Adoption of Hybrid Methodology in projects

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Abstract

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Agile project management approach is known for its adaptability to changes in project lifecycle but has uncertainties in costs and time. Debates are still ongoing between practitioners and the academics regarding the project managers approach while choosing the methodology to gain the project success. We investigated and explored the adoption of hybrid methodology, which is a fusion of traditional and agile project management methodologies in project. The hybrid methodology is becoming popular but still emerging, provides hybrid success with the fusion of structured waterfall and the flexible agile. The research question addressed was “How and why hybrid methodology is adapted and used in projects?”

We investigated the implementation of hybrid methodology in various software organizations and adoption of hybrid methodology in various projects at different phases by conducting nine semi-structured interviews with three different software organizations. This included the interviews of project managers, team leaders, team members who are working with hybrid methodology. We analyzed the practice of hybrid methodology in projects and its benefits and challenges. This thesis concluded with assessing values from hybrid approach from their implementation of hybrid methodology. The benefits revealed from hybrid approach focused on business value, time and costs, customizing the project management methodology to the problem rather than using a single approach and enhancing the quality on complex projects.
Acknowledgements

We would like to express our deepest gratitude to all those who helped in accomplishing our Master thesis. We would like to thank all our professors who helped us to attain the knowledge to work on this research study. We would like to thank our subject reader and the examiner who helped us to reach all the milestones in our thesis to complete with their constant support whenever required.

We would also like to thank the interviewees who helped us in our thesis by sharing their valuable knowledge for constructing our thesis.

Special thanks to all our family members and friends for their constant motivation and belief in us.
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1 Introduction

Traditional project management methodologies were introduced during the second half of the 19th century as prescribed models and procedures to manage various projects (Špundak, 2014). The Waterfall model was denoted as the “traditional” model in the field of project management (Baird and Riggins, 2012; Tonnquist, 2012). Waterfall method has a clear goal outcome with a fixed start and an end (Tonnquist, 2012). Waterfall model follows a sequential development planning method which has step by step execution (Baird and Riggins, 2012; Salah et al., 2017; Salum et al., 2014; Tonnquist, 2012). Due to structural complexity in projects, time constraints and uncertainties in outcomes certain organizations have shifted towards an agile project management approach (Špundak, 2014).

Agile project management approach is known for its adaptability to changes during the project life cycle and its innovative outcomes (Boehm and Turner, 2004; Špundak, 2014; Wysocki, 2012). Agile methodology is flexible, an iterative method having no clear structure for carrying out the projects (Tonnquist, 2012; Wysocki, 2012). Agile methods are used for ‘goal-seeking projects’ where the outcome is unclear and has uncertainties in costs and time (Tonnquist, 2012). Scrum framework is the most widely used agile methodology for software development despite other methods like Extreme Programming, Kanban, Crystals, etc are available. (Schwaber, 1995). Scrum is an agile framework which allows flexibility in project deadlines, frequent iterations in the project plan, deliverables as per customer requirements (Schwaber, 1995). Due to organizational constraints, communication within team members and extensive documentation makes agile project management implementation difficult (Špundak, 2014).

Both traditional and agile project management approaches have their own advantages and disadvantages depending on project categories, project characteristics or specific techniques needed for a project makes these approaches unique (Špundak, 2014). Researchers have found that a combination of both agile and traditional methods would provide better understanding about explorative capabilities (Baird and Riggins, 2012; Vinekar et al., 2006). Structure and agility can counterpart with each other when worked as a combination of both traditional and agile as a hybrid form on a project (Baird and Riggins, 2012). The Hybrid approach follows the structure from traditional project management and flexibility from agile project management (Smith and Lewis, 2011). The benefits of a hybrid approach would be focusing on business value, time and costs, customizing the project management methodology to the problem rather than using a single approach and enhancing the quality on complex projects (Baird and Riggins, 2012; Karlstrom and Runeson, 2005; Vinekar et al., 2006).

The purpose of this research study is to understand the nature of hybrid methodology in software organizations. This study can reveal the reason to choose hybrid methodology and the method to implement in software projects. The implementation and working practices of hybrid methodology in projects by project managers are well discussed in this study.

1.1 Research problem

The choice of the type of project management methodology by project managers determines the strategic path about a project from initiation stage to closure stage (Grushka-Cockayne et al., 2015). A project can be classified into four dimensions; complexity, novelty, technology, and pace (Shenhar and Dvir, 2007). These four dimensions can give us information about how a project can be managed (Grushka-Cockayne et al., 2015). The traditional methodology is not for all new projects as they differ between the complexity of the project and the sources of uncertainty (Loch et al., 2006). Agile methodology is for highly ambiguous projects which aspire for iterations and changes during the project (Loch et al.,
2006). Comparison of the methodologies is difficult due to variations of requirements in projects and choosing one suitable method for all projects is not possible (Shenhar et al., 2002). The choice of the type of methodology used depends on type of organization, team characteristics and project size (Vijayasarathy and Butler, 2016).

All the project management requirements cannot be achieved through agile-scrum or agile process (Salah et al., 2017). To fill in the gaps found in agile-scrum or agile process it is necessary to combine with other project management models or references (Fewell, 2017; Salah et al., 2017). Combination of both waterfall and agile is great challenge but it is beneficial to software project management (Fewell, 2017; Salah et al., 2017) and there needs to be regular checkpoints to enable flow in the processes of the project (Archer and Kaufman, 2013; Fewell, 2017). Software projects are failing to meet their user requirements due to factors such as time schedule, over budget etc. (Salah et al., 2017). Many researchers advise project managers to be experimental rather than being superficial in hybrid methodology which gave us the foundation for conducting this research study (Archer and Kaufman, 2013; Fewell, 2017). The main reason for the failure of a project could be due to lack of project management and the type of methodology that a project manager implement (Salah et al., 2017).

Research scholars suggested project managers to try slicing the work items into micro deliverables (Fewell, 2017). According to them, traditional and agile project methodologies creates some limitations for the project success so they recommend for the fusion of both methodologies (Batra et al., 2010; Cobb, 2011; Fewell, 2017; Serrador and Pinto, 2015). In hybrid methodology, the issues of the product will be identified at the earliest in the development cycle which is the best approach (Archer and Kaufman, 2013). There is lack of literature about the hybrid approaches in software projects, especially regarding the implementation of the hybrid methodology (Salah et al., 2017). So, the research questions have been formulated as:

\textit{RQ1. Why is hybrid methodology used in projects?}

\textit{RQ2. How is hybrid methodology used in projects?}

1.2 Research Objective

The objective of this research is to investigate the combination of traditional and agile methods termed as ‘hybrid’. Through our interviews we would also investigate about how project managers overcome their difficulties and increase their benefits by the implementation of hybrid methodology.

1.3 Limitations

This thesis is limited to only investigate hybrid project methodology as an integration of waterfall and agile project management methodologies. The interviews conducted were from team member, team leader and project manager working on hybrid projects in United States of America, Sweden and India. This thesis investigated the practice of hybrid methodology in projects and how the project team and project managers are adopting to hybrid methodology and not a guideline on how the hybrid project methodology should be used.
2 Literature review

The literature review explains the following topics: project, traditional project management methodology, agile project management methodology and hybrid project management methodology. The characteristics, practices, benefits and challenges are also described in literature review.

2.1 Project

A project is a sequence of unique, transient and connected activities to achieve planned objectives which would be defined in terms of their output or benefits (Wysocki, 2012). A project has a beginning and an end which lasts for a limited time period and is considered successful when planned objectives are met within the agreed timescale and budget (Tonnquist, 2012). The project triangle in Figure 1 can explain about the processes that needed to be worked upon, the timeline for these processes, and the resources needed for completing these processes (Tonnquist, 2012; Wysocki, 2012).

![Project Triangle](image1.png)

Figure 1: Project triangle (Tonnquist, 2012)

The project lifecycle consists of five phases before reaching its completion. The phases in a project lifecycle shown in figure 2 helps in ensuring the project goal is reached and helps in segmenting the work phase by phase explained below (Tonnquist, 2012).

![Project Lifecycle](image2.png)

Figure 2: Project Lifecycle (Tonnquist, 2012)

The perpendicular line in the above figure represents the decision point or tollgates which help in identifying results from each phase to make a decision to go back, continue or terminate the project respectively (Tonnquist, 2012).
Idea is the first phase which helps the management in assessing the project ideas and prioritize them. This phase also revolves around queries, capitals, and initiation of the project (Jaziri et al., 2018; Tonnquist, 2012). Pre-study phase helps in defining the project by identifying the scope and a possible solution to minimize the uncertainties and risks. Stakeholder identification, business values and analyzing a structure for executing the project can be carried out in this phase (Jaziri et al., 2018; Tonnquist, 2012). Planning phase deals with the selection of methods to achieve the planned objectives so they coincide with the project goal for example, resources needed, cost estimation, resources identification and handling of risks and uncertainties (Tonnquist, 2012). Execution phase deals with planned activities that are being executed and are analyzed for deviations or changes and are handled. During this phase, results are created and are handed over at the end of the execution phase (Tonnquist, 2012). Closure phase is to evaluate the project, approving the final report, end the project and phase out the project team (Jaziri et al., 2018; Tonnquist, 2012). Impact phase helps in ensuring the benefits from the project and the learning outcomes gained during the various phases of the project cycle which could be followed up (Jaziri et al., 2018; Tonnquist, 2012).

2.2 Traditional project management practices

Project management has been considered as one of their core business competencies in many organizations today creating business values. The performance of projects are evaluated and found to be low in IT industry due to avoidance of project management practices (Armshaw, 2005; Wysocki, 2012). Project management practice involves defining the objectives of the project, scope of the project, deliverable and approaches towards the project on how it can be carried out (Armshaw, 2005; Wysocki, 2012). Engaging stakeholders in the project could help in aligning the project with its goal so the project could be delivered on time and budget meeting the expectation of the project owner (Wysocki, 2012). Project management practices also involves assigning individual roles and responsibilities with a clear understanding of their role and objectives so they could deliver the results of the project (Armshaw, 2005; Thieme et al., 2003). As unrealistic and unachievable objectives would end in project failure, the project team should be involved during the planning as they would be working on the project and help them achieve the planned objectives (Armshaw, 2005). Comparing the project plan with actual plan can help in tracking the project progress. This could ensure the expected outcome within the set timeframe. (Armshaw, 2005; Wysocki, 2012). These practices can help in identifying risks, uncertainties and managing them effectively with changes could help to minimize them. These practices can also help to ensure flexibility in attaining the deliverables by adapting to changes for the project team. The project manager has to follow and focus on the project group towards the project goal (Armshaw, 2005). Project management involves open communication between all parties involved in the project as they could help to achieve expected results for the end users or stakeholders (Armshaw, 2005; Wysocki, 2012).

2.2.1 Traditional Project management characteristics

Traditional project management methods involve a high level of detailing in its project plan so they could ensure their project deliverables are attained with a defined scope, cost and time (Azanha et al., 2017; Salum et al., 2014). The working efficiency and success of the project depends on an individual who should have proper understanding of the tools and activities to ensure the process (Kannan and Jhajharia, 2014; Tonnquist, 2012). This method follows a project lifecycle in a sequential manner. There are regular check-up meetings at the end of each phase reducing risk and uncertainties (Tonnquist, 2012). This method has a structured model following control and command management style. They have a outcome which is predictable and they work on achieving that outcome (Kannan and Jhajharia, 2014; Salum et al., 2014; Tonnquist, 2012). Traditional project management is characterized by their
heavy documentation, minimal customer interactions, formal communication and unique outcome as their end result (Tonquist, 2012).

Many organizations choose their project methods depending on the best fit of their projects (Špundak, 2014). The traditional project management model was introduced in 1970s and is one of the earliest project models widely adopted by organization. The traditional project management model has a fixed budget and their projects always have a defined start and an end timeline (Špundak, 2014; Tonquist, 2012). The Waterfall model is still the most commonly used project management method with goal-oriented projects (clear goals) with no possibilities for future changes (Tonquist, 2012).

The term „waterfall” relates to one of the traditional project management ways to manage software development (Baird and Riggins, 2012; Špundak, 2014; Tonquist, 2012). Waterfall model was known as “plan-driven model” as they can be implemented in small and complex projects (Špundak, 2014; Tonquist, 2012). This is a sequential development planning method, where activities are performed step by step reducing the risks and uncertainties (Tonquist, 2012). Each planned activity should be completed and approved before moving on to the next activity, creating no overlaps of different phases (Tonquist, 2012).

Waterfall model has a linear flow, simple to understand and a plan that contains all details to avoid delays or errors (Salah et al., 2017; Tonquist, 2012). The requirements stated should be clearly understood and each step should be executed as return to an earlier phase would be time-consuming and expensive (Špundak, 2014).

![Figure 3: “Waterfall Method”- Software development (Murray, 2016)](image)

The Waterfall method in relation to software development is illustrated in figure 3. The first phase is the requirements phase which is classified into system requirements and software requirements (Salah et al., 2017; Tonquist, 2012). System requirements define the hardware components needed whereas software requirements describe the software functionalities, databases, and interactions between applications for the execution of the project (Murray, 2016; Tonquist, 2012). In design phase, the requirements are handed over to the designer to write the code according to the final documentation (Murray, 2016; Tonquist, 2012). Testing phase identifies the bugs and errors in the code during execution and changes are made to relieve errors followed by retesting (Murray, 2016; Tonquist, 2012). Verification phase checks for the tested code that was formulated by the project team aligns with the stated plan according to the documentation (Murray, 2016; Tonquist, 2012). Once these phases are over, maintenance phase helps in explaining the features of the program to the end user so they can understand the entire process (Murray, 2016; Tonquist, 2012).

There should be detailed planning in the phases of Waterfall methodology to avoid errors or else there can be unplanned changes during its execution of each phase (Murray, 2016; Tonquist, 2012). This
method is time-consuming making it unsuitable for small projects and documentation should be explained effectively at the start itself as it could lead to project failure (Murray, 2016; Tonnquist, 2012).

2.2.2 Challenges and benefits of Traditional project management

Waterfall method is widely used in software development and software requirements from clients can be either improperly noted or impractical for execution. This issue is caused by an insufficient understanding of requirements or improper documentation from the start of the project. Due to the requirements insufficiency, improper understanding regarding requirements may sometimes result in failure of the project. Failure of the project leads to reconstruction of the software according to the requirements of the clients and this increases the time and cost of the project (Bassil, 2012; Kannan and Jhajharia, 2014). Inflexibility is another challenge when working with waterfall methodology. Changes arising suddenly or alterations from the stated plan leads to a formal process by the management extending timescale of deliverables (Kannan and Jhajharia, 2014; Tonnquist, 2012). Software projects using waterfall method in a software project can be time-consuming. By the time it reaches its completion the technology have progressed and changed (Wysocki, 2012). Progression in the project made is unaligned with the planned business requirements leading to unexpected outcomes and failures (Thieme et al., 2003).

Traditional project management follows detailed planning where higher management can make changes at the beginning of the project life-cycle (Bassil, 2012; Kannan and Jhajharia, 2014; Tonnquist, 2012). Traditional project management clearly states the project requirements for every phase in the life-cycle and stakeholder’s involvement that can help to achieve desired outcomes (Bassil, 2012; Kannan and Jhajharia, 2014; Tonnquist, 2012). Traditional project methods utilize comprehensive documentation which establishes transparency in all phases of the project (Tonnquist, 2012). Organizations using project management framework enhances organization value by their project success and effectiveness of human efforts by understanding the user needs and increase their efficiency to deliver results (Badewi, 2016; Tonnquist, 2012). Traditional project management is used and best suitable for goal oriented projects (Badewi, 2016; Tonnquist, 2012). Project investment success shows the project’s return of investments defining the success of the project’s outcome thus satisfying the stakeholders and the project group involved (Badewi, 2016). Project benefits are analyzed by Key Performance Indicators (KPI) shows the values gained financially and non-financially by means of the project for the organization (Badewi, 2016).

2.3 Agile project management practices

As agile project management research is in transition there is no particular formulated way of recognized practices as each agile project management has their own set of rules and regulations in practice (Conforto et al., 2016). There are some common practices depending on which method that a project team uses in their projects such as scrum or other etc. However all the practices are designed according to agile manifesto (Bohem and Turner, 2004). Tools, techniques and functional behavior are included in agile project management practices (Conforto et al., 2016). There are six management practices for the usage of agile project management (Salum et al., 2014). One of them is product vision, which involves visual tools utilization for creating a clear explanation of project deliverables (Salum et al., 2014). It is necessary to have team members collaboration with key stakeholders’ involvement (Salum et al., 2014). Strong team members collaborations with stakeholders develop product vision (Salum et al., 2014). Simple project plan, communication, tools and processes is carried out through visual boards, figures and prototypes as means of communication tools and processes (Salum et al., 2014). Agile project management is iterative by nature, and the changes are done by the team members and the project
manager, during the project plan and in relation to the requirements (Salum et al., 2014). Self-managed teams create a great focus with involvement, dedication towards the project plan (Salum et al., 2014). These self managed teams require involvement, commitment while monitoring and updating the project progress (Salum et al., 2014).

2.3.1 Agile project management characteristics

There is no clear definition for agile project management and the theory development of agile project management is still in transition (Salum et al., 2014). The crucial part of success of agile project management is planning, control and communication (Bohem and Turner, 2004). The main management characteristics of agile project management is introduced and described below.

Customer relation is one of the key characteristics in agile project management methodology. Agile project methods depend on a dedicated and active customer, as customer inputs provide value to the project (Bohem and Turner, 2004). The customer interactions and their involvement are increased in agile project management methodology (Bohem and Turner, 2004). Planning and control is another characteristic where the estimated time spent on project planning is 20% in agile methods (Bohem and Turner, 2004). The speed and agility of the agile projects are based mostly on the tacit knowledge rather than documented explicit knowledge (Bohem and Turner, 2004). Project communication in agile project management depends on tacit and interpersonal knowledge (Bohem and Turner, 2004). The agile project management team develop by sharing their experiences with the team and use the tacit knowledge to great extent in the project while implementing the tasks (Bohem and Turner, 2004). Here the communication is through face-face and should be more frequent, which is to be done as per the agile manifesto values (Bohem and Turner, 2004).

Some of the agile methods’ technical characteristics are requirements, development and testing. In agile method, the content is established through negotiations in the upcoming iteration and development in agile project management uses simple design architecture (Bohem and Turner, 2004). This is based on two fundamental assertions, one to reduce the cost of rework and the other to implement rapid change (Bohem and Turner, 2004). To test the agile project management, different techniques and pair programming tools are used to remove code errors (Bohem and Turner, 2004).

During the last two decades there have been an increased shift towards agile project management methods (Lesnevsky, 2008). Agile refers to the project methods which adopt to change by applying flexibility during the process (Bohem and Turner, 2004; Salum et al., 2014). Agile practices are used in software projects due to their robust planning, flexible iterations, progressive improvements with developments and quick delivery (Bohem and Turner, 2004; Schwaber, 2004; Sliger, 2012).

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<td>Individuals and interactions over processes and tools</td>
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<tr>
<td>2</td>
<td>Working software over comprehensive documentation</td>
</tr>
<tr>
<td>3</td>
<td>Customer collaboration over contract negotiation</td>
</tr>
<tr>
<td>4</td>
<td>Responding to change over following a plan</td>
</tr>
</tbody>
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Table 1: List of Agile values collected from Agile Manifesto (Cohn Mike, 2005)

Agile manifesto was created in February 2001 for software development (Cohn Mike, 2005). The main agile values are summarized by the authors of agile manifesto (Cohn Mike, 2005) which are listed in Table 1. Agile methods are developed to create innovations, experience a great impact in their project
success (Cohn Mike, 2005; Špundak, 2014). This method invites for any change, promotes face to face communications and is applicable for small and medium-size projects (Cohn Mike, 2005; Stoica et al., 2013). Agile project team works as one, aiming towards a common goal (Cohn Mike, 2005). Due to the iterative working process the agile team learn while adapting to the changes (Stoica et al., 2013). Each and every task are to be tested properly to reduce the risks in the next upcoming tasks (Stoica et al., 2013).

2.3.2 Scrum

The most commonly used agile methodology for software developments delivery in a project is Scrum (Cobb, 2011; Sliger, 2011). Scrum is not a technique or process or methodology but is a framework as the word refers to prescriptive nature (Sliger, 2011). Similarly, scrum allows flexibility in project deadlines, frequent iterations in the project plan, deliverables as per customer requirements (Schwaber, 1995). Scrum is not the only method of implementing agile principles but there are other methods such as extreme programming, kanban, crystal, etc.(Archer and Kaufman, 2013; Schwaber, 1995; Sliger, 2011).

In this framework, which is shown in Figure 4, the main focus is on time boxes which are called sprints with fixed durations (Batra et al., 2010; Schwaber and Sutherland, 2017). There are two scrum artifacts; product backlog and sprint backlog (Azanha et al., 2017). Product backlog is the list of prioritized product requirements which has features and iterations that need to be done by a project team, customers, sales and marketing (Azanha et al., 2017; Sliger, 2011). The product owner is the customer or customer representative who is responsible for maintaining product backlog (Sliger, 2011). Sprints are one to four weeks in length and this is followed throughout the project lifetime (Sliger, 2011). The project team selects the items which they assume that will be completed in the current sprint from product backlog and they create sprint backlog (Sliger, 2011). A sprint backlog is the features list which assigns to specific sprint during the process (Azanha et al., 2017).

Scrum master, product owner, team are the three main roles in scrum (Sliger, 2011). Scrum master is the defender, supporter, advocator, keeper to both team and the total scrum life cycle during the project (Sliger, 2011). The scrum master act as mediators in the team as well as negotiate and lubricates the communication within the team by removing difficulties (Sliger, 2011; Tonnquist, 2012). Product owner is the voice of the customer who works with the project team and makes necessary decisions regarding the product (Sliger, 2011). Product owner is responsible for communicating by answering questions, defining, prioritizing the backlog teams with the team members (Sliger, 2011). Product owner owns what it chooses to build features of a product (Sliger, 2011; Tonnquist, 2012). The scrum team is the main responsible for the delivery of the product and consists of five to seven people (Sliger, 2011). The team track the progress of the tasks that they perform on a daily basis and report during the daily scrum meetings (Sliger, 2011). The team works only for one project at the time. (Sliger, 2011; Tonnquist, 2012).
The five main activities performed by the project team are kick-off meeting, sprint planning meeting, sprint, daily scrum and sprint review meeting (Cervone, 2011; Schwaber and Sutherland, 2017). In kick-off meeting the main priorities from the product backlog are discussed at the beginning of the project (Cervone, 2011). The main important roles that are involved in sprint planning meeting are scrum team, product owner and scrum master (Cervone, 2011). These main responsibilities are responsible for determining the goals as per the product backlog (Cervone, 2011). Sprint backlog comprises both sprint goals and plan (Cervone, 2011). After sprint planning meeting, sprint begins and the maximum time span for each sprint is 30 days (Cervone, 2011; Sliger, 2011). In each sprint, scrum master ensures a potential usable product as an output of the sprint (Cervone, 2011). Scrum master aims for incremental development during each sprint which is the main characteristic of all the agile project management methods (Cervone, 2011). Daily scrum includes scrum team members along with the scrum master in order to have a scrum meeting on day-to-day basis. These meetings are conducted to track the progress of the daily work and discuss the interruptions and accountabilities (Cervone, 2011; Schwaber and Sutherland, 2017). The team discusses the work they have done yesterday, work needs to be done today, interruptions and what result they get (Sliger, 2011). Each sprint is concluded with the sprint review meeting where the scrum team conducts self-evaluation and present it to the product owner (Cervone, 2011). During their self-evaluation, there is a large scope of understanding the strengths, weakness which lays a foundation for further improvements in the next sprints during the project plan (Cervone, 2011). Transparency, inspection, and adaption are the three pillars of scrum, which will be focused during this scrum review meeting (Sliger, 2011).

### 2.3.3 Kanban

Another method used in agile project management for software development focusing on delivery time is Kanban (Lei et al., 2017). Kanban method denotes clearly about what work needs to be done and when it needs to be done with the help of skilled set of developers (Ahmad et al., 2018; Lei et al., 2017). Project developers start by applying project components that add value and avoid unnecessary needs reducing time and effort (Brechner and Waletzky, 2015; Lei et al., 2017).

Kanban method works based on prioritizing tasks, defining workflow and completion of deliverables within the projected timeline (Ahmad et al., 2013; Lei et al., 2017). Kanban creates flexibility between tasks and reduces risks of task incompleteness helping in a continuous flow in the project (Ahmad et al.,
2013; Brechner and Waletzky, 2015; Lei et al., 2017). In an organisation, workflow varies through different states of the project (Ahmad et al., 2018). Kanban system uses visualization as main tool by using physical or virtual boards and cards (Ahmad et al., 2018). These cards help the team members to organize and carry out the work items with proper planning (Ahmad et al., 2018; Brechner and Waletzky, 2015). The limit in work in progress (WIP) determines the work flow progress and identifies the quantity of work that needs to be carried out at any given stage (Ahmad et al., 2018; Brechner and Waletzky, 2015). Flow is concerned with people, processes and culture and is measured using queue size, throughput time, cycle time and lead time. This method is one of the hardest concepts that are used to manage flow that can be represented using burn-down charts, value stream maps, Kanban board and cumulative flow diagrams (CFDs) (Ahmad et al., 2018; Brechner and Waletzky, 2015). These explicit policies help to clear the activities off the board one by one as they have got the entry and exit criteria. These also enables organisation to identify ‘cause and effect’ whenever changes are done and balance data. (Ahmad et al., 2018; Brechner and Waletzky, 2015; Lei et al., 2017). Certain models like theory of constraints, systems thinking and techniques like value stream mapping could help in continuous improvement opportunities (Ahmad et al., 2018; Brechner and Waletzky, 2015).

2.3.4 Challenges and benefits of agile project management

Corporate culture is the major hindrance for implementation of agile project management methodology (Cobb, 2011). The team members or the manager who work with traditional methodology have lack of understanding about the benefits and the design procedure of the agile as they carry same traditional way of working style (Fewell et al., 2009). This is an obstacle because it won’t allow successful employment of agile project management methods (Cobb, 2011). The management and leadership styles of many companies are not properly aligned to the agile project methodologies and to attain organizational commitment towards agile is difficult (Cobb, 2011). To shift from traditional methodology way of working style to agile in order to balance costs and have flexibility in an uncertain environment culture becomes another major challenge in implementing agile project management methodology (Cobb, 2011). In order to implement and adapt agile methodologies, it is important that there should be a great organization commitment from the business side to involve in the process and to attain the project success (Cobb, 2011). In agile project management, customer or sponsor should be available with the project team on a daily basis which is a great difficulty (Cobb, 2011). The project require an active client and customer and if proper customer commitment is not maintained there is a high risk of failure in the project (Bohem and Turner, 2004). Companies implementing agile project management have minimal documentation because of the continuous tasks and changes which is the major challenge while implementing the methodology (Bohem and Turner, 2004). Scalability is another challenge as the methodology is mainly applicable for small and medium-sized but not for large projects (Bohem and Turner, 2004; Sliger, 2011).

Agile project management improves the quality of the delivery output when they are applied successfully (Cobb, 2011). Flexibility in applying the agile project management methods helps to reduce the rework as it allows for adaption and provide a proper response to the iterations (Cobb, 2011). This methodology requires a great collaboration of the employee engagement leads to improved employee morale in the organization which stands as another benefit (Cobb, 2011). This methodology is meant to gain competitiveness and develop innovation through projects. Due to its approach of iterations and changes in the process, innovations can occur. (Conforto et al., 2016). Collaboration of end-users, project team, project managers, stakeholders leads to the overall success of the project by attains fast delivery output (Serrador and Pinto, 2015). Satisfying the stakeholder expectations towards the project leads to project success with great benefit (Serrador and Pinto, 2015).
2.4 Hybrid project management

The hybrid project management approach is often considered for projects to increase stakeholder feedback and reduce the risk and uncertainties (Archer and Kaufman, 2013; Jaziri et al., 2018). Though we attain numerous benefits from traditional waterfall and agile methodologies, project managers are still facing many challenges while implementing large scale projects (Bohem and Turner, 2004; Salum et al., 2014). The lack of effective usage of project management methodology leads to poor performance of the projects (McHugh and Hogan, 2011). The implementation of different project methodologies such as traditional and agile does not give the overall benefits what the project managers are expecting. A hybrid model was proposed by Hayata and Han to develop IT projects, by mixing both the agile-scrum and waterfall methodologies (Salah et al., 2017). Waterfall is used to specify requirements for the project and agile-scrum is applied during the design, implementation, closure(Salah et al., 2017). Waterfall methodology can be used in testing phase (Salah et al., 2017). Another flexible hybrid methodology was defined by Lozo and Jovanovic for managing IT projects has four different phases of project life cycle (Salah et al., 2017). The first and fourth phases of project life cycle are always in waterfall methodology and the second, third phases are in flexible/agile methodology (Salah et al., 2017). To implement flexible way of methodology, either waterfall or the agile methodology can be used (Salah et al., 2017). However, this depends upon the type of the project (Salah et al., 2017). As we have already discussed the challenges in implementing traditional and agile project methodologies, every organization has different management structures and project life cycles (McHugh and Hogan, 2011). So, one project management methodology does not fit all. Organizations needs to adapt the methodology which fits their business process and achieve project success (McHugh and Hogan, 2011). Hybrid project model is the solution for traditional and agile challenges, so it is called as “water-scrum-fall”. This is how hybrid model came into existence by combining both the traditional and agile methodologies in order to provide a solution for the project failures (Bohem and Turner, 2004; Fewell, 2017).

Hybrid approach is popular as it combines the structure from the traditional approach with the flexibility from the agile approach (Smith and Lewis, 2011). Combining both traditional and agile techniques resolve many situations in projects and can achieve success (Archer and Kaufman, 2013; Baird and Riggins, 2012; Fewell, 2017; Salah et al., 2017). Implementing hybrid methodology depends on the type of the project and its requirements (Fewell, 2017; Salah et al., 2017). By adopting hybrid approach, mix and match of techniques from traditional and agile model can be tried out for achieving working efficiency (Fewell, 2017).

When a project manager selects hybrid approach for a project they look up to the output solution as a complete picture made out of puzzles (Archer and Kaufman, 2013). The most commonly used process in an hybrid model consist of five phases, planning, initial requirements & design phases, iterative agile sprints, quality assurance and deployment. These five phases are shown in Figure 5 (Archer and Kaufman, 2013; Jaziri et al., 2018).

The project begins with the traditional waterfall model of planning (Archer and Kaufman, 2013; Baird and Riggins, 2012; Jaziri et al., 2018; Salah et al., 2017). During the initial analysis, joint application development sessions will be conducted (Archer and Kaufman, 2013; Jaziri et al., 2018). In order to have a clear scope of the project the design and the requirements were properly framed to lay a solid foundation (Archer and Kaufman, 2013; Baird and Riggins, 2012). During this planning phase the team members define and refine the design, requirements of the project by working with the client stakeholders (Archer and Kaufman, 2013; Baird and Riggins, 2012). In this phase 80% of the design and requirement are finalized and 20% will remain during the iterative sprints (Archer and Kaufman, 2013). According to the requirements which turned to logical work future sprint tasks will be defined by the team (Archer and Kaufman, 2013).
The iterations are planned in accordance with the defined scope, priorities, high level repeating finale design, build, and test (Archer and Kaufman, 2013; Baird and Riggins, 2012). For every three weeks over a seven-month duration period the iterative development sprints will be scheduled (Archer and Kaufman, 2013). Hybrid approach recommends for scope bound iterations which means planned scope of first iteration gets completed before starting the second iteration in order to verify the committed scope, dependencies are managed perfectly as per the schedule (Archer and Kaufman, 2013; Baird and Riggins, 2012).

Figure 5: Hybrid waterfall and agile approach (Archer and Kaufman, 2013)

Individual system tests are conducted during each sprint (Archer and Kaufman, 2013; Baird and Riggins, 2012; Sliger, 2011). After the tests the integration testing are conducted based on the used cases, relative system (Archer and Kaufman, 2013). In each sprint the development team releases working build, and this is tested. Each sprint provides potential thin slices (Archer and Kaufman, 2013). During each sprint partial UAT (User access testing) which is user acceptance testing represents about the involvement of the client during the testing process in each sprint (Archer and Kaufman, 2013; Sliger, 2011). The client reviews accept the integration test scripts which were created in each sprint and this is executed during the UAT (Archer and Kaufman, 2013; Baird and Riggins, 2012; Sliger, 2011). This process could be done rapidly with collaboration of design and the development team as they receive feedbacks and adapts themselves to the concepts which are framed (Archer and Kaufman, 2013).

Before the final go-live dedicated test cycles are conducted and defects are managed to get the final solution (Archer and Kaufman, 2013; Baird and Riggins, 2012). Functional, performance, integration, usability, UAT testing are the testing cycle which were included in this phase (Archer and Kaufman, 2013). The solution is deployed after the quality assurance is completed (Archer and Kaufman, 2013; Baird and Riggins, 2012).

There is a high level list associated within the technical dimension in implementing the stages are stage charter, work break down structure, scope, stage management plan, schedules, costs, quality plan, status reports, and risks (Jaziri et al., 2018).

2.4.1 Challenges and benefits of hybrid project management

Combining traditional and agile leads to some unavoidable adjustments in practice as they have different ways of managing projects and difficult to achieve (Batra et al., 2010). When waterfall and agile approaches are used side by side, it is viewed quite challenging because it can create conflicts in the
organizational levels. Disturbance in organizational levels is due to the opposing principles and assumptions of waterfall and agile methodologies. (Dikert et al., 2016). This is more evident when a traditional organization adapts agile project management (Dikert et al., 2016). There will be development process conflicts, people conflicts, business conflicts in an organization when agile is adapted in traditional organization (Bohem and Turner, 2004). Continuation of sprint timelines will be challenging if the tasks run late (Archer and Kaufman, 2013). It takes time to adapt to new methodology and learn (McHugh and Hogan, 2011). The organizations when trying to implement new methodology they face many challenges with team members who don't want to change from internally used and developed their previous methodology (McHugh and Hogan, 2011).

There have been some research concerning benefits of hybrid project management, for instance flexibility for project member during their work, mitigation of rework due to data transparency and so on (Cram and Marabelli, 2017). Performance aspects such as commitment, leadership, information accuracy were increased due to the adoption of hybrid approach (Salum et al., 2014). Higher success rates and reduce costs have been achieved in certain software projects by following practices of hybrid project management (Imani et al., 2017). Flexibility is the major benefit of hybrid project management methodology and this is the major challenge of traditional projet management methodology (Serrador and Pinto, 2015). Flexibility reduce rework and allow responsiveness to changes in project management (Serrador and Pinto, 2015). Reduce rework results in efficiency and responsiveness to change results in flexibility which are the major benefits of hybrid project management methodology (Serrador and Pinto, 2015).
3 Methodology

In order to find an answer for the formulated research questions we have chosen qualitative research method as this helps in understanding people’s behavior, experiences, and interactions (Pathak et al., 2013). Interview studies is a category in qualitative research helps in focusing on research questions approaches (Crescentini and Mainardi, 2009; Pathak et al., 2013). The empirics and discussion are based on semi structured interviewees interactions which laid the base to investigate why hybrid project management methodology is adapted in projects and how this hybrid methodology is implemented in organizations.

3.1 Primary data collection

This qualitative research study based on interviews helped in collecting data and analyzing them. Qualitative methods are supervised by a set of coherent rules and provide an opportunity to explore new issues (Bhattacherjee, 2012; Greener, 2008; Pathak et al., 2013). An interviewer should prepare the questionnaire in advance to achieve the aim of the research study (Crescentini and Mainardi, 2009; Greener, 2008). The interviews can be conducted in structured, semi-structured and unstructured (Crescentini and Mainardi, 2009; Greener, 2008). In structured interviews, a prior set of questions will be framed and there is no flexibility to go beyond that whereas in semi-structured and unstructured interviews there will be more flexibility in building up the conversation and it is possible to ask new questions (Crescentini and Mainardi, 2009; Greener, 2008).

In this research study, we conducted semi-structured interviews and the questionnaire is attached in the appendix. The problems involved in qualitative analysis while collecting data from interviewees and transcribing them were time, cost and method as reported before (Crescentini and Mainardi, 2009; Greener, 2008).

Digital recorders were used during our interviews as audio tapes were helpful in analyzing the data. (Greener, 2008) Prior notice to the interviewee requesting permission for recording were obtained before recording the interview.

We used semi-structured interviews because this is more suitable for our research study as it creates more flexibility during the interview situation. These semi-structured interviews could help us to know more about interviewees working experiences. As interviewers, we focused on our behavior by keeping ourselves open, clear, gentle and sensitive. The critical aspects that were shared about the project by the interviewees were not disclosed as per the interviewees request. We have conducted nine interviews by means of a phone call in various geographical locations which includes project manager, project lead and project member working on hybrid projects for their organization.

3.2 Secondary data collection

We have read from articles, scientific journals, project management institute and research gate to orient ourselves in relation to ongoing research in the field of project management and a way to develop a literature review for the analysis. Uppsala University library helped us to find more relevant articles for this research study. Google scholar is another search engine that we used to find the appropriate articles. Some of the keywords that we used in our search engine are, “traditional project management”, “traditional project management and agile methodologies”, “agile”, “scrum”, “kanban”, “hybrid project management”. We have studied approximately thirty plus articles based on traditional and agile
methodologies, however, we have identified few articles around eight to ten on hybrid project management through which we have developed a literature review for the analysis.

3.3 Interviewee selection

For this research study, we wanted to interview project managers, team leaders and the corresponding team members with more than five years of experience in software organizations who worked with both traditional, agile methodologies and the combination of the two. As the hybrid methodology is still a new emerging methodology, it became quite difficult for us to get many interviews. However, we still tried and managed with our chain of contacts from the software organizations and finally collected the interviews from three major organizations.

Table 2: Information about the interviewees

<table>
<thead>
<tr>
<th>S.no</th>
<th>Interviewee</th>
<th>Age</th>
<th>Experience</th>
<th>Location</th>
<th>Type of interview</th>
<th>Duration (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project manager 1 (PM1)</td>
<td>45</td>
<td>15</td>
<td>India</td>
<td>phone call</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>Team leader 1 (TL1)</td>
<td>32</td>
<td>6</td>
<td>India</td>
<td>phone call</td>
<td>27</td>
</tr>
<tr>
<td>3</td>
<td>Team member 1 (TM1)</td>
<td>27</td>
<td>3</td>
<td>India</td>
<td>phone call</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>Project manager 2 (PM2)</td>
<td>40</td>
<td>11</td>
<td>United States of America</td>
<td>phone call</td>
<td>57</td>
</tr>
<tr>
<td>5</td>
<td>Team leader 2 (TL2)</td>
<td>37</td>
<td>7</td>
<td>United States of America</td>
<td>phone call</td>
<td>34</td>
</tr>
<tr>
<td>6</td>
<td>Team member 2 (TM2)</td>
<td>29</td>
<td>5</td>
<td>United States of America</td>
<td>phone call</td>
<td>25</td>
</tr>
<tr>
<td>7</td>
<td>Project manager 3 (PM3)</td>
<td>38</td>
<td>9</td>
<td>Sweden</td>
<td>phone call</td>
<td>47</td>
</tr>
<tr>
<td>8</td>
<td>Team leader 3 (TL3)</td>
<td>33</td>
<td>6</td>
<td>Sweden</td>
<td>phone call</td>
<td>23</td>
</tr>
<tr>
<td>9</td>
<td>Team member 3 (TM3)</td>
<td>28</td>
<td>5</td>
<td>Sweden</td>
<td>phone call</td>
<td>18</td>
</tr>
</tbody>
</table>

Above table 2, provides the details about interviewees location, age, experience and so on. We interviewed three project managers, three team leaders and three team members about their implementation of hybrid methodology in their projects from three different software organizations. PM1, TL1, TM1 are working for organization 1. PM2, TL2, TM2 are working for organization 2 and PM3, TL3, TM3 are working for organization 3. All the interviewees are working on hybrid methodology in their respective projects. All these software organizations are working on different types of projects with hybrid methodology. We have chosen the software organizations that are working on hybrid project management and conducted interviews who are working in the United States of America, India, and Sweden.

3.4 Design of the interview

We sent an email about our research study to all our nine interviewees and asked their time to share their experiences through an interview. We also notified them about the interview recording and asked their permission for recording the interview. All agreed for recording the interview however one project manager from the United States of America refused to provide project details as he informed that is more confidential. Due to the interviewees’ request, we maintained their information confidential and anonymous. Phone interviews are conducted due to location constraint. Digital recorders were used to record the interview due to our flexibility for further usage in transcribing the data. All the interviews
were conducted in English and the time of interviews ranged between 30 minutes to 1 hour. The questionnaire guided us to maintain the focus on the research.

The main aim of this interview conducted was to investigate how the hybrid methodology is adopted in a project according to hybrid project management requirements. Interview questions are attached in the appendix. Before directly focusing on hybrid methodology we wanted to know how they switched from waterfall methodology to agile methodology and agile to hybrid methodology. So, the first and the second question we asked about the working of waterfall and agile methodology, benefits and challenges. Third and fourth question we asked about how the interviewees define hybrid methodology and why are they adapting hybrid methodology. Fifth and sixth question focused on implementation process and tools they use to implement the hybrid methodology. Seventh question addressed on challenges and benefits. Eighth and ninth question addressed about their professional experience details.

3.5 Data Analysis

The collected data needs to be analyzed and filtered out accordingly to answer the purpose of the research study (Bhattacherjee, 2012; Greener, 2008). We personally transcribed the data instead of using any software to make ourselves more attentive and build a structure by identifying data from the interviews that we have conducted. It is hard, time-consuming to analyze the data collected from the interview at the start as the interview has a large amount of data which needs to be analyzed (Recker, 2012). The aim of this research study is to analyze how hybrid methodology is adapted in projects. The transcribed data has been formed as a summary under empirical findings. Next, collected data is analyzed and discussed in the findings. Further, we conclude with a suggestion or a result from the analyzed data answering the formulated research questions.

3.6 Research Quality

To attain quality in this research study, a sharp focus on reliability, validity, and ethics were strictly maintained.

Reliability plays a vital role in research and the research study should be as transparent as glass so that the reader can use these results for further studies or reference (Crescentini and Mainardi, 2009; Greener, 2008; Pathak et al., 2013). In other words, it needs to be repetitive and consistent. We framed questions that need to be asked in advance of our interviews to ensure reliability for our research study.

Validity helps in measuring the quality of research. The collected data helps in answering the research question ensuring validity (Bhattacherjee, 2012; Crescentini and Mainardi, 2009; Recker, 2012). To ensure the validity in our research we have sent the summary of the interview to the interviewees so that they can add, modify more information or delete some confidential sensitive data.

Ethics correlates to moral choices which affect standards, decisions and behavior (Bhattacherjee, 2012; Greener, 2008). We thoroughly followed guidelines and approached the right people for the interview. We asked prior permission from the interviewees for recording the interviews to maintain transparency. We gave assurance to interviewees in keeping sensitive data confidential. Have provided our full information to the interviewees of our research. We provided flexibility to the interviewees for sharing their views about their projects.
4 Empirical Findings

In this empirical finding, we have summarized about the discussions that we had in our interview about the working of hybrid project management in three different software organizations. Interviewee details such as personal name and the company are kept anonymous. We have conducted interviews from project managers, team leads, team members working for three different projects. Further, we are going to address them as PM1, TL1, TM1 from organization 1, PM2, TL2, TM2 from organization 2 and PM3, TL3, TM3 are from organization 3.

The empirical data has been presented as transformation to hybrid in three different software organizations under section (4.1 - 4.3). This would also explain about the working of waterfall, agile and hybrid methodologies in these software organizations. This could help us in understanding about the benefits and challenges faced in these methodologies by these organizations. The empirical data from interviews explains about the transitions from waterfall-agile-hybrid in these software organization working on hybrid projects.

4.1 Organization 1: Transformation to Hybrid methodology

The following illustration presents the transformation from waterfall to agile methodology. Organization 1 follows the structure of pre-requirement phase, requirement phase, design and build, implementation phase, execution phase and closure phase in waterfall methodology for most of their projects. Scope created in organization 1 is based on user requirements and bounded with stringent timeliness. Tools used by organization 1 would be “Clarity tool” and “Microsoft plan” to track the plan along with the timeline in the waterfall method. Organization 1 uses waterfall methodology for small projects where the requirements for the project and documentation are clear as they turn out to be beneficial in time and money. The problems faced by organization 1 would be scope creep when project deliverables are not planned accordingly leading to extension in timeline and raising the cost of the project. Organization 1 also faced challenges when changes had to be made in any phase causing a lot of rework and delay in the project. Organization 1 also stated that the unavailability of an experienced subject matter expert along with the project manager failed in helping them to frame the scope by understanding clearly about the project requirements. The lack of flexibility and rework caused due to scope creep was the reason behind their transition to agile methodology in organization 1. PM1 from organization 1 informed that:

“Waterfall methodology is a structured process with framed scope. Due to its clear scope the end result, budget, timeliness will be easily predictable. Change management is a big headache for this type of methodology because if the business comes back and changes the scope of the project before 4- 5 months of execution it will be very hard to rework again.”

The following illustration presents the transformation from waterfall to agile methodology. The project team (PM1, TL1, TM1) use kanban agile methodology. They have iterations in the process and conduct daily meetings with 15 minutes time bound. Each iteration is to be completed within 2-4 weeks. The two main meetings are kanban delivery planning meeting which they have for every month where they discuss the deliverables and think about the ongoing tasks that they need to deliver for the next four weeks. Another is backlog roaming meeting where they meet every week and discuss how many deliverables such as user stories can be delivered. They use agile central which is from computer associates’ company and the RALLY tool to track the work progress. As a consequence, data analysis has become easy and more transparent about tasks have been achieved. Organization 1 by using Kanban has minimized rework and increased quality in the deliverables. Internally within the organization due
to large projects there was difficulty in implementation. They also faced difficulties in Kanban agile methodology in conducting meetings globally and communications with remote team. Organization 1 understood that pure agile would not work for all projects, thus they wanted to try something new as a combination of both waterfall and agile process leading to the transition to hybrid methodology. Because of the above challenges and also from the realization that pure agile will not work for all projects, organization 1 wanted to try something new and this is how they came up with the combination of waterfall and agile process as hybrid methodology. PM1 from organization 1 informed that:

“Agile is more flexible and responds to the iterations. Due to the iteration process, it made things more flexible and fun and no headache of change management. Organizational commitment will always become a challenge for large projects and conducting agile ceremony’s with the remote teams will become an issue as they will be in different time zones.”

The following illustration presents the implementation of hybrid methodology. Before transforming to the hybrid methodology, they found that pure waterfall and agile will not be applicable for all projects and moved to hybrid methodology. Their main reason for the adoption of the hybrid methodology is the extra work load when conducting an agile process where they used to spend time on the whole process along with the core team. The transparency of the activities that were performed from a team member and the data transfer helped them in reduced the rework. Organization 1 transition to hybrid methodology was a result from the previous experiences of waterfall and agile methodology. Hybrid methodology was created by using the strengths of both these methodologies with understanding of their challenges. Organization 1 worked on trial and error combinations using waterfall and agile methodologies phases to form the combination for hybrid methodology. They (PM1, TL1, TM1) implement hybrid methodology by following pre-requirement phase, requirement phase, execution, and closure phase from waterfall methodology whereas design and build, implementation phase from the Kanban agile methodology. PM1 from organization 1 stated that the areas which are controlled by stringent timeliness would use waterfall methodology and the areas where flexibility is available agile-Kanban is used. The areas not under their control are independent teams such as purchase teams and finance teams. As project teams have their own service line agreements (SLA’s) to work on, project managers cannot influence them to work quickly. Here project managers power of authority will not influence on the product delivery SLA’s or task resolution. Because certain product delivery tasks have different SLA time periods. PM1 informed that

“Hybrid methodology is the implementation of flexible stages of both the waterfall and agile into one methodology. It did not take in one go. For 6-7 months we had transformation coaches who have 15-16 years of working experience on various methodologies worked on trial and error method and formulated the best out of those. As we could see the actual benefits out of this, we have adapted for this hybrid methodology.”

PM1 stated that implementation of hybrid methodology took some time. They have done several changes in their implementation process and all these changes were under the supervision of their transformation coaches. Their transformation coaches are working on hybrid methodology implementation full-time and provided a lot of suggestion regarding how to combine traditional and agile methodologies. The main reason for the adoption of the hybrid methodology is the extra work load when conducting an agile process where they used to spend time on the whole process along with the core team. The transparency of the activities that were performed from a team member and the data transfer helped them in reduced the rework. TL1 stated that:

“Transparency of the data is open from top management to bottom level and the usage of agile central tool helped them to know how much a percentage of work a person is occupied with and is there any
need to assign the work to other will be updated clearly which relaxes us from extra work which influenced to adapt to hybrid methodology’.

They use agile central tool from Company X (company name of the tool). The tool is available for everyone working in that proposed hybrid project. This tool helped them to know about which activity is assigned to whom, complete details of the project activities etc. The outcomes of months of trial and error on various projects conducted by experts has resulted in project phases of hybrid methodology such as planning, implementation phase, execution, closure. Planning phase works in accordance with waterfall methodology which includes the pre-requirement phase and requirement phase. In the planning phase they try to understand the market requirements and develop a new business model for their launch. They do impact analysis after understanding the market requirements and analyze how the new model that they launch impact the applications. This analysis goes on for 2-3 months for small projects and a year for large projects. Next, the project is handed over to the implementation team where the team starts detailing the requirements as they receive high-level data and start implementing at the site. Project starts by writing of the Project charter which kick-starts the project, and this takes about 2-3 months. The project charter is kept open to all who are involved in the project. During this planning phase, there are many other external stakeholders, suppliers, vendors which are involved in the project. These people are very important as they bring their services, hardware, servers, licenses which needs to be purchased.

The purchasing process will be managed by the purchasing department which the project team cannot influence due to SLA’s (service line agreement). It will take between 8 to 12 weeks to deliver the hardware. The project charter, however, cannot reveal purchasing details and finance issues as these are under the control of finance and purchasing departments.

Next comes the implementation phase which works according to kanban methodology. They are using RALLY tool which is in other words called agile central. This tool is helping to track the activities about how much amount of work a particular team member is occupied and the percentage of work that is done. Due to this tool the data analysis became easier. In everyday standup meetings the status of the work and the work plan is discussed. PM1 informed that

“We have a time bound of 15 minutes for standup meetings that we will conduct on daily basis and as a Project manager I observed that the team are more enthusiastic, energetic when explaining about the project work details.”

Kanban delivery planning meeting is conducted every month. The team should plan their deliverables about what they are going to deliver in their next four weeks of iteration period. All these will be recorded as user-stories in the RALLY tool (Agile central). They must think beyond the current iteration and think about what they are going to deliver in the next two iterations. The iterations are generally referred to as sprints and help in creating an appropriate backlog. They also use the backlog roaming meeting to inform about how many user stories that they are going to deliver. There will be a demo at the end of the iteration regarding what they have done in the past to be discussed. Later retrospection will be carried out where they discuss the activities which went well, which did not go well, which needs to be improved. The product owner is the representative from the business side and works closely with the team and is available on a daily basis to monitor the activities which are delivered. Here product owner will give prioritization for all the works and have complete authorization to change the priority. Here, service managers, agile team facilitators ensure that all the metrics are met.

In the execution phase, the project manager checks whether they have met the milestone and arrange a business meeting to discuss their deliverables and sign off the process. Later they inform the support team within IT about what they have done and what the support team needs to do further on. In the
closure phase the project manager ensures all the sign-offs are obtained and other financials are closed. They try to disengage some resources, suppliers and conduct a formal closure meeting to close the project. The execution and closure are done according to the the waterfall method.

According to interviewees from organization 1, challenges of the hybrid methodology were acceptance to the change at the beginning of the project, product owner availability and iteration period. Acceptance to change from agile to hybrid methodology by team members were difficult as they had to understand to the combination of waterfall and agile methodology phases and their working for the specific project. The second challenge regarding the product owner availability all the time as they had to look into multiple projects or their own business activities. The iteration period will sometimes become difficult as they would be short to fix the complex tasks or unavailability of project members. As a results certain complex tasks would be moved to the next iterations.

According to interviewees from organization 1, benefits of the hybrid methodology were data transparency, flexibility, development in delivering values to the project and mitigation of rework. As per the interviewees, data transparency mitigated the rework and informed us that results can be evident in 3-4 weeks. Flexibility is another benefit where they are adopting different stages and informed that it is working well. The team is giving development in delivering values to the project which is another benefit of hybrid methodology. Daily sprint meetings, sprint review meetings help them to track the progress of the project and their deliverables. Hybrid mitigated the rework because of the agile central tool which is open to all and gives them the timely status.

4.2 Organization 2: Transformation to Hybrid methodology

The following illustration presents the use of waterfall methodology in organization 2. Organization 2 follows initiation phase, planning phase, execution phase, and closure phase used in the waterfall methodology. There needs to be a clear scope and goal for the project in waterfall methodology. Scope would explain about what is included in the project and what are the activities that needs to be completed to reach the goal. A clear scope would enable the access to both financial and human resources allocated from top management for the project. Therefore, project charter needs to be summarized about why they are doing the project and about the happenings in the project. PM2 from organization 2 informed that

“A project with a clean project chart with well-defined scope. Every person who is involved in this project should have a clear understanding of the scope and should strictly follow that not to think out of the scope. A major advantage is you know what you are doing, what you are going to deliver and work towards one goal.”

Implementing waterfall methodology in a project helps in identifying the budget, time required to attain the goal and the resources required for the project which are important for handling a project. The waterfall is beneficial as it has a clear transparent scope and will construct the work details strictly from the start of the project. They maintain clear documentation from start-end for the current project and the previous projects which would help them in analyzing for their next projects. The challenges mentioned by the interviewees are lack of innovations due to the work is strictly directed by its scope. Lack of flexibility and stringent timeliness is another challenge with the waterfall methodology. The last challenge relates to if something needs to be added, modified, deleted which causes change in the scope which is challenging using waterfall methodology where no changes are allowed in the middle of the project.
The following illustration presents the use of agile-scrum methodology in organization 2. Organization 2 follow agile-scrum methodology. According to the interviewees from organization 2, Scrum is flexible as it doesn’t have to follow any formal process. No traditional work breaks down structure, no project charter, no charter approvals is used, instead they have sprints in the process and conduct 15 minutes daily meetings. For each sprint to complete there will be 2-4 weeks or 6-8 weeks of time depending upon the size of the project. The two main meetings in agile are daily scrum meetings and sprint zero meetings. In daily scrum meetings they discuss about what are they going to do today, what they accomplished yesterday, and are there any issues to resolve. The interviewees also explained for sprint zero meetings they invite every person who is involved in the process and explain to them about the process of implementation of agile in the project. This explains about the ceremonies conducted by organization 2 in agile-scrum methodology in their software projects. TL2 from organization 2 informed that

“No one owns something entirely. Everyone works in their own space with the tasks allocated. We use the burn-down chart. When we start with our tasks it will be 100% and when we complete it will become 0% which is just exactly as energy consumption”.

They informed that it is fun, easy, flexible to work with agile. Due to iterations in the process, it creates interest to think outside of the box, that is how they are exploring new things. Project quality with efficient deliverables has improved with the use of agile methodologies. This also reduced rework and improved team members morale. Main challenges mentioned relates to the unclear outcome as well as unsupportive management because higher management wants to know about time, budget, resource in detail which is not clear in agile. Due to unidentifiable budget, unclear goal and project completion time as they are unclear in agile would create conflicts between project manager and higher management. These conflicts would develop work pressure for the project team members in organization 2. As there is minimal documentation available for the activities in the projects. This becomes another challenge in agile-scrum methodology for organization 2.

The following illustrates the implementation of hybrid methodology in organization 2. The reason behind adoption of hybrid methodology by organization 2 were the possibility to be flexible due to market trends and customer requirements. Organization 2 interviewees informed that the implemented hybrid methodology follows the following lifecycle stages; initiation phase, planning phase, execution phase, and closure phase. For initiation phase and the planning phase, the waterfall methodology is used whereas for the execution phase and closure phase they use agile-scrum methodology. PM2 from organization 2 informed that

“Mixing of any stage from waterfall and agile to meet your requirements would create flexibility for working. As we are working for a software company all we need is flexibility to innovate in our output and meet the customer requirements by following the market trend.”

According to PM2, it is important for them to think about, following market trends and customer requirements. In order to meet their project requirements, they needed to change their mindset for trying something new. So, they tried working on combining the best from waterfall and agile into one as hybrid methodology. This hybrid methodology added value to the quality of deliverables in each sprint which they are happy about. As team members change their mindset to try something new which allowed them to brainstorm and encouraged new ideas. In this way hybrid methodology added value to the quality of deliverables.

In the initiation phase, they use a project charter consisting of the objective of why they are doing the project and clearly defining the scope of the project. A well-experienced team leader and a project
manager are important for defining the scope. When working with a combination of both the methodologies it is important to have a project manager, team leader, team member who are experienced in both the waterfall and agile methodologies. As they are working with hybrid methodology the scope is not well-defined as scope changes when the requirement changes. In this phase, they prepare a clear communication plan which tells how they would update the stakeholders, suppliers, vendors, etc., and conduct meetings. They use the project triangle during initiation phase when defining the scope.

Next is the planning phase where they sit and plan the tasks using a work break down structure. After they complete with work break structure, they use precedence diagram, where critical path shows the dependencies between the activities. This precedence diagram gives the details of the earliest start, earliest end date, latest start, latest end date. The implementation phase works according to scrum methodology. They create backlogs whatever comes into mind and divide them as sprints. A sprint can be 2-4 or 6-8 weeks depending upon the size of the project. They make projections such as by this sprint this task will get completed and then the other or can be sometimes parallel sprints. These parallel sprints won’t work in pure agile but in hybrid according to their flexibility, they can work on parallel sprints. They call the requirements user stories which they put in backlogs and comprising all these requirements as backlogs is called as the product backlog. They also have daily scrum meetings not exceeding 15 minutes. Here each and everyone come and share their task details. For daily scrum meetings, they have a product owner, project manager and they follow sprint review meetings after each sprint and conduct retrospectives which is helping them to know about the failures and the lessons learned from the sprints that they worked on. They are using smart sheets to track the activities which is a convenient tool. Due to the flexibility, they have high chances to think beyond the scope and introduce innovating solutions keeping up with the market trend. The product owner is the representative from the customer side who decides when the task is done. In the execution phase, they can implement new things and modify the scope of the project. This phase has a lot of involvement from different departments as they can experiment and innovate in the project. In the closure phase, deliverables are checked as well as milestones.

According to interviewees from organization 2, challenges they faced with hybrid methodology was that every project that they worked on hybrid was an explain with no clear knowledge of time, budget or resource compared to traditional methodologies. The customer has no experience or minimal knowledge about this hybrid method and leads to miscommunication. Learning new technology and methodology takes time and require a lot of commitment from the project team.

According to interviewees from organization 2, benefits from hybrid methodology are flexibility and experimentation and learning from mistakes during the phases in the project. Due to flexibility they have high chances to explore in their tasks. In this way they had an opportunity to experiment in their project tasks. They learn from their mistakes while handling the project. More than the individual goal for the project members, project goal is what matters and defines success for the project team. Due to the use of hybrid methodology there is a change in team members mindset, which improved efficiency and create value in their productivity due to the availability of flexibility for the team member in the project.

4.3 Organization 3: Transformation to Hybrid methodology

The following illustrates the use of hybrid methodology in organization 3. The interviewees from organization 3 don’t call it hybrid methodology, as they have just combined the strengths from waterfall and agile methodology for their benefit of time reduction and efficient goal outcome. Later they analyzed and found out that in project management terms they are followed as hybrid methodology. The projects in organization 3 need a combination of structure and flexibility that is why they decided to use hybrid methodology. Earlier the selection of agile or waterfall methodologies
were dependent on tool availability and size of projects for organization 3. Due to the availability of combination of both these methodologies they develop softwares within a month whereas usually they take around 2-3 months using pure waterfall or agile methodologies. Interviewees from organization that there was enormous time reduction in activities and project outcome were more efficient.

According to interviewees from organization 3 the phases they followed was initiation, planning, implementation phase, closure phase. Initiation, planning phase, closure phase works according to waterfall whereas implementation phase works according to agile. In the initiation phase, they gather information regarding project requirements. They use project charter which indicates the start of the project and they do an impact analysis. In the planning phase, they will set up clear plan regarding the resources. In this phase, they conduct a peer committee meeting with all the stakeholders, suppliers and everyone who is involved in the project to discuss about their software deployment. Next in the implementation phase they use an agile process. Every month they have steering committee meeting where they take major decisions regarding the resources. Once a week they have a core team meeting where we discuss about the project ongoing tasks and every two weeks, they have a meeting with the local team where they discuss the resources for instance if they want more support from the local team etc. Every Thursday or Friday they have issue log call where they discuss the issues which they receive and on-going activities. The tool is open to all who are involved in the project. They work in parallel which means when this project is in the implementation phase for country x, they simultaneously start their planning for country. In closure phase they use waterfall and they show their planning and resources to the client. They should provide software and the fixed user training sheet to the steering committee. Here, the steering committee requires the final deployment date of the software. The closure phase in organization would follow waterfall methodology as the learning from the project can be identified.

According to interviewees from organization 3, challenges with hybrid methodology is communication with the remote team and lack of proper communication leads to disturbances from higher level management to lower level. Communication with remote team is hard because all the remote teams work in different locations with different time zones. As they work in different locations its hard to gather all the team members for a meeting irrespective of time zones. Requirements gathering is also a big challenge as any missed requirements may lead to rework.

According to the interviewees from organization 3, benefits of hybrid methodology was improved commitment towards the project and improved accuracy in the product delivered. Moreover, a reduction of time, increased flexibility as also mentioned as benefits. Also, the efficiency of the working team increased. Understanding the capability of resources and using them appropriately turned out to be beneficial as they reduced cost and usage of time. Availability of flexibility within project helped team member innovate and experiment in project enhancing the work outcome.
5 Analysis

In this chapter we will discuss the empirical findings with the help of the literature review presented in chapter 2. This analysis is an attempt to bridge the theory with practice regarding implementation of hybrid project management methodology. More specifically, each research question will be answered by using the literature and the collected empirics.

RQ1: Why is hybrid methodology used in projects?

Adopting waterfall and agile methodologies in organizations are beneficial according to the growing trend in the market to meet user requirements with the flexibility (Archer and Kaufman, 2013; Fewell, 2017; Jaziri et al., 2018; Salah et al., 2017). All the interviewees stated that flexibility is the main reason to adopt hybrid methodology. PM1, TL1, TM1 working for the organization1 explained that they adopted the hybrid methodology for flexibility, data transparency, potential benefits, reduced time, market trend, user requirements. In organization 2, PM2 explained that they adopted hybrid methodology for flexibility, to follow the market trend, meet user requirements. While PM3 informed that they adopted hybrid methodology for flexibility, potential benefit, reduced time.

Flexibility and adaptability were identified as a major reason of using a hybrid PM approach. Appropriate allocation of work to the team members helps in reducing the iteration time. Our analysis revealed the reason for adopting hybrid methodology by project managers as flexibility for project team members in order to increase possibility to innovate and experiment with efficient project outcomes. As hybrid methodology does not have clear scope defined in the beginning it is hard to have an idea regarding the resources, budget, time etc. Our study show that adoption of hybrid methodology can lead to innovations as team members are given the possibility of flexibility in their work and therefore think beyond the scope and the goal of the project. This helps in keeping up with the market trend and customer requirements for the hybrid project.

There have been some research concerning benefits of hybrid project management, for instance flexibility for project member during their work, mitigation of rework due to data transparency (Cram and Marabelli, 2017). Flexibility reduce rework and allow responsiveness to changes in project management (Serrador and Pinto, 2015). Reduced rework results in efficiency and responsiveness to change results in flexibility which are the major benefits of hybrid project management methodology (Serrador and Pinto, 2015). Our study coincided with the literature review statings showing the reason behind adopting hybrid methodology was data transparency which helped in mitigation of rework for the team members. The reduced rework and flexibility enhanced the efficiency while working in hybrid methodology. Allocation of appropriate work by knowing their strengths to project team members can increase work efficiency and reduce iteration time. Due to good understanding and communication within the team members helps in attaining the deliverables within the time frame. Performance aspects such as commitment, leadership, information accuracy were increased due to the adoption of hybrid approach (Salum et al., 2014). Higher success rates and reduce costs have been achieved in certain software projects by following practices of hybrid project management (Imani et al., 2017). The availability of flexibility helps in developing and increase the commitment for the project members. Thus, Flexibility and adaptability were identified as a major reason of using a hybrid PM approach.

RQ2: How is hybrid methodology used in projects?

The challenges faced by using new project models would be learning new methods require more dedication and support from the team members. Learning new methods to adopt would be a time-consuming process for the team members. The iteration period and phases of the project along with
necessary resources should be planned properly in project models with unknown goals. Any project model where team members working in different time zones would have communication problems or unavailability of support at any time for the project. Higher management should understand the project requirements and chooses the type of methodology to work on the project.

Interviewees discussed different ways of combining the waterfall and agile methodologies. Waterfall and agile methodologies are two different approaches. Organizations combines the best of two methodologies to form a hybrid approach. Our study showed that the project manager from the organization forming the hybrid approach requires an in-depth knowledge of both traditional and agile methodologies. The project manager should also know the requirements of the project along with advantages and disadvantages of methodologies could help in enhancing a smoother flow in the hybrid approach. They also discussed that they require flexibility when implementing projects. Combining both the methodologies results a great positive impact on project in terms of balance stability, flexibility which became a potential solution for many technology based companies (Conforto et al., 2016). There are five stages in project life cycle initiation, planning, executing, monitoring, closure (Salah et al., 2017; Tonnquist, 2012). Organization 1 follows planning, implementation, execution, closure. Organization 2 follows initiation, planning, implementation, and closure phases. Organization 3 follows initiation, planning, implementation phase, closure phase. All the above organizations follow different project phases. To implement hybrid methodology project managers, combine both waterfall and agile methodology phases into one methodology according to project requirements.

There are many ways to combine different stages to manage project work. The phases involved are purely waterfall or agile but not the combination of both. Below are some of the ways how they combine different phases when mixing waterfall and agile methodologies.

- Initiation, planning, execution, closure according to waterfall and implementation according to agile
- Initiation, planning according to waterfall and implementation, execution, closure according to agile
- Initiation, planning, closure according to waterfall and implementation, execution according to agile.

The working efficiency and success of the project depends on an individual who should have proper understanding of the tools and activities to ensure the process (Kannan and Jhajharia, 2014; Tonnquist, 2012). Our study showed that in organizations there is a lack of unified definition regarding resources and tools in project management. Such companies work with flexible tools and go with easy adapting tools which satisfy their needs (Integration of classical and agile project management methodologies based on ontological models). Some of the tools that these organizations use in their phases are agile central, smart sheet, project place was mentioned by the interviewees for hybrid methodology.

Our analysis shows that, project managers work with combination of waterfall and agile according to their flexibility and adaptability of team members. Hayata and Han, proposed hybrid model to develop IT projects, by mixing both the agile-scrum and waterfall methodologies(Salah et al., 2017). Waterfall is used to specify requirements for the project and agile-scrum is applied during the design, implementation, closure(Salah et al., 2017). Waterfall methodology can be used in testing phase(Salah et al., 2017). The areas which are controlled by stringent timeliness would use waterfall methodology and the areas where flexibility in timeline is available agile is used. Our analysis also revealed that different organizations have flexibility in different areas. So, the particular phases of the project life cycle are not fixed and depending on the requirements for the project their phases are aligned with
waterfall or agile. Hence organization flexibility and depending on the understanding of the phases involved in the project helps in adoption of hybrid project management methodology.

Our analysis revealed that, combining the waterfall and agile varies between project and the way that a project manager wants to implement the methodology in accordance with project requirements. Lozo and Jovanovic defined flexible hybrid methodology for managing IT projects which has four different phases of project life cycle (Salah et al., 2017). The first and fourth phases of project life cycle are always in waterfall methodology and the second, third phases are in flexible/agile methodology (Salah et al., 2017). To implement flexible way of methodology, either waterfall or the agile methodology can be used (Salah et al., 2017). However, this depends upon the type of the project (Salah et al., 2017). It purely depends upon the project managers flexibility in handling the project. This analysis showed that as agile is iterative carrying out implementation phase would be more common using agile than waterfall. Hence this helps in deciding the phases of waterfall or agile in a project for adoption of hybrid project management methodology.
6 Conclusions

This research study reflects on why and how hybrid methodology is adopted by project managers. There are several benefits of adopting hybrid methodology to handle different software projects which includes, organizations can produce desired results as output to increase the success rate and can create value to end users or project owners within and outside the organization. The other benefits are data transparency, reduced rework, user requirements, flexibility for innovations and deliver the results within planned timeframe. How this methodology can be adopted is purely depends on the project managers flexibility in handling the projects by considering their projects requirements, potential benefits and productivity of the end results that can create value in the organisation.
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Appendix

Below are the interview questions

1. How they define waterfall methodology, its benefits, and challenges?
2. How they define agile methodology, its benefits, and challenges?
3. Define hybrid methodology? Is this being a new, formal methodology?
4. Why are you adapting hybrid methodology?
5. How you implement the hybrid methodology as per your requirements? Do you add or change or delete any of the stages?
6. What are the tools you use when working with hybrid methodology?
7. What are the challenges, and benefits that they are facing with hybrid methodology?
8. Is it important that each and every team member should be well experienced to work with hybrid projects?
9. Share your experience working with the hybrid from other methodologies?