3.

#### **3.2.6** Theoretical Support

Along with the analytical framework, the GQM model and the Cornerstone model shape the core of the empirical findings. The research question is the improvement goal, based on which interviews, questionnaires and observations are pursued. While the GQM model shapes the research towards the definition of metrics, the Cornerstone model provides the basis for formulating the questions in the GQM process. The findings from empirical data are compared the literature concerning agile methodology and they are together, mapped back to the six cornerstones of the cornerstone model. The most impactful cornerstones have been selected and they provide the basis for the questions to be formulated. Both models complement each other in this research. While the cornerstone model provides support from an organizational perspective to the findings and improves the validity of the empirical data, the GQM model is enhanced in terms of reliability with the use of the cornerstones to develop questions.

### **3.3** Ethical Considerations

As identified by Bryman and Bell (2015), the major four ethical aspects to be considered fall under harm to the participants, deception, lack of informed consent and invasion of privacy. Therefore, the research has been ethically strengthened based on these four areas.

*Harm to participants:* The research group ensured that the practices within the company were compliant to the organizational rules and regulations as per the contract signed. Also the interviews and questionnaires did not contain any points that questioned the morality of the respondents and gave full respect to their opinions. The work schedules of employees were taking into consideration right from the beginning of the interview and survey designs and attention was given to obtaining rich data in the shortest possible time.

*Deception:* The interview data and the survey response were not used for any form of manipulation and deception. Only the collective responses from the qualitative responses were used and no individual response was misquoted. Finally, the internal data of the company was not shared to anyone in any form and all the project details were kept confidential throughout the project. KPIs agreed with customer as per the KPI agreement signed for the project have not been included in the research to maintain confidentiality.

*Lack of informed consent:* The project has been performed according to confinements defined in a non-disclosure agreement specified by the company. Consent was sought from all the concerned employees responsible for sharing internal data. While performing the interviews, the purpose was clarified to the interviewees and they were onboarded before commencing the interview. Permission was sought to record the interviews prior to the start.

*Invasion of privacy:* The interview questions were sent to the participants by email before the interview so that they could prepare their answers. The questions were not meant to intervene into private matters of individuals but rather touched upon their experiences with the company's systems. Only the collective responses were used for the analysis and individuals were not quoted in the report or in the findings.

# 4 Case Description

This section deals with describing the case of an agile project in Delphi Automotive Systems, Sweden where the research was undertaken. The company, being new to agile, had merged the methodology with its own operating system and still had faced some issues regarding project performance measurement.

### 4.1 Company Background

Delphi is one of the largest suppliers operating in the automotive sector in 44 countries and provides technology solutions in the fields of electronics, powertrain and safety to vehicle manufacturers worldwide. The organization focuses on integrated services that are safer, greener, and more connected.

There are two main divisions operating in the city of Gothenburg in Sweden, with strong focus on Electronics & Safety and Electrical/Electronic Architecture, as shown in Figure 4.1.1.



Figure 4.1.1 The Company's Divisions Chart.

Being a complex matrix organization, the company houses several business units based on its product portfolio. All these units function based on their own project management approaches that is centrally aligned to the corporate strategy. Delphi's business thrives on the quality of projects undertaken. The Electronics & Safety division accommodates the software development section and consists of many projects from a variety of customers. With increasing project complexity, fluctuating customer requirements and rapid changes, the company has initiated a drive to improve their project management in the software development section. Each software project is run uniquely with the notion that specific objectives should be completed within a certain time-frame, and the compliance to this time frame is measured in the form of KPIs.

### 4.2 Project Case Study

With the realization of the need to improve their project management, the company has tried to follow an agile approach in one of their software development projects under Infotainment & Driver Interface business unit. This project has been chosen for

the research. The project follows the standard procedures as outlined in the Engineering Operating System (EOS) of the organization. The EOS derives its roots from agile methodology and covers Scrum based and Kanban based teams. However, the overall project is being directed by Feature Driven Development. Development teams are Scrum based, while Kanban based teams offer maintenance and support.

The project functions based on an agile organizational set up for complex projects. There are over 250 people who are working in this project across four countries: Sweden, Germany, Poland, and India. The project organization can be segregated into Management (Steering Team and Project Management Team) and Operational levels as displayed in Figure 4.2.1.



Figure 4.2.1 Project's Organizational Structure.

According to Figure 4.2.1, the management level is the group of people, who take crucial decisions regarding the project and design, establish and continuously monitor the work system. Roles and responsibilities of personnel in the management level are briefly described below.

*Chief Engineer:* Chief engineer has an overall focus on the project, managing customer relationship, resolving escalated problems, and monitoring project status and performance including initiation of corrective measures.

*Engineering Group Manager (EGM):* The main functions of the EGM include managing resources to ensure that the right staffs are assigned to the teams based on their skills and competences, as well as supporting in escalation of issues at the operational level.

*Project Manager (PM):* The project organization has a Project Manager for the development process (PDP PM), who focuses on the overall project scope including product development and software. The Software Project Manager (SW PM) on the other hand is primarily responsible for overall software development, planning and tracking all software and systems tasks, solving issues across teams, and monitoring project status and metrics.

*Software Lead (SW Lead)*: Software lead focuses on technical aspects of the software development and is a technical contact point for the customer. The SW lead also facilitates detailed planning and tracking of all software component teams.

*System Lead (SYS Lead)*: System lead is accountable for leading system engineers to manage requirements, planning and tracking of overall system tasks, solving and escalating problems which are raised from component teams and keeping track of and reporting system status.

Independent Test and Verification Lead (IT&V Lead): The major duties include managing testing and verification of the developed and implemented software, reporting test status, and escalating problems relating to testing and verification functions.

The operational level, as shown in Figure 4.2.1, includes the team members who execute daily work such as reviewing, coding and testing of customer requirements to achieve target deliveries. They engage extensively in the technical aspects of software development. Each location has its own Project Local Lead (PLL) who coordinates between SW PM and local teams. The development teams are divided into 35 component teams which have 29 Product Owners (POs) in total. Each component teams consists of PO as the component team lead, Scrum Master (SM), Software Engineer (SW), System Engineer (SYS), and IT&V Tester. Roles and responsibilities of operational level are briefly described as following.

*Product Owner*: Product Owner is the main bridge between the component team, customers and suppliers. The product owner represents the decisions of the team concerning requirement planning and sprint planning. They also act as the point of contact between the management level and their component team members as they need to transform the requirements from managers in the project into detailed plans which can be executed by their team. They also escalate problems to their managers if they cannot solve those within teams.

*Scrum Master*: The scrum master facilitates everyday work in the team to make sure that the team can achieve their targets as per the sprint plan. They also work with the team members to convey key concepts and development strategies.

*Software Engineer*: The key tasks include creating and implementing tasks based on the features defined in the backlog as well as fixing bugs which are reported from testers.

*System Engineer (SYS)*: System Engineer is accountable for supporting system lead to execute the process pertaining to the system, manage system requirements, support project management, problem resolution and change management of the system.

*IT&V Tester (IT&V)*: The role is focused on performing verification of the implemented software from software engineer, verifying bug reports when they are corrected by the team and coordinating both within the component team and with the IT&V lead.



Figure 4.2.2 Project Communication and Escalation.

Team members can escalate the issues to their own POs or SMs during need of decision support. If POs or SMs cannot solve the issues, they would need to carry them to their SW PMs. Any issues which are beyond SW PMs' or Leads' responsibilities need to be escalated to PDP PM and Chief Engineer, as shown in Figure 4.2.2. Communication flow from top management to the operational level is handled in the same flow. In addition, SYS Lead and SYS Engineers in each component team, normally communicate to ensure that work pertaining to the system is aligned to the project management process. Similarly, IT&V Lead and IT&V Testers from component teams communicate regarding testing plan, execution and results.

The whole project timeline is scheduled with the customer and a sprint spans for a period of two weeks. Daily standup meetings occur within component teams and the team is updated on the work done and the tasks to be completed. Sprint planning meetings occur at the start of a sprint to plan tasks based on priorities. At the end of the sprint, teams in all four countries join through the internet along with all project members for a sprint review meeting. Towards the end of the meeting, time is provided for teams to showcase their innovation through product demos. The teams display creative developments they have achieved and the work is appreciated by everyone attending the meeting.

At the end of each sprint, the teams go into retrospection. Problems regarding the tasks or conflicts should be brought up as early as possible, especially in the sprint retrospective meetings and feedback is provided for the team to improve from the previous sprint. It is; however, not mandatory for every team to perform retrospective meetings and usually the results of the retrospective meeting are kept within the team. Any work which cannot be done from the previous sprint and gets approved by customers is shifted to the next sprint.

This is the first project where the company is closely collaborating with its customers with utmost transparency. Employees from the customer site are involved in the component teams and working on site at Delphi. Customers are invited to the sprint meetings as well to know and discuss the project's progress and future strides.

Project performance is based on metrics defined in agile methodology. Along with this, some metrics have also been used based on the company's operating system. Table 4.2.1 provides some of the main metrics that play a key role in providing information about the project performance.

Metric	Description
Feature Growth	The actual progress of features against plan per iteration
Epic Status	The number of epics shown in each status per delivery
Epic Burn-up	The progress of how much the number of epics have been completed against the total amount of work
Requirement Status	The percentage of requirements shown in each status per delivery

Requirement Burn-up	The progress of how much the number of requirements have been completed against the total amount of work
Iteration Performance	The completion rate against total task count
SCR Statistic	Software complaint report statistic showing how many bugs have been opened and closed
Bugs Trend	The progress of how many bugs have been opened, resolved, closed, and postponed
Showstopper Bugs per Component Team	The number of the highest priority bugs which are still not resolved per each component teams
Bugs per Component Teams	The number of bugs according to the severity level per each component teams
Bugs Average Resolution Time	The average resolution days of taking to resolve bugs from the time they are created until the time they are resolved
Overall Bugs Distribution according to Severity Level	The total number of both internal and external bugs regarding the severity level
External Bugs Distribution according to Severity Level	The total number of external bugs regarding the severity level
Code Coverage	The percentage of how many lines/blocks/arcs of source code are executed while the automated tests are running
CR Trend	The overall trend of change request since it is estimated until the completion
CR Progress based on EPIC Status	The progress of epics' change request since it is created until implementation done
Team Velocity	The progress of how much work for the team can actually complete within a sprint

### 4.3 Challenges

Despite having a very clearly defined work system the organization still faces certain issues with project performance measurement in the current project. Since the teams are distributed over four countries and the project organization is large and complex, the bar for decision making has been lowered which means that the teams make most decisions for themselves. Although this gives each team an identity to decide their own ways of working to fulfil customer requirements, at some point, the teams have not fully succeeded in being able to plan their work as per the plan drafted for the sprint. This affects the deliveries to the customer and hence the project performance. Although the current metrics show results resembling the component teams' performance, the management level have not been able to take decisions forecasting problems. Decision making has been very reactive and in an environment of continuous delivery, such an approach is expected to create problems for both the company and the stakeholders. At a certain point, the management of the project has not been fully able to understand what happens at the operational level. In other words, component teams' performance measurement seems to be deficient and this in turn seems to have affected the overall project performance measurement.

## 5 Empirical Data

#### 5.1 Interview Results with Project Management Team

#### **5.1.1** Focus on Product Deliveries

According to all the respondents, the current KPIs provide good insight in terms of meeting delivery schedules and they are highly focused on the customer. KPIs like the epic burn-up and feature growth are deemed as the most important determinants of project performance at a management level. However, measuring progress through epic status does not give a full picture and the project team knows the completion of an epic in an objective manner, as either 0% complete or 100% complete. The management meetings center around epics and features and how much has been accomplished in terms of the working product. Certain other KPIs are mentioned sometimes but they have not been much focused. Moreover, the existing KPIs are still perceived with a traditional mindset than an agile one, and this can be expected given the fact that this project is the first of its kind. The operational level has raised the concern about having more active involvement in activities from management level. The management expects the teams to hold more accountability to their deliverables. Taking proactive decisions and forecasting has not been fully successful.

#### 5.1.2 Focus on Soft Aspects

Respondents have seen the importance to improve the internal performance of the teams and their need to establish focus on this aspect to deliver successfully to the customer each sprint. How a team communicates and how smoothly they function, were two aspects that grabs the attention of the respondents. Although these issues are dealt with in an informal manner and a lot of talks about them have been occurring, an action has not yet been taken. According to one of the interviewees:

"Soft aspects are understood at a company level through meetings and surveys a few times annually. However, it will be interesting to see how these soft aspects can be measured at a project level".

#### 5.1.2.1 Team Communication

Each team has been given the freedom to choose their own way of communicating and moving their work forward. Interviewees see communication and cooperation problems within the project, particularly across component teams. According to an interviewee:

"I have seen the communication between component teams has more problems, especially when teams have dependency on each other. When it comes to communication between managers and teams, I don't think there are that many issues of concern". The interviewees assume certain teams to remain isolated, while some other teams need to interact a lot because of the nature and demand of their respective functions. The hindrance in communication due to the very nature of work is perceived to have affected deliveries on time. The growth within teams has also been affected by the limited knowledge shared due to weak communication with other teams.

Communication in general has been highlighted in sprint meetings. This is a known issue for project management team as all interviewees mentioned and expressed their opinions regarding this matter. But what the organization currently lacks is a way to identify these issues proactively and make decisions accordingly.

#### 5.1.2.2 Team Dynamics

All interviewees are aware of the concrete link between internal team performance and overall project performance and they see that the deliveries are contributed to immensely, by the teams' collective effort. Currently, the measurement regarding team performance is through KPIs that show the accomplishment of tasks as per the sprint plan. The performance also is interpreted to the number of errors in the team's delivery and the swiftness to counter it. However, the team also has other factors that contributes to its performance like team dynamics and coherence, but these determinants are understood through talks and discussions. No formal follow-up is in place to track them and escalate the right issues to the management proactively. Although most of the KPIs are related to team performance, individual competence is still a major factor resulting in the team struggling to grow on a consistent basis. As per the following statement:

"Every time you get new people into the team, your team will go back to the zero state. We are focusing on individual competence; not working in a team. It really needs to build the team".

Although people have their own independence to pull their work, the lack of clarity in roles and responsibilities created issues regarding the work to be pulled, the prioritization of tasks and communication of completed work to other teams.

In the retrospective meetings, the teams are encouraged to discuss about issues related to soft aspects. But conducting retrospection after every sprint has not been made mandatory. The follow-up after retrospection is also not mandatory and is not standardized. Discussions about soft dimensions are not frequent in higher management meetings until they are serious issues that are beyond the reach of being addressed by the teams. Such issues are escalated by the product owners and then dealt with by the management.

The company is new to agile and the project is the first time when customers are included as co-producers within the component teams, with an aim to co-create and build customer relationships. Due to this new way of working, there has been an initial variation in dynamics within teams. Also, there are concerns raised about possible burnouts, overwork and saturation among some employees and the management are aware of this. Although interviewees see the possibility of increased conflicts within teams, the satisfaction regarding their resolution is there.

### 5.2 Questionnaires Results from Product Owners

#### 5.2.1 Communication

#### 5.2.1.1 Vertical Communication

Information flows all the way from superiors to subordinates and vice versa in the project organization. Therefore, requirements are communicated by the project management team to product owners who represent each component team and the team's progress is similarly communicated backwards. According to all respondents, there is frequent communication between product owners and their managers. Majority of the respondents have received updates regarding the project information. They have also mostly been comfortable with sharing information to their managers. However, the effectiveness of communication is a problem since concerns have been raised regarding clarity and timeliness of data shared. The result shows that the data is not clear enough for them to make decisions. The product owners believe that the attentiveness of managers towards information about teams need to be improved. The degree of informal communication. Overall the way of communication between the management and the component teams is in need of certain improvements.

#### 5.2.1.2 Horizontal Communication

According to the outcome of the survey, there is a problem in information flow between component teams. Respondents are confident that they frequently communicate the relevant information related to project and are comfortable to discuss and share information to other component teams. However, the clarity and timeliness are crucially addressed as the issues of communication between teams. The delayed and ambiguous data has impacted decision making within teams. Communication also happens informally, but the frequency of this is relatively less. The way information is being communicated needs attention and has a lot of scope for improvement. There is a contradiction between high frequency of their own communication perception to other component teams and the communication that they perceive from other teams. Thus, it implies that there is a strong problem in communication across teams.

#### 5.2.1.3 Communication within Component Team

Communication within component teams is seen to be positive. Product owners frequently communicate to their own team members. Most of them are highly comfortable to discuss and share relevant information, and there is enough support from their own teams to make effective decisions. They perceive their team members to have communicated well among themselves and most of them know who they should contact when they need help. Informal communication typically happens within the teams and they build strong relations within teams. The overall perception of the way team members share information among themselves is effective.

#### 5.2.2 Team Dynamics

Respondents are happy with the coherence and dynamics of their component teams. Although some of them pointed out that the commitment from their team should be improved, almost all of the respondents are confident about the team members' dedication to achieve the tasks within the given sprint. Team members quickly responding to sudden change, knowledge sharing between team members, and sharing responsibilities are notably sound, but there is scope for improvement in all these areas as well. Roles and responsibilities are not fully clear for the team members and most of them have their own understanding of what they are supposed to do. Teams are effective in addressing conflicts early. Product owners believe that team members enjoy working in the teams. In terms of team structure and management style, the respondents still see a need for improvement while communication flow and team motivation are in a good state. Respondents see their team members working at very good levels with good dedication and commitment and are in line with the effort put in by the team.

## 6 Analysis and Discussion

In order to analyze the findings, the data from both interviews and questionnaires were compared to see the common attributes in perceptions of two levels of the project. The collective perceptions were then mapped back to literature concerning agile methodology (Table 10.1.1, Appendix 10.1) and agile performance measurement and finally, the organizational view of performance measurement was built into the analysis through the cornerstone model, as shown in Table 10.1.2 in Appendix 10.1. Many similarities and differences in perception were found to be evidently present in the project organization. There are also links between these perspectives and theoretical deficiencies agile performance measurement inherently possesses. Also, from an organizational perspective, the shortcomings in performance measurement are seen to have an impact in the overall goal of customer satisfaction as shown in Figure 6.1 and getting employees committed towards delivering to the customer as displayed in Figure 6.2.



Figure 6.1 Agile with focusing on customers.

According to Figure 6.1, as the core principle of agile is to create value to the customers and project teams need to deliver to the customer in short cycles of iterations (Canty, 2015). Due to this reason, the project group has managed to work in a short period of time that is 2 weeks for each sprint in order to adapt to the changing circumstances and deliver faster to the customers. Consequently customers receive usable software and can have partial functionality of their product up and running. It has to be noted that the team size of this project is high, the way of working varies among teams, the project team is geographically distributed and the planning cycle is short, all leading to an increased complexity in project environment. This is expected to have its effects on project performance. As stated by Chin (2004), to execute agile effectively the company has to undergo training to be able to perform well and cater to customer needs. This statement is reiterated by the fact that there is a misconception of roles and responsibilities within the project teams and it was lifted up both by the interviewees and respondents to the survey. The project also has customers working on-site together with the teams. In order to be more inclusive and transparent to customers, the inclusion of customers on-site could create extra bit of work pressure with the feeling that employees are being observed. But to evaluate the climate of the project organization, there are no soft aspects being considered and hence, data regarding the perceived increase of pressure on employees becomes unavailable. With the heavy focus on external customers, it is likely that there is lesser attention to internal stakeholders, especially the team members who are the core resources to drive the project forward. There is no soft metrics to measure how well collaboration and interaction within the project teams is which effect to reactive decision making from management level. They cannot clearly see the potential root causes that impact the customer deliveries and the variations in interpreting the customer focused KPIs. Chin (2004) mentions that agile's extensive focus on customers helps measure performance from the customer's point of view but satisfying internal stakeholders is still an informal process. In this project case, the soft issues such as people's perception, collaboration and communication are normally discussed through informal communication. Some problems are escalated if they cannot be solved within the component teams, Running projects in agile methodology requires proactivity and understanding of team members as Canty (2015) also explains that the way of working is crucial to enhance adaptability and flexibility.



Figure 6.2 Agile methodology and its focus on internal stakeholders.

Another major perspective that impacts agile project performance is people since the key success highly depends on how teams perform. The engaging nature of agile methodology commands more involvement and commitment from all levels within the organization as demonstrated in Figure 6.2. Agile relies heavily on people and the interactions, rather than process and tools (Canty, 2015). A successful agile team is expected to show positive signs in both soft and hard characteristics of team performance. There is a link between soft aspects like team interaction, collaboration and communication and hard aspects such as the requirements met per sprint and it would definitely affect the project performance in terms of time, cost, and quality (Ravindranath, 2016; Liang et al., 2007). In this case, generally a team that is delivering to the sprint goals is expected to be performing well. The project management teams are aware of the soft aspects, but have not looked at how it can be addressed. It is evident in the project management team that the commitment, accountability and motivation of the team members should improve while the teams are satisfied with the levels in these respective parameters. They have communicated

frequently to each other but there were issues with clarity and timeliness of information transferred, particularly between component teams. The informal communication between project team members is low. The fact that effectiveness of the communication is the problem, is not realized due to the absence of data suggesting this. Although the method commands more involvement and engagement from all employees in the organization through its processes and measurement metrics, the performance of a team being based both on hard and soft aspects is not fully absorbed. Agile way of working encourages people to collaborate through regular meeting and interaction, but the issues identified are dealt with in an informal manner. In this interviews the project team has realized the significance of managing soft issues, but there is no indicators to provide such an information at project level and those soft issues are normally mentioned through informal discussion when it is escalated. For a team to constantly deliver to the demands of the project, the team should have good chemistry and should be satisfied with their work, but in the case, the team raised complaints about overwork and burnout of employees. Even by the observation, the pressure of a short planning cycle was evident on the employees and there were many instances of people staying overtime to complete their work.

### 6.1 Problems with Current KPI System

Based on the analysis, it is clear that there are concerns with the current system of KPIs used to measure project performance in agile software development projects. As agile methodology is strongly focused on adding value to the customers (Canty, 2015), the current KPIs are purely based on customer deliveries. The performance of the project are typically measured through the number of requirements (called as epics in this case study) which have been met with the customer each sprint against plan and the minimum number of defects per software delivery. These metrics are quantitative attributes relating to the measureable objects which are synchronous with efficient delivery and control against the targets (Pollack, 2007). The existing KPIs are mainly focused on external rather than internal stakeholders which results in less attention to how effectively teams communicate and collaborate. Yang et al. (2012) indicates that there is an interdependence between team interaction and team performance which has affected the overall project performance. Working in scrum, kanban and feature-driven development processes highly requires active involvement, closed collaboration and commitment from project team members as they need to perform regular meetings, keep their team members updated, make decisions based on consensus, and work in iterative planning (Maximini, 2015, Ambler, 2014). Measuring performance of the project without considering these soft factors does not give a full picture and it hardly reflects to the actual root causes if the project cannot achieve the goals (Ravindranath, 2016). Currently, there is no measurement of the level of team communication and cohesion in the project level even though the management team has understood the importance of these soft dimensions that would impact to the performance of the project. Instead, those soft issues are handled through an informal discussion. Additionally, people have become the essential concern of project success or failure (Purna Sudhakar et al., 2011). With the short planning cycle, the team members could be burned out and overworked as they need to keep delivering software for the upcoming sprints as well as attending to defects and changes of the previous sprints. Therefore, these soft factors are significantly important to the project performance and need to be included in KPIs in an agile project.

### 6.2 Development of KPI's system

According to Cheng et al. (2009), many software development managers are typically unaware of the holistic set of tracking and controlling mechanisms which lead to the failure customer deliveries. Ability to communicate progress to stakeholders and include several aspects which are team, task and quality during the software development process is vital (Cheng et al., 2009; Broadus Iii, 2013). Since agile's way of working highly depends on people's participation, cooperation, and communication, it is recommended to include these soft paradigm when it comes to performance measurement.

Regarding the case study, the existing KPIs provide information about how well the team has performed to deliver to the customer, but not about how well the team has functioned. With the engaging nature of the methodology coupled with project complexity, traditional methods of company surveys and one on one meetings seem to serve the cause less. Hence, the need for a structured approach to tackle soft factors through measurement with the hard KPIs is necessary.



Figure 6.2.1 A holistic view of team performance KPIs through GQM model.

Figure 6.2.1 visualizes the parameters giving performance of the component teams in a more holistic view by applying GQM model. The goal is set to balancing customer focus and internal stakeholder focus in relation to team performance by combining hard and soft aspects as metrics as Canty (2015) and Yiu et al. (2013) mention about including the focusing on customers and people dependency to improve project performance measurement. According to Bergman and Klefsjo (2010), the central focus of an organization is customer focus and the internal stakeholders have to be motivated to deliver to the customer. Therefore, although the KPIs that are customer focused are the most crucial indicators for the company's business, capacity of the employees to achieve that particular level of project performance has to be looked at both from hard and soft sides. But with increasing complexity of the project environment, the soft aspects evolve from an area that requires informal actions to an area that has to be dealt along with the hard performance metrics. Therefore, from the analysis shown in Figure 6.1 and 6.2, the global themes give rise to the main questions of the GQM model. Hence, the GQM model devices metrics based on the project team's performance in terms of delivering to the customer as per the project plan and smooth functioning of the project team in order to do so. Generally, the hard metrics in agile software project are dealt with task related measurements, that is, the number of completed or remained tasks, the number of hours spent on task, and how fast the team can deliver the tasks according to the timeplan, defect density and the average time to resolve defects (Broadus Iii, 2013; Cheng et al., 2009). Comparing to the project case, the existing KPIs involve measurement of aspects such as Epic Burnup, Feature Growth, Overall Bugs Distribution according to Severity Level and Average Resolution Time for Bugs.

Including soft aspects in terms of people communication, collaboration, and engagement in project performance measurement would facilitate the management team to have clear mindset and make the proactive decisions. The importance of communication has been brought up from every interviewee and they have realized how it impacts project performance. Similarly, Ravindranath (2016) points out that having effective communication would mainly drive the project successfully where people express their ideas and expectations clearly and team members are allowed to talk openly and honestly. As Figure 6.2.1, in order to know whether the team is functioning smoothly, the questions are broken down into communication, team dynamics, and team improvement regarding soft issues.

Poor communication can cause project failures as all tasks and issues are solved by brainstorming, sharing information, and discussion (Pinto and Pinto, 1990). In order to examine effective communication in the project, the direction of communication, vertical and horizontal communication, has been applied to this KPIs system. Practically, the information flow is gone to all directions as per the project organizational structure. The vertical communication represents the communication between the management level and the operational level or vice versa (Lunenburg, 2010). They must know who they report to and who must answer to whom while the horizontal communication can be seen as communication between the teams and within the teams. Horizontal communication refers to the exchange of information between team members who are in the same hierarchical level (Bartels et al., 2010). It enhances team collaboration especially information sharing within their own teams and between teams. Pinto and Pinto (1990) also explain that the quality of deliverables is interlinked to the communication and collaboration between different

functional teams. Regarding the project case, the level of communication in the project significantly needs to be improved, especially between component teams and between teams and their managers. The level of communication also includes verbal, written and nonverbal communication such as talking, emails, and body languages (Carpenter et al., 2010). Close communication, being informed in time and reliable content would enhance the team engagement and commitment (Kim et al., 2016).

Team dynamics is to be included in the agile performance measurement as the team cohesions plays an important role in team performance which results to the overall project performance (Yang et al., 2012). The interview results shows that the management level are aware of the link between internal team performance and the overall project performance, but there is no KPIs presently which actually reflects how well the communication and collaboration in the project teams is. Kim et al. (2016) calls team dynamics as "team chemistry" since it represents the climate, collaboration, and communication within teams. The interpersonal interaction, sharing information and responsibility, group communication, and task commitment are highly concerned factors for agile projects (Franz et al., 2017). The result of team performance is based on team cohesions mainly associated with personal interaction, trust, and commitment. These factors lead to the satisfaction of team members as they are interlinked and dependent on each other. In the project case, the conflicts and differences in opinions are resolved in an informal way. So, it is hard to track and monitor how effectively the team has interacted and trusted to resolve complaints and conflicts within their own teams. Moreover, Buvik and Tvedt (2016) reveal that there is a relationship between the climate of the team and trust among members which corresponds to the productive interactions and show good teamwork. As per the project case, the level of cohesion and satisfaction in the team can be investigated through sharing knowledge and responsibility, task commitment, solving conflicts, etc. Also, having an informal communication strengthen team members to exchange information instantly and comfortably without organized meetings (Kraut et al., 1990). Hence, promoting team cohesion and team satisfaction in measuring agile projects helps provide more insight into project performance by combining soft paradigm into hard paradigm.

The improvement of team is another dimension that enhance the team to function smoothly. In this case, it means how much the team has improved to solving the soft issues which have been raised through retrospective meeting at the end of each sprint. In scrum, the teams have had regular meetings such as daily stand-up meetings in the beginning of the day, a sprint planning meeting at the beginning of each sprint, and a sprint review and retrospective meeting at the end of sprint (Pries and Quigley, 2011). The team members are engaged throughout the meetings and are expected to discuss what they have done, what they plan to do, and the problems that they found. Especially in retrospective meeting, the session is expected to summarize the feedback from the teams such as the success factors and scope for improvement as well as dealing with those improvements in the next sprint. However, in the project case, it is not mandatory for every team to perform this meeting. So, it is hard to track and monitor how much the team has improved in terms of resolving complaints and conflicts to improve their team climate. If the number of resolved issues have been monitored, it would help facilitate the team dynamics and results in the team functioning smoothly.

In Figure 6.2.1, the parameters to be measured are touched upon in a generalized manner to be suitable for teams regardless of any agile process frameworks. For simplicity, a scrum team can be considered as an example to explain the elements of this concept. For a scrum team, the effort put in by the team to deliver according to plan can be measured by the team velocity (Cheng et al., 2009; Cobb, 2015). The metric would provide insight into how complex or how big a user story the team is dealing with and how long it will take to complete it. The epic burn-up would give the idea about the planned user stories to be completed in a sprint while the epic burndown would provide how much the user stories have been achieved according to this plan (Broadus Iii, 2013; Cobb, 2015). Factors like man-hours (Cheng et al., 2009) will give the number of hours put in by the team in delivering the requirements of the iteration. Metrics showing the trend of bugs (Broadus Iii, 2013; Cheng et al., 2009) occurring in the final deliveries and the team's bug resolution time (ibid) would signify the ability to counter defects. Also, the team's ability to adapt itself during cases of change requests would be found by the time taken to include a change into the product with respect to its complexity and size. On the softer side, the team's effectiveness in communication would indicate the efficiency in which information is being transferred in all directions (Lunenburg, 2010; Ravindranath, 2016). Along with this the dynamics within the team, the growth of the team and level of satisfaction among team members can be visualized.

The concept of combining hard and soft aspects to make project performance measurement more holistic is a relatively new initiative. With project complexity increasing, it is seen that managing soft aspects can be difficult. Even in this case, the project involved 250 people from 4 different countries and to know about how smoothly all 35 teams are functioning is difficult through informal ways. Respondents expressed their interests to see the motivation, engagement, satisfaction, and communication of the teams. The research enabled the management level to enquire whether the support provided to the component teams was adequate. This further asserts the need for agile methodology to adopt more structured ways in project performance measurement combining hard and soft aspects in project environments that house many such component teams.

## 7 Conclusion

Typically, the performance of the project are measured according to the hard aspect which means quantifiable attributes primarily relating to the product deliverable, time, cost and quality, while the soft aspect which refers to people's perceptions, interaction, and communication has become significantly important in determining project performance. With increasing complexity of managing projects, it was evident that the impact of soft aspects had on project performance is more than usual, especially in agile projects. The master thesis was carried out through a qualitative analysis of a single case study of an agile software development project. By carefully combining data collection with the theoretical approach and models, it helped to develop intriguing findings and be able to answer the research questions.

Regarding the first sub-question, what are the issues with the current system of KPIs used to measure project performance in agile software development?, it can be argued that KPIs in agile projects are very much focused on deliveries to the customers. Regarding agile' way of working, KPIs are considerably towards hard aspects associated with tasks, cost and quality while soft dimensions are dealt with informally and no mandatory follow-up process. Agile methodology highly requires active involvement from stakeholders and closed collaboration among internal teams, so without considering these soft aspects, the KPIs cannot provide a holistic view to reflect the project performance and lead to reactive decision making from project management team. For the second sub-question, how can this system be developed to provide more insight into agile software project performance?, it was clear that the KPI' system can be developed through GQM model. Having a goal as balancing on customer focus and internal stakeholders would help merge soft into hard paradigms. The questions of how the team delivers to the project plan and how the team is functioning smoothly are broken down into sub-questions in order to break through the metrics. This KPI's system can be applied to any agile software development projects since the finding metrics are kept as generic. To answer the main research question, how can hard and soft aspects of project performance be combined as Key Performance Indicators in agile software development projects?, it is clear that the answer from the second sub-question lays down the foundation of how hard and soft aspects can be combined as KPIs in agile software development projects. Looking both aspects under the same goal provides the way to combine hard metrics relating to the effort the team put in to achieve the plan, to soft metrics in terms of the smooth functioning of the teams. The hard KPIs ensure the focus on project performance from customer satisfaction's point of view, whereas the soft KPIs would provide a supporting role to the hard KPIs, and formalizes the process of monitoring soft aspects.

Finally, this framework is expected to open doors for standardization of the way of working, minimizing micro-management of teams through increased balance in the focus of processes between external and internal stakeholders in agile software development projects. Particularly, this framework would be more fit to the complex agile project regarding the large size or virtual teams connection as it is hardly for management team to monitor and cope with the soft sides. A balanced focus on both hard and soft aspects would enable teams to undertake introspections and not only will there be discussions regarding shortcomings in the soft sides, but also the KPIs will act as a follow-up mechanism for the projects. Moreover, the model is also expected to increase the attention of management to the operational teams.

Management level would be more aware of how the employees feel while they work and how this affects the overall project performance with continuous updates through the metrics.

## 8 Future Study

The research concludes at identifying the factors to be measured to understand project performance in a better way. The GQM-based model as illustrated in Figure 6.2.1 identifies parameters that can indicate true project performance, but an actual method to quantify soft aspects and connect them to the hard aspects to be able to visualize and quantify the combined effect on project performance is still ambiguous. Therefore, it would be interesting to see how such a system would work from a mathematical point of view. It can be understood that a conceptual research would pave the way for further studies in the concerned domain. A very interesting aspect to investigate would be to device the prioritization of KPIs in decision-making. In order for the system to work efficiently managers must be able to work efficiently both the management and operational levels of the project should be strategically aligned. Hence, to know how the operational level perceives the business goals of the projects and how the management perceives the capacity of operational level employees within the scope of a complex project environment would be a key issue to be studied.

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# 10 Appendix

## **10.1** Thematic Network Approach

Table 10.1.1 Coding framework for interview data (adapted from Stirling (2001)).

Codes	Issues Discussed	<b>Basic Themes</b>
<ul> <li>Need for agile methodology</li> <li>Level of application of agile</li> <li>Agile process</li> <li>Strategic fit</li> <li>Project management</li> <li>Decision making</li> <li>Project organization</li> <li>Handling of new members</li> <li>Organizational shortcomings</li> <li>Project Performance</li> <li>KPIs</li> <li>Hard KPIs</li> <li>Soft KPIs</li> <li>Improvement opportunities</li> </ul>	<ul> <li>Effect of agile in project</li> <li>Experience in agile</li> <li>Approaches to agile methodology</li> <li>Agile project's impact on meeting project goals</li> <li>Way of working with agile principles</li> <li>Current project status</li> <li>Sprint meetings</li> <li>Challenges in the project</li> <li>Opportunities in the project</li> <li>On-boarding for the project</li> <li>Project planning</li> <li>Measurement of project performance</li> <li>Interpreting project performance</li> <li>Style of decision making based on findings</li> <li>KPIs to indicate right performance</li> <li>Distinguishing good and poor performances</li> <li>Challenges with current set of KPIs</li> <li>Definitions of KPIs</li> <li>Logic behind the use of the KPIs</li> <li>Interpreting KPIs</li> <li>Soft aspects in project performance</li> </ul>	<ul> <li>The KPIs currently used are entirely focused on delivering to the external customer.</li> <li>The existing KPIs do not fulfill quick decision making from an internal perspective</li> <li>No soft factors measurement to track the internal team performance through KPIs.</li> <li>This is the first time where they get customer working on site together with the team.</li> <li>Managers need more commitment, accountability and motivation from teams while teams believe this is good.</li> </ul>

<ul> <li>Amount of focus on the soft aspects</li> <li>Most important soft issues in project</li> <li>Communication</li> <li>Team Dynamics</li> <li>Employee burnout</li> <li>Employee retention</li> </ul>	<ul> <li>The clarity and timeliness of information transferred in all directions is a concern.</li> <li>The levels of informal communication in the organization is generally less.</li> <li>Communication is frequent but not fully effective.</li> <li>Horizontal communication is good but gaps are there in vertical communication.</li> </ul>
	• Burnout and overwork are identified as two concerns.
	<ul> <li>There are no indicators that provide information about the softer aspects of team dynamics.</li> <li>Softer issues are dealt with informally and have not been followed up.</li> <li>Level of attentiveness of management to the operational level has been</li> </ul>

		highlighted
	•	There is no detail on how the short planning cycles have affected team dynamics and motivation and what needs to be improved
	•	It is up to the teams to decide whether they want to conduct retrospective meetings or not
	•	The decision making is reactive, and management get involved only comes after a problem occurs.
	•	Planning and decision-making is purely based on hard aspects
	•	The company has customized its agile process, but level of coaching the teams on this has not been investigated.

Table	10.1.2	Mapping	the	findings	based	on	"focus	on	the	customers"	and	"Let
everyb	ody be	committea	l" (E	Bergman d	and Kle	efsjö	(2010)	).				

Cornerstones	Agile Methodology	<b>Empirical Findings</b>
	• Agile is highly customer	• The KPIs
	focused and works to	currently used
	iteratively deliver to the	are entirely
	external customer.	focused on
		delivering to

Focus on the	•	Agile is focused more on the		the external
customer	-	external customer than the		customer
edistomer		internal stakeholders		eustomer.
		Internal stakeholders	•	The existing
			•	VDIa do not
				fulfill quick
				decision
				making from
				an internal
				perspective
	•	The company needs to be	•	No soft
	-	trained well in agile to		factors
		deliver successful projects		measurement
		denver successful projects		to track the
				internal team
				performance
				through KPIs.
			•	This is the
				first time
				where they get
				customer
				working on
				site together
				with the team.
	•	Agile methodology needs	•	Managers
	•	Agile methodology needs more active team	•	Managers need more
	•	Agile methodology needs more active team involvement, closer	•	Managers need more commitment,
	•	Agile methodology needs more active team involvement, closer collaboration and good	•	Managers need more commitment, accountability
	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and
Let everybody be	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good.
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions is a concern.
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions is a concern. The levels of
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions is a concern. The levels of informal
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions is a concern. The levels of informal communicatio
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions is a concern. The levels of informal communicatio n in the
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions is a concern. The levels of informal communicatio n in the organization
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions is a concern. The levels of informal communicatio n in the organization is generally
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions is a concern. The levels of informal communicatio n in the organization is generally less.
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions is a concern. The levels of informal communicatio n in the organization is generally less. Communicati
Let everybody be committed	•	Agile methodology needs more active team involvement, closer collaboration and good effective communication.	•	Managers need more commitment, accountability and motivation from teams while teams believe this is good. The clarity and timeliness of information transferred in all directions is a concern. The levels of informal communicatio n in the organization is generally less. Communicati on is frequent

• With its short planning	but not fully
more workload on	<ul> <li>Horizontal</li> </ul>
employees	
	n is good but
• Agile, being an engaging	gaps are there
model of work generally	in vertical
deals with soft aspects of	communicatio
project performance in an informal way	n.
	<ul> <li>Burnout and</li> </ul>
	overwork are
	identified as
	two concerns
	two concerns.
	• The second second
	• There are no
	indicators that
	provide
	information
	about the
	softer aspects
	of team
	dynamics.
	• Softer issues
	are dealt with
	informally
	and have not
	been followed
	up.
	<b>ч</b> р.

Table 10.1.3 Mapping the findings based on the other four cornerstones of the cornerstone model (Bergman and Klefsjö (2010)).

Cornerstones	Agile Methodology	Empirical Data
	• Due to the demand placed	Level of
	on employees the	attentiveness
	commitment, the attention	of
Ton monogoment	of top management to the	management
	project should be higher	to the
communent	than normal	operational
		level has been
		highlighted
	• Generally agile does not	• There is no
	address continuous	detail on how
Improve	improvement in a very	the short
continuously	formal manner	planning
		cycles have
	• the amount of	affected team

	documentation and follow-	dynamics and
	up is generally less in agile	motivation
	methodology	and what
		needs to be
		improved
		• It is up to the
		teams to
		decide
		whether they
		whether they
		wallt to
		conduct
		retrospective
		meetings or
		not
	• The system is designed to be	• The decision
	implemented in an	making is
	environment of	reactive, and
	unpredictability.	management
		get involved
		only comes
	<ul> <li>Decision making is backed</li> </ul>	after a
Base decisions on	up by facts but generally	problem
facts	doesn't not include soft	occurs.
	aspects	
	_	• Planning and
		decision-
		making is
		purely based
		on hard
		aspects
	• Agile focuses very much on	• The company
	delivering the product to the	has
	customer than improving the	customized its
	actual process for achieving	agile process.
Focus on processes	the same.	but level of
		coaching the
		teams on this
		has not been
		investigated
		investigated.
# **10.2** Interview Questions with Project Management Team

#### **INTERVIEW TEMPLATE**

### PURPOSE

The master thesis research aims to explore the possibilities of improving project performance measurement in agile software development projects as well as provide the framework by combining hard and soft aspects as measurement metrics. Hence, as a part of the research we wish to perform interviews to collect more information from the senior management level of the project.

The interviews are exploratory and the objective is to get an overview of the management perspective about the current set of KPIs and how they could be improved.

The interview session is expected to cover duration of approximately 1 hour. Only the collective output from the interviewees will be used for research purposes and therefore, the anonymity of the interviewees will be maintained.

## **INTERVIEW QUESTIONS**

- 1. What is your role and responsibility in this project?
- 2. How long have you been working in this project?
- 3. What is your opinion about the need for KPIs to measure and keep track of project

performance?

4. Is there something that you would like to share from your experiences in using KPIs for

measurements?

5. What are the factors based on which project performance is currently being measured in

the ICUP project?

- 6. How is a certain measured level of project performance characterized as 'good' or 'bad'?
- What is your opinion about the current set of KPIs used in software development for this
  - project?
- 8. Do you feel that there are aspects that you currently do not measure but that would be relevant?
- 9. How much do the current metrics take into consideration the soft aspects of the

employees? (E.g. communication, engagement, motivation etc.)

10. What are your thoughts about being able to track and measure soft factors that contribute

to project performance?

11. Could you identify some of the soft factors that are an immediate cause for concern for the project group?

# **10.3** List of Questionnaires for Product Owners

## QUESTIONNAIRES

Survey Target Group: Component Owners / Product Owners of Teams Expected Sample Size Prior to Questionnaire: 29

**Survey Design:** Completely Objective with close ended questions and Likert Scale questions. More Likert Scale questions than close ended questions to get more data in less time.

#### Purpose

The questionnaire is part of the master thesis research to explore the possibilities of combining hard and soft factors as KPIs to measure project performance. The questionnaire aims to tackle the soft aspects of communication and team dynamics, and explores the current situations regarding the same. It is directed towards identifying the gaps between management's perception of soft factors and the Product Owners' perception of the same. The answers are kept anonymous and only the collective findings from responses have been used.

**1.** The first part covering demographic data and frequency of communication is comprised of open-ended questions. The respondents are expected to answer based on the options provided.

#### **1.1 Demographic Data**

- How long have you been working in ICUP Project?
  - o Less than 4 months
  - o 5-9 months
  - o 10-14 months
  - o More than 14 months
- How many team members inside your component team (not including yourself)?
  - o Less than 4 people
  - o 5-7 people
  - o 8-10 people
  - o More than 10 people

#### **1.2 Frequency of Communication**

• How frequently do you communicate with your managers?

- o Daily
- o Once a week
- o Once in two weeks
- o Once in a month
- o Other
- How frequently do you communicate with other component teams?
  - o Daily
  - o Once a week
  - o Once in two weeks
  - o Once a month
  - o Other
- How frequently do you communicate within your component team?
  - o Daily
  - o Once a week
  - o Once in two weeks
  - o Once a month
  - o Other

2. The following sections of the questionnaire are based on a Likert Scale measurement and need to be answered on a scale of 1 to 5 based on the degree of agreement with the statements provided, categorized as shown below.

- 1: Strongly Disagree
- 2: Moderately Disagree
- 3: Neutral/ Uncertain
- 4: Moderately Agree
- 5: Strongly Agree

#### 2.1 Communication with your managers

- I am frequently updated about relevant information in the project by my managers
- I feel comfortable discussing information regarding the project with my managers
- Information between me and my managers is always shared on time
- The information I receive from my managers is clear enough to make decisions
- My managers are always attentive to what I communicate
- I have frequent informal communication with my managers
- The way of communication between me and my managers is effective

#### 2.2 Communication among component teams

- I frequently communicate relevant information about the project with other component teams
- I feel comfortable to discuss information relevant to the project with other component teams

- Information is shared between members of other component teams and me on time
- The information I receive from other component teams is clear enough for me to make decisions
- I have frequent Informal communication with members of other component teams
- The way of communication between me and members of other component teams is effective

#### **2.3** Communication within teams

- I feel comfortable to discuss all relevant information with members of my team
- I receive enough support from my team members to make decisions
- Members of my team communicate well among themselves
- Members of my team know who they should contact when they need help
- There is frequent informal communication among team members
- The way of communication between me and my team is usually effective

#### 2.4 Team Performance

- The team members are committed towards the targets to be achieved in a given sprint
- The team members respond quickly to sudden changes in work
- Members of my team have a clear picture of their roles and responsibilities of their project
- Members of my team share the responsibility for the tasks assigned to them
- Members of my team share knowledge that is important for the project
- Conflicts or differences in opinion is quickly addressed within the team
- I am convinced that my team members enjoy working in the team
- I have full confidence in my team to achieve our targets

3. The following questions involve rating and concluding the opinions of respondents. The respondents are asked to choose the option that fits their judgement. The questions involve rating the specific area on a scale of 1 to 5 with 1 representing 'poor' and 5 representing 'excellent'.

3.1 How satisfied are you with the current communication in the project organization?

- 1:
- 2:
- 3:
- 4:

5:

3.2 How satisfied are you with the performance of your component team?

- 1:
- 2:
- 3:
- 4:

5:

3.3 On a scale of 1 to 5, how would you rate your component teams in terms of these parameters? (1: Poor, 5: Excellent)

- Team Structure
- Management Style
- Extent of Motivation of Team
- Communication Flow
- Team Effectiveness
- Work Environment with Team

## 4. Additional Comments: