

**AN AGILE BEST PRACTICE FRAMEWORK FOR
INFORMATION TECHNOLOGY PROJECT MANAGEMENT**

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**FACULTY OF COMPUTER SCIENCE AND INFORMATION
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INFORMATION TECHNOLOGY PROJECT MANAGEMENT

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ORIGINAL LITERARY WORK DECLARATION

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Title of Project Paper/Research Report/Dissertation/Thesis (“this Work”): **An Agile Best Practice Framework for Information Technology Project Management**

Field of Study: **Software Engineering**

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AN AGILE BEST PRACTICE FRAMEWORK FOR INFORMATION TECHNOLOGY PROJECT MANAGEMENT

ABSTRACT

The demand for success in IT projects is increasing, commanding careful attention to the factors impacting project success. Organisations are embracing the agile method due to its popularity and the benefits it yields. The agile manifesto provides a set of values and principles, but does not provide solutions for best practice in managing and delivering successful projects. Project issues and challenges are discussed in literature, with the absence of a best practice framework for the management of agile projects. This research aims to identify the factors from literature and the industry practitioners, to produce a validated best practice framework for the successful management of agile projects. A Systematic Literature Review initially compiled the factors impacting projects from the existing literature, followed by a Grounded Theory research which identified if the exact findings in literature are also impacting the industry practitioners. From 175 selected literature, 37 prominent factors affecting agile project success were identified. An initial list of 111 factors, along with proposed mitigation methods were then compiled from the industry practitioners. Comparing both findings, a list of 55 unique factors were produced using the Delphi technique, environmental scanning, and emerging issues analysis, segregating them into four categories: Organisation, People, Process and Technical. Various factors impacting agile projects were discussed in literature, with an absence of a holistic review to determine the critical factors which are impacting the success of projects in the industry. Project governance and the proper implementation of agile methods was the most addressed factor in literature, followed by people related factors. Literature suggests sound understanding of the agile principles with proper governance, by people with the right attitude, knowledge, skills and teamwork. The practitioners mainly discussed the process and people categories, with key issues on the misalignment of agile with the business objectives, the lack of understanding of agile principles, lack

of teamwork and required skillset. The findings were used to develop a best practice framework evaluated by a panel of practitioners who found the framework comprehensive, relevant and applicable. A set of scenarios were created based on historical data, employing expert review to verify the validity, suitability and usefulness of the framework. The feedback received was verified against literature and used to fine-tune the framework and develop a tool, expected to assist in the successful management of agile projects.

Keywords: Factors, Agile Project Management, Information Technology, Issues, Challenges

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RANGKA KERJA AMALAN TERBAIK KAEDAH TANGKAS UNTUK PENGURUSAN PROJEK TEKNOLOGI MAKLUMAT

ABSTRAK

Permintaan untuk kejayaan amat meningkat dalam projek teknologi maklumat, memaksa pemerhatian yang teliti kepada faktor-faktor yang mempengaruhi kejayaan projek. Organisasi-organisasi sedia menggunakan kaedah tangkas (Agile) disebabkan populariti dan faedah yang dihasilkan. Manifesto Tangkas (Agile Manifesto) menyediakan satu set nilai dan prinsip, tetapi tidak memberikan penyelesaian untuk amalan terbaik dalam mengurus dan meningkatkan kejayaan dalam projek. Isu dan cabaran projek dibahas dalam literatur, dengan ketiadaan rangka kerja praktik terbaik untuk pengelolaan projek tangkas. Kajian ini bertujuan untuk mengenal pasti faktor-faktor dari literatur dan pengamal industri, untuk menghasilkan rangka kerja praktik terbaik yang disahkan untuk pengurusan projek tangkas yang berjaya. Sebagai langkah pertama, tinjauan literatur sistematik mengumpulkan faktor-faktor yang mempengaruhi projek-projek dari literatur yang ada. Sebagai langkah kedua, penelitian Teori Terpusat dikendalikan untuk mengenalpasti penemuan dalam literatur juga mempengaruhi praktis-praktis daripada industri. Daripada 175 literatur terpilih, 37 faktor penting yang mempengaruhi kejayaan projek tangkas dikenalpasti. Senarai awal yang mengandungi 111 faktor, bersama-sama dengan cadangan kaedah-kaedah menghadapi isu kemudian dikumpulkan dari pengamal industri. Daripada kedua-dua penemuan, 55 faktor unik dihasilkan menggunakan teknik Delphi, pengimbasan alam sekitar dan analisis isu yang muncul, memisahkannya kepada empat kategori asas; Organisasi, Orang, Proses dan Teknikal. Pelbagai faktor yang memberi kesan kepada projek tangkas telah dibincangkan dalam literatur, dengan ketiadaan semakan holistik untuk menentukan faktor kritikal yang memberi kesan kepada kejayaan projek dalam industri. Tadbir urus projek dan pelaksanaan kaedah tangkas yang betul adalah faktor yang paling ditekankan dalam literatur, diikuti oleh faktor-faktor yang berkaitan dengan orang. Literatur mencadangkan pemahaman yang baik tentang prinsip-

prinsip yang tangkas dengan tadbir urus yang betul, oleh orang yang mempunyai sikap yang betul, pengetahuan, kemahiran dan sanggup berkerja berpasukan. Para pengamal terutamanya membincangkan proses dan kategori orang, dengan isu-isu penting mengenai penyelewengan tangkas berobjektifkan perniagaan, kurang-fahaman prinsip tangkas, kekurangan kerja berpasukan dan kemahiran yang diperlukan. Penemuan ini digunakan untuk membangunkan rangka kerja praktik terbaik yang dinilai oleh panel pengamal yang memutuskan rangka kerja yang komprehensif, relevan dan sesuai. Satu set senario telah dibuat berdasarkan data sejarah, menggunakan kajian pakar untuk mengesahkan kesahihan, kesesuaian dan kegunaan rangka kerja itu. Maklum balas yang diterima telah disahkan terhadap literatur dan digunakan untuk memperincikan rangka kerja dan penciptaan alat-kerja yang diharapkan dapat membantu dalam pengurusan projek tangkas untuk menghasilkan projek yang berjaya.

Kata Kunci: Faktor Kritikal, Pengurusan Projek Tangkas, Teknologi Maklumat, Isu dan Cabaran Projek

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LIST OF SYMBOLS AND ABBREVIATIONS

AP	Agile Project
APs	Agile Projects
APM	Agile Project Management
ASD	Adaptive Software Development
CMM	Capability Maturity Model
CSFs	Critical Success Factors
DSDM	Dynamic Systems Development Method
FDD	Feature-Driven Development
GT	Grounded Theory
HAT-PMF	Hybrid Agile Traditional-Project Management Framework
HAT-PMFv1.0	Hybrid Agile Traditional-Project Management Framework ver.1.0
HAT-PMFv2.0	Hybrid Agile Traditional-Project Management Framework ver.2.0
ISSIG	Information Systems Special Interest Group
IT	Information Technology
IS	Information Systems
ITPM	Information Technology Project Management
LSD	Lean Software Development
Mgmt	Management
MNC	Multi-National Company
MNCs	Multi-National Companies
OO	Object Oriented
PM	Project Manager

PMs	Project Managers
PMgmt	Project Management
PMI	Project Management Institute
PMBOK	Project Management Body of Knowledge
PMO	Project Management Office
PMOs	Project Management Offices
RO	Research Objective
ROs	Research Objectives
RQ	Research Question
RQs	Research Questions
SDLC	System Development Life Cycle
SEI	Software Engineering Institute
SLR	Systematic Literature Review
SME	Subject Matter Expert
SMEs	Subject Matter Experts
XP	Extreme Programming

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Universiti Malaya

CHAPTER 1: INTRODUCTION

1.1 Overview

Projects are executed for the purpose of delivering a product or an outcome, within a pre-defined timeframe. In the Information Technology (IT) industry, projects are executed to produce many different outcomes, related to the release of a software, hardware, network connectivity, infrastructure, and many other outcomes. Projects either attain full or partial success, are challenged, or fail. Challenged projects are normally mitigated to achieve a certain level of success, but will normally attract additional resources, cost, or time. The degree of challenged and failed IT projects is predominantly high, based on the CHAOS Report produced by the Standish Group (2008, 2015). Various other literature on Project Management (PMgmt) also supports this statement. This has been a great concern to the industry and organisations championing projects, especially over the last decade where the PMgmt field has gained more attention and recognition, with increasing demand for the successful completion of projects. The latest CHAOS report published in 2019 shows an average of 34% of projects as successful, 14.5% as failed and 51.5% as challenged (Standish Group, 2019).

This chapter will present the background of the problem and describe the problem statement and the purpose of this study. The rationale of this research is described, along with the research objectives (ROs) and research questions (RQs). The research method to be used will be described briefly, and further elaborated in Chapter 4 (Systematic Literature Review) and Chapter 5 (Grounded Theory Research). The chapter further elaborates the significance of the study, with the known assumptions and limitations described. Finally, the chapter will be concluded with the nature of the study, with the detailed literature review presented in Chapter 2 (Literature Review).

Project analysis has been on-going for a long time, becoming more aggressive over the last few decades where a number of literary publications have addressed project issues and challenges, software projects in particular, which were reported as either exceeding the budgeted cost, falling behind the anticipated schedule, or not meeting the expectations of the stakeholders (Ewusi-Mensah, 1997; Hartman and Ashrafi, 2002; Suardi, 2004; Shore, 2005; Standing et al., 2006; Mahaney and Lederer, 2006). This accords to the three critical elements of PMgmt which are Scope, Cost and Time, described by Atkinson (1999) as the Iron Triangle, which is a central concept of PMgmt (Pollack et al., 2018). Traversing beyond the Iron Triangle, the human elements of PMgmt surfaces (Turner, 2016).

The Standish Group (2008, 2015), through their studies on IT projects, produced the CHAOS reports on a regular basis, reporting that software projects generally did not meet one or more of the elements of the iron triangle, which is cost (budget), time (schedule), and scope (requirements). These requirements are popularly referred to in the context of PMgmt as the triple constraint parameters (Schwalbe, 2006; Pollack et al., 2018). The study initiated by the Standish Group in 1994, over a duration of 12 years, until 2006, showed that an average of 35% of projects were successful, 19% of projects failed, while the remaining 46% of projects were faced with various challenges (Standish Group, 2008), resulting in non-delivery of the anticipated or expected project outcomes. The Standish report published in 2015 for projects between the years 2011 and 2015 reported an average of 18.8% of failed projects, 28.8% of project success, and 52.4% of challenged projects, as described in Table 1.1 and Figure 1.1 (Standish Group, 2015).

Table 1.1: Percentage of Successful, Challenged and Failed projects from years 2011 to 2015

Project Status	2011	2012	2013	2014	2015
Successful	29%	27%	31%	28%	29%
Challenged	49%	56%	50%	55%	52%
Failed	22%	17%	19%	17%	19%
	100%	100%	100%	100%	100%

Source: CHAOS report (Standish Group, 2015)

The percentage of challenged projects are rather consistent around the 50% gradian (49% to 56%), indicating that there is a serious need of attention to be given to the systematic identification of project challenges with the intention of mitigating them to attain greater project success.

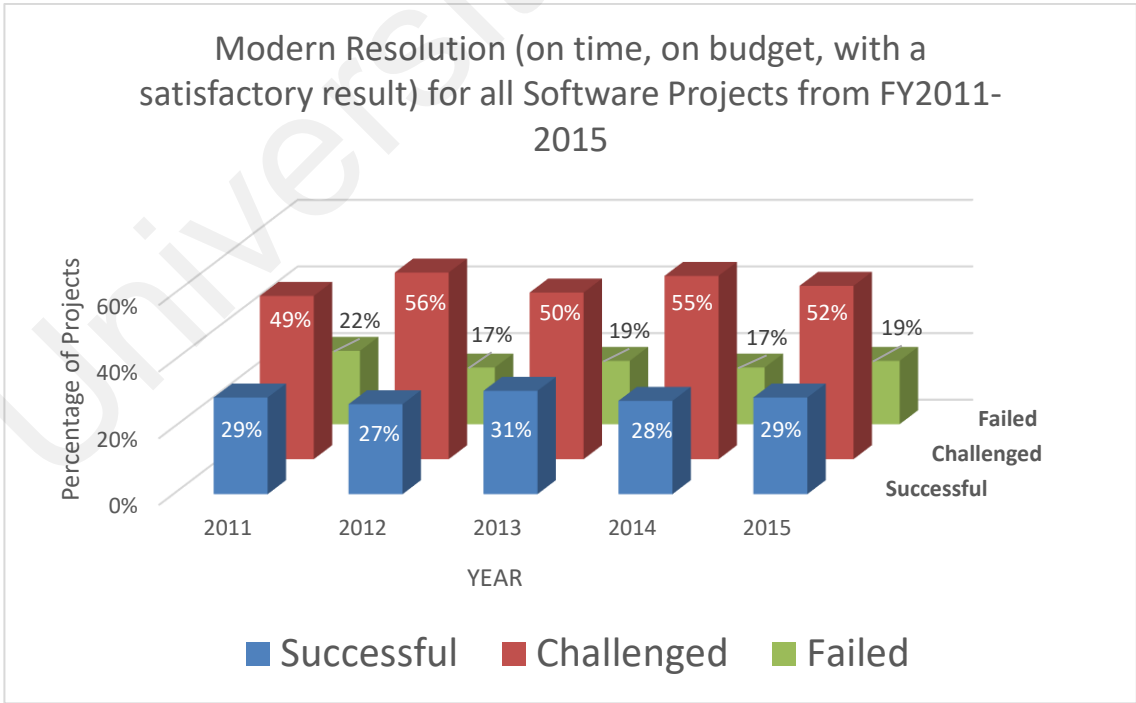


Figure 1.1: Comparison of Successful, Challenged and Failed projects over a 5-year period

Source: CHAOS report (Standish Group, 2015)

As per the statistics summarised in Table 1.2, the average of failed projects is rather consistent (19% and 18.8%), with a decrease on the percentage of successful projects (from 35% to 28.8%). The delta seems to contribute to the increase in challenged projects (from 45% to 52.4%). This can be accorded to the increasing complexity and size of projects and the challenging environments in which projects are executed. This could also be indirectly or directly caused by the varying demand for project expertise, rendered by experienced Project Managers (PMs) and team members.

Table 1.2: Summary of Successful, Challenged and Failed projects from two separate studies covering different time periods

Period of study	Successful Projects	Challenged Projects	Failed Projects
1994 to 2006	35%	46%	19%
2011 to 2015	28.8%	52.4%	18.8%

Source: CHAOS report (Standish Group, 2015)

The core of the discussion is around failing projects and mitigation techniques to reduce project failure, and possibly to convert them into successful projects. The main factors which are contributing to either the success or failure of IT projects are generally related to organisational areas which includes (a) executive sponsorship, (b) stakeholder engagement, (c) PMgmt, (d) resource availability (e) change management, and (f) third-party relationships (Simon, 2010). The level of PMgmt maturity in an organisation is believed to be directly related to the degree of mitigation the organisation can perform on the challenged or failed projects (Ibbs and Reginato, 2002; Kerzner, 2019), thus indicating that the level of PMgmt maturity in an organisation is directly related to the success rates of projects. Between 30% to 70% of IT projects recorded a failure from the

perspectives of objectives or goal, schedule or time, and scope or schedule (Simon, 2010), relating project performance to the iron triangle (Muriana and Vizzini, 2017).

It is believed that by implementing relevant and sufficient enterprise-wide PMgmt processes, which includes the required level of training and support, aligning projects against the organisational objectives and goals, and prioritising projects based on corporate strategies, the level of PMgmt maturity can be improved (Pennypacker and Grant, 2003). This gives rise for proper ordinance in PMgmt, which takes us to the proper setup and execution of a structured PMgmt office. In summary, the studies show that project governance improves the success rate of projects. The Chaos report on project success by project size between year 2011 and 2015 (Table 1.3) shows that smaller projects have a greater success rate than larger ones.

Table 1.3: Comparison of Successful, Challenged and Failed project by project size

Project Size	Successful	Challenged	Failed
Grand	2%	7%	17%
Large	6%	18%	24%
Medium	9%	26%	31%
Moderate	21%	32%	17%
Small	62%	17%	11%
TOTAL	100%	100%	100%

Source: CHAOS report (Standish Group, 2015)

1.2 Background of the Study

Too many IT projects (which widely includes software projects) are not delivered on time, within the agreed and allocated budget, and within the stipulated scope, resulting in overruns in cost and schedule, resulting in unexploited business opportunities (Standish Group, 2008; Muriana and Vizzini, 2017). Despite the significant amount of time and effort spent on projects, the evolvement of the PMgmt discipline to a recognised element

was only seen in the 20th century (Shenhar and Dvir, 2007). Cleland (1999) suggested that many PMgmt techniques resulted from projects undertaken by the United States military organisation. One of the techniques is the popular Gantt chart used for the graphical representation of the project schedule for the construction of U.S. Navy ships during World War I, which was created by Henry Gantt (Murch, 2001), with its beneficial implementation in an international setting (Wren, 2015). The Critical Path Method (CPM) and the Program Evaluation Review Technique (PERT) are some of the other PMgmt techniques created in the 1950s for the development of the U.S. Navy Polaris submarine (Marchewka, 2006). Inappropriate scheduling methods employed by some organisations can be resolved by the utilisation of CPM and PERT methods (Ba'Its, 2020).

1.2.1 Standards and Guidelines

The establishment of the Project Management Institute (PMI) in 1969 marked a significant structural development in the field of PMgmt, providing guidelines in managing projects and contributing to the successful completion of projects (Shenhar and Dvir, 2007; Karaman and Kurt, 2015). PMI established PMgmt standards across various industries, systematically producing a structured document called the Project Management Body of Knowledge (PMBOK) (PMI Standard, 2017). The construction industry was the main target of representation for PMI in the early days of inception. Over the last few decades, the IT influence in PMI increased with the Information Systems Special Interest Group (ISSIG) becoming the largest Special Interest Group. As the awareness on the importance of PMgmt have been inflicted onto organisations, they become more aware of the corresponding need for the implementation and support of a PMgmt method in a systematic manner (Block and Frame, 1998). In addition to organising PMgmt training and acquiring software and tools to automate project tasks, establishing a Project Office. It was recommended that a project office be established, in

addition to exposing and involving employees in PMgmt training and acquiring software to automate project tasks such as tracking and scheduling (Block and Frame, 1998). The name of the project office has evolved over time to become the Project Management Office (PMO) for a majority of organisations (Hobbs, 2007). PMgmt, people, higher management and organisation barriers need to be analysed to devise a way to help organisations and practitioners to overcome them (Kotb and Ghattas, 2017).

In a survey of 252 organisations, 69% of all project failures appear to be related to either the absence of PMgmt methodologies or its improper or ineffective implementation (Krebs, 2009). A PMO is “an organisational entity established to assist PMs and teams throughout the organisation in implementing PMgmt principles, practices, methodologies, tools, and techniques” (Dai, 2001, p.1), and can be regarded as an avenue for the provision of a framework to enable organisations to improve the success rates across the program and portfolio management function (Kaufman and Korrapati, 2007). Research on the level contributions of a PMO towards the effectiveness of project administration and management was conducted by Dai (2001), which was associated to increased project success rates. In many instances, there seems to be a positive relationship between the increase in project success rates and the presence of a PMO function in an organisation (Dai, 2001). However, the PMO structures and framework are often seen to be unstable due to the lack of agreement for the implementation of an effective PMO model (Aubry and Hobbs, 2011). Establishing PMgmt standards, along with its applicable processes and the relevant method during its implementation are clear benefits of a PMO (Wells, 1999). The PMBOK produced by PMI has helped the PMO function to a considerable extent. Based on an early study on IT PMOs conducted by Lee (2006a) against the PMI knowledge areas, based on the fourth Edition of PMBOK (PMI Standard, 2008), positive effects were found between the nine knowledge areas of

integration, schedule, scope, cost, quality, risk, communication, resource and procurement. The PMBOK evolved and included “Stakeholder Management” as a separate knowledge area in its fifth Edition (PMI Standard, 2013), making it a total of 10 knowledge areas to address in this discussion. The sixth Edition was produced four years later, in 2017 (PMI Standard, 2017). Crawford (2006a) asserted that the level of PMgmt maturity within an organisation can be increased with the establishment of a PMO, by the means of initially establishing PMgmt standards, processes and methods, and subsequently extending its services, which includes providing support for the project team (consulting, coaching, and mentoring), identifying and organising training programs, and identifying and establishing reporting mechanisms (types of reports, reporting frequency and target audience).

1.2.2 Governance and Administration

PMgmt has evolved from the mode of standalone projects using a simple set of tools and techniques, to becoming integrated across multiple projects to form the organisational capability (Crawford, 2006b). Its popularity led many American corporations towards ‘projectised’ operations, further becoming the method by which organisations make investments in IT that create valued business assets, with improved project performance when commissioning more mature PMgmt practices (Conforto et al., 2016; Lavingia, 2001; Ibbs and Reginato, 2002; Kwak and Ibbs, 2000). Organisations went on to make investments in IT, using projects as a method to create assets, valued by the organisation from the business perspectives (Lavingia, 2001). Organisations with more mature and established PMgmt practices have recorded improved performance by producing more predictable project schedules and more accurate project costings (Ibbs and Reginato, 2002). Crawford’s (2002a, 2006a) studies showed the implementation of a PMO as an approach to improve an organisation’s PMgmt maturity to enable improved project

success. This proves to show that a software project can envisage and obtain a better chance of success if the project is managed properly, with proper project governance, with a high likelihood of the projects either controlled or supported by a PMO. Insufficient initial planning can result in project failure (Serrador and Pinto, 2015).

PMgmt evolved into a recognised discipline in the 20th century to become an organisational capability integrated across multiple projects, acquiring the need for organisations to employ a systematic method for its implementation and support, enforcing good governance (Hetemi, 2020; Drechsler and Breth 2019; Delisle, 2019; Einhorn, 2019; Shenhar and Dvir, 2007; Crawford, 2006; Block and Frame, 1998). Despite various advancements and improvements in the PMgmt field, the failure rates of IT projects remain consistently high over the last two decades, coupled with unsatisfactory performance (Marchewka, 2006; Simon, 2010, Golini et al., 2015). Poor implementation of PMgmt methods, processes and principles contribute vastly to this high failure rate, leading to the general disorder on the organisational capability (Al-Ahmad et al., 2009; Krebs, 2009; Highsmith, 2010). Project governance is widely achieved by employing a PMO. There are many functions which can be performed by a PMO, providing them as services to the project manager (PM) and team members, which includes improving the maturity level of PMgmt in the organisation by implementing and controlling the PMgmt methodology, setting up a program and portfolio management profile, identifying training needs and organising the appropriate training programs, monitoring project status and providing reporting avenues, leading towards the creation of an organisational PMgmt culture. (Block and Frame, 1998; Charavat, 2003; Crawford, 2002b; Crawford, 2006a; Crawford, 2006b; Dai, 2001; Kerzner, 2003; Levatec, 2006; Levine, 2005). It is evident that PMO's are implemented by many organisations, aiming to improve the overall maturity level of the PMgmt function within the organisation,

hence expecting to increase project success rates (Centre for Business Practices, 2007; Pennypacker and Grant, 2003).

Ibbs and Reginato's (2002) study of PMgmt maturity found:

1. Companies attain better project performance indicators when they have increased PMgmt maturity in terms of conformance and practice.
2. PMgmt maturity is strongly correlated with more accurate budgetary forecasts and more predictable schedule management outcomes.
3. Organisations with good PMgmt practices have lower direct costs than its proponents with poor PMgmt practices.

The Standish Group (2003) established the fact that challenged projects, specifically for projects which deliver production systems, usually suffer from a cluster of symptoms which includes exceeding the target schedule and estimated budget, scope creep and altered requirements. A PMO is generally regarded as an agent for the improvement of organisational PMgmt maturity, inducing a PMgmt culture which leads to improvements towards the successful delivery of projects (J.K. Crawford, 2006a; Dai, 2001; Dai and Wells, 2004; Lee, 2006a; Stewart, 2004; Stewart and Kingsberry, 2003; Serrador and Pinto, 2015). The academicians are looking for theoretical bases that can be used to expand the body of knowledge related to the PMO, while the practitioners in the industry are looking for standards or guidelines to help establish and maintain effective PMOs (Aubry et al., 2010).

1.2.3 Traditional Vs Agile

“Agile” is generally defined as the ability to move quickly and easily. When used in the context of PMgmt, it refers to the specific manner in which projects are managed, in a

volatile and highly responsive environment to deliver a product or service in close conformance to the demands of quality, time and cost. Organisational agility is defined as the ability to react to scope and environmental changes quickly within a dynamic business landscape (Ciric et al., 2019). Many organisations have adopted the agile concept in PMgmt with the expectations of better aligning with the customers' demand and requirements, while expecting to turn-around projects faster to achieve greater project success. The agile concept initially emerged as a concept for software development and general IT projects, which has been expanded into achieving competitive advantages in modern-day organisations, expected to provide an optimal balance between flexibility and stability (Ciric et al., 2019). On attesting the success of agile projects, a comparison was made between the agile and waterfall method, as presented in the Chaos report (Standish Group, 2019), reporting greater success in projects using the agile method (42%), compared to projects using the waterfall method (26%), as shown in Figure 1.2.

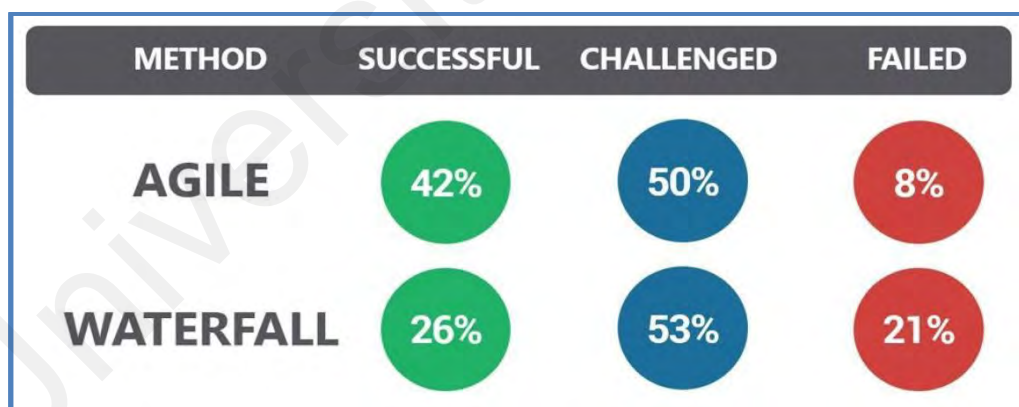


Figure 1.2: Comparison of Successful, Challenged and Failed project between Agile and Waterfall methods

Source: CHAOS report (Standish Group, 2019)

There is also a lower percentage of failure for projects using the agile method (8%), compared to the waterfall method (21%). The number of challenged projects remain quite similar in both agile (50%) and waterfall (53%) methods of PMgmt. The CHAOS report (2016) further describes project success comparing the project delivery method,

particularly addressing a comparison between the Agile and Waterfall model (Table 1.4), generally showing that the Agile method brings greater success to project delivery, compared to the Waterfall method.

Table 1.4: Comparison of Successful, Challenged and Failed project by project size, in comparison to Agile and Waterfall PMgmt methodology

Project Size	Method	Successful	Challenged	Failed
All Sizes	Agile	39%	52%	9%
	Waterfall	11%	60%	29%
Large	Agile	18%	59%	23%
	Waterfall	3%	55%	42%
Medium	Agile	27%	62%	11%
	Waterfall	7%	68%	25%
Small	Agile	58%	38%	4%
	Waterfall	44%	45%	11%

Source: CHAOS report (Standish Group, 2015)

A further group of researchers propose that traditional approaches for PMgmt may impose too much of structure for IT projects, while imposing constraints of rigidity to them, hence assimilating the need for agile methods of PMgmt (DeCarlo, 2004; Erickson, Lytinen, and Siau, 2005; Fernandez and Fernandez, 2008; Serrador and Pinto, 2015). The most common success criterion for traditional Information Technology Project Management (ITPM) is represented by the iron triangle of success, consisting of meeting schedule (time), budget (cost), and requirements (scope) (Atkinson, 1999). It is also described as the Triple Constraint (PMI Standard, 2017).

Agile methods of PMgmt downplay detailed planning and documentation while focusing on working software supporting business strategy and the regular interaction with the customer or client (Boehm, 2002; Augustine et al., 2005). Agile methods promote the susceptibility to change as agile projects (APs) are more flexible in accepting and dealing with changes, and being more tolerant to changing requirements, whereas its proponent

of traditional methods negate changes once the requirements are 'locked-in', with a determination on comprehensive planning (Nerur et al, 2005). Looking at examples set out in the Extreme Programming (XP) and SCRUM methods, agile methodologies evidently incorporates ITPM practices along with a number of software development techniques (Highsmith, 2004; Highsmith, 2010). As traditional and agile methods of PMgmt may not be communal in terms of exclusivity, the practitioners who engage the traditional method may also command a beneficial stand from other methods associated to the agile approach, with an understanding of being able to generally improve the performance of IT projects (Shenhar and Dvir, 2008; Reich et al, 2008).

The Agile Manifesto is based on 12 principles (Beck et. al., 2001), "Principles behind the Agile Manifesto":

1. Customer satisfaction by rapid delivery of useful software
2. Welcome changing requirements, even late in development
3. Working software is delivered frequently (weeks rather than months)
4. Close, daily cooperation between businesspeople and developers
5. Projects are built around motivated individuals, who should be trusted
6. Face-to-face conversation is the best form of communication (co-location)
7. Working software is the principal measure of progress
8. Sustainable development, able to maintain a constant pace
9. Continuous attention to technical excellence and good design
10. Simplicity—the art of maximizing the amount of work not done—is essential
11. Self-organizing teams
12. Regular adaptation to changing circumstances

Table 1.5 shows the factors of project success as reported in the Chaos report (Standish Group, 2015).

Table 1.5: Success Factors in Projects

Factors of Success	Points	Investment
Executive Sponsorship	15	15%
Emotional Maturity	15	15%
User Involvement	15	15%
Optimisation	15	15%
Skilled Resources	10	10%
Standard Architecture	8	8%
Agile Process	7	7%
Modest Execution	6	6%
PMgmt Expertise	5	5%
Clear Business Objectives	4	4%
TOTAL	100	100%

Source: CHAOS report (Standish Group, 2015)

The report lists the ratings against 10 success factors, organised by highest to lowest ratings (points). Each of these factors is described in the Chaos Report (Standish Group, 2015) as follows:

- 1) Executive Sponsorship: Agreement from the leadership team or the executive team to provide both emotional and financial backing, assisting and encouraging the successful completion of a project, program or portfolio, consisting of multiple projects.
- 2) Emotional Maturity: A collection of basic behaviours of people and their methods and capabilities of working together. The level of emotional maturity in the organisation or team is determined by all of their combined skills, subtracting the non-capabilities of the weakest link.
- 3) User Involvement: This scenario occurs when users are involved in the information-gathering and decision-making process within the project, and it

includes feedback from the user, the review of requirements, prototyping, basic research, and other consensus-building tools.

- 4) **Optimisation:** A means of improving business effectiveness and optimizing a collection of either the major requirements or small projects in a structured manner. Optimisation starts with managing scope against the business objectives.
- 5) **Skilled Resources:** People who understand both the technology and the business alike. A skilled team member will appear highly proficient in the execution of the project's requirements and the delivery of the project or product.
- 6) **Standard Architecture:** Defined as a consistent group of integrated services, practices, and products for developing, implementing, and operating software systems or applications, termed as "Standard Architectural Management Environment (SAME)" by the Standish Group.
- 7) **Agile Process:** Refers to the skill level and proficiency of the product owner and the agile team when executing the agile process. Agile proficiency is referring to the delta between the positive and negative agile outcomes.
- 8) **Modest Execution:** Having a process with a limited number of automated and streamlined moving parts. Modest execution also means using a set of PMgmt tools frugally with nominal or limited features.
- 9) **PMgmt Expertise:** The application of skills, techniques and knowledge to project activities in order to produce value for the organisation and to meet or exceed stakeholder expectations.
- 10) **Clear Business Objectives:** The task of understanding all project stakeholders and all participants in the business process, for the executing of the project. Clear Business Objectives could also dictate that the project is aligned with the organisation's objectives, strategy and goals.

1.3 Problem Statement

There are many instances of project failures that occur due to issues in PMgmt, accorded to the lack of or ineffective implementation of PMgmt methodologies and inappropriate processes and methods used to manage projects (Serrador and Pinto, 2015; Marchewka, 2006; Simon, 2010; Krebs, 2009; Conforto et al., 2016). Organisations are looking for an effective PMgmt model to facilitate the administration of an appropriate PMgmt methodology and its processes with proper standards or guidelines, as project failures are predominantly caused by the poor implementation of PMgmt processes and principles (Aubry and Hobbs, 2011; Aubry et al., 2010; Al-Ahmad et al., 2009; Highsmith, 2010; Krebs, 2009; Conforto et al., 2016), and the failure to mitigate the project issues and challenges on a timely manner. The importance of identifying the issues and challenges hindering the successful management of projects has led to the focus of this research on identifying success factors to attain greater success in PMgmt, while investigating and compiling the best practice in managing projects. Notably, not many empirical grounded studies exist on agile PMgmt (Ciric et al., 2019).

Most projects do not fail due to technology, but due to social and organisational deficits, and a lack of effective and direct communication between stakeholders, making it more likely for larger projects to fail than small projects (Lehtinen and Aaltonen, 2020; Koshravi, 2020; Birollo and Teerikangas, 2019; Kaur and Singh, 2016; Stettina, 2015). Issues and challenges faced in APs are usually unique and occur due to variabilities within the organisation, the people, the execution of the practices, increased complexities, or other factors, and there is no single guide which can be used to eliminate these issues (Wied et al., 2020; Momeni and Martinsuo, 2019; Miller, 2013). The critical requirement of staying successful is to find out and meet the challenges and its corresponding success factors, governance being a critical factor for project success (ul Musawir et al., 2020;

Hetemi, 2020; Drechsler and Breth 2019; Einhorn, 2019; Kaur and Singh, 2016; Nasir et al., 2015). As further described in Chapter 2, it can be concluded that the Agile Manifesto does not provide solutions for best practice and methods of managing and delivering successful projects by mitigating the issues and challenges. Having team members with experience and management buy-in can help management mitigate the negative impact of any issues, problems, or challenges (Miller, 2013). Hence, it is imperative that the existing issues be analysed so that the success factors can be identified and employed to projects to achieve project success. Carrillo et al. (2010) asserted that it is important to establish real factors that are in accordance with the characteristics of the key players of the project (project practitioners/manager/team), in order to adopt a methodology. However, a single methodology may not be able to identify all the critical success factors (Nasir et al., 2015).

The Agile Manifesto does not prescribe any specific methodology; it provides a set of values and principles on which agile methodologies are based (Miller, 2013; Krehbiel et al., 2017), arriving at a conclusion that the Agile Manifesto does not provide solutions for best practice and methods of managing and delivering successful projects by mitigating the issues and challenges. Acquiring management support and experienced team members can aid the management team in their effort to mitigate the negative impact of any issues or challenges (Miller, 2013). Hence, it is imperative that the existing PMgmt issues be analysed so that the success factors can be identified and employed to projects to achieve project success. A best practice framework, coupled with an issue mitigation process, is expected to reduce the occurrence of project failures, hence increasing the success rate of IT projects.

Apart from the findings above, various other literatures were reviewed to determine a broader variety of project challenges (Farashah et al., 2019; Ebert and Paasivaara, 2017; Lloyd et al., 2017; Yang et al., 2016; Joslin and Müller, 2016; Tilk, 2016; Silvius and Schipper, 2014; Lalsing et al., 2012; Drury et al., 2012; McHugh et al., 2012; Guerra, 2010; Hochmüller and Mittermeir, 2008; Lee et al., 2006b; Nerur et al., 2005), which provided the researchers the foundation in soliciting feedback from the ground. There could possibly be many more literatures addressing a broader variety of challenges, but due to the intention of obtaining them from the ground, they were not analysed further.

This study is motivated by the call for thorough analysis on the critical success factors (CSFs), issues and challenges; the absence of a comprehensive list of project issues and success factors; insufficient comparison between literature and industry; lack of organisational support and failure in timely mitigating issues; lack of a holistic best practice framework and an issue mitigation model. In the context of this research, issues and challenges refer to the problems associated to managing projects, while factors refer to the area which can impact the project either positively (success factors) or negatively (failure factors). Many PMgmt frameworks have been established in literature (Shenhar, 1999; Iivari et al., 2000; Kaufman and Korrapati, 2007; Aubry et al., 2007; Zhu, 2010; Molhanec, 2010; Gandomani and Nafchi, 2015; Conforto and Amaral, 2015; Sommer et al., 2015; Fontana et al., 2015a; Ali and Khan, 2016; Vallon et al., 2016; Szalay, 2017; Turetken, 2017; Hidalgo, 2019), with the absence of a holistic framework with mitigation methods obtained from the industry experts.

1.4 Purpose of the Study

The purpose of this study is to identify the documented issues and challenges faced by APs within the literature, as well as the additional (newly captured) issues in both the traditional and Agile Project Management (APM) industry. The population for the research is targeted at members of the PMI and Practitioners of PMgmt practices with relevant credentials in PMgmt (i.e. PMP, PgMP, PfMP, PMI-ACP, Prince2, and other relevant credentials) and an average of five to 10 years of experience in either assuming a role in the PMgmt office or as a PM, involved in the management of both Traditional and Agile projects. By performing an analysis of the issues and challenges benevolent to the management of APs, the critical issues can be targeted to attain methods of mitigation, following a formal risk mitigation model, which will form the basis of the success factors of managing IT projects, in the form of a best practice framework.

Based on the time of this study, the researcher perceives that there is a limit on the level of breadth and depth on the critical success factors within IT projects as the researcher believes that the current research findings are limited in terms of its ability to conclude a combined perception from the perspectives of both the industry and literature. The CSFs have been a popular area of discussion in literature for a long time, with evidence that they are sector specific (Tsigas et al., 2017), calling for more research in this area. This is believed to be triggered by the perceived disjoint between literature and the industry, as most information are seen to be derived from studies which are based on the performance of specific IT projects, rather than retrieving them through the experience of the PMs, or PMgmt practitioners, calling for empirical grounded studies on APM (Ciric et al., 2019). The inclusion of the techniques and principles of the agile approach into the traditional methods may generally benefit IT projects, although a number of literary findings regard the traditional and agile approaches as distinct and unique (Reich et al., 2008; Shenhar

and Dvir, 2008). This could be further accorded to the recent demand of hybrid methods consisting of a combination of traditional and agile methods (Conforto and Amaral, 2015; Papadakis and Tsironis, 2018).

This study seeks to identify and provide an insight into the CSFs that help IT projects using agile methods to succeed. The study will review the issues and challenges in agile methods as identified in literature, capture additional and specific issues not listed in literature, discuss mitigation factors with industry practitioners, to verify and realign the success factors reported in the agile literature with the new findings of challenges and issues from the industry. The extraction of issues and challenges from literature is intended to be achieved through a Systematic Literature Review (SLR). The study further intends to gather survey feedback and background information from the agile practitioner community via a Grounded Theory (GT) research. The main purpose is to provide verification of the issues and challenges and to validate the mitigation factors to be able to delineate a clear list of project issues and challenges, in the form of projects factors, which may be regarded directly as project risks, to be able to either prevent, mitigate or accept these risks by minimizing the impact to the project. Project risk management techniques, through the analysis of the CSFs, will be used to draw out the mitigation methods from the industry experts, which will jointly form the basis of the best practice framework of APs. Further, the identified risks will be evaluated and verified by industry experts, with feedback collected and used to further improve the framework, thus producing an improvised agile best practice framework.

The emergence of Agile methods for software development is claimed to, “enable faster, cheaper, better software development with on-time, on-budget delivery of the agreed scope” (Anderson, 2003, p.28). Some practitioners of the Agile method, known as

“Agilists”, reported a four-fold economic improvement over its proponents, generally referred to as traditional methods (Highsmith, 2002; Schwaber and Beedle, 2002). This study is attempting to assist PMs who are governed by a PMO in an Agile environment, to manage or better manage projects to attain better experience in APM and to promote the delivery of successful projects. The contribution of the study is also placed into assisting PMs and the project team members who are not governed by a PMO, who will benefit from the best practice advise contained in the framework. A PMgmt framework is envisaged to provide structure and direction to a project, which is neither too detailed nor too rigid, unlike PMgmt methodologies. A frameworks guides projects in achieving its goals while being flexible enough to adapt to evolving conditions, offering guidance to PMs in achieving outstanding results. There are many frameworks which exist, which caters for varying environments, industries, settings and audiences. The researchers are not

1.5 Research Objectives

The broad objective of this research is to identify the extent to which the existence of a PMO contributes to reported project success in an agile software development environment. The ROs are as follows:

Objective 1: To compare Agile ITPM issues and challenges between literature (theory) and the industry (practice).

Objective 2: To develop a best practice framework for APs.

Objective 3: To validate the proposed framework.

Objective 4: To develop a tool for ITPM.

1.6 Research Questions

This study follows up on the research performed by Chow and Cao (2008) which identified 19 failure factors in projects based upon the research conducted on APM. The outcome of the study by Chow and Cao (2008) produced a comprehensive list of factors related to APM, which was found to be directly related to the context of this study, hence it was adopted as the basis of this research. The study also analyses other prominent issues and challenges addressed in other literature to identify other factors impacting the management of APs. Based on the four objectives identified in Section 1.5, the following research questions were identified:

Based on the first objective, to compare Agile ITPM issues and challenges between literature (theory) and the industry (practice), the following RQs were identified:

Research Question 1(a): What are the issues and challenges of managing APs addressed in literature?

Research Question 1(b): What are the factors impacting the successful management and delivery of APs in the IT industry?

Research Question 1(c): What are the gaps between the issues and challenges addressed in literature and the factors identified from the IT industry?

Based on the second objective, to develop a best practice framework for APs, the following RQs were produced:

Research Question 2(a): What are the proposed mitigation methods which can be used to minimise the impact of the factors affecting project success?

Research Question 2(b): Where and how can the consolidated list of factors and mitigation methods be evaluated against its suitability and usefulness?

Research Question 2(c): How can the identified factors be developed into an agile best practice framework, which can be used as a guideline for managing IT projects successfully?

Based on the third objective, to validate the proposed framework, the following RQs were formulated:

Research Question 3(a): How can the developed agile best practice framework be validated against its relevance, usefulness, practicality, and applicability for possible use as a reference material on managing and administrating projects within the respective organisations?

Research Question 3(b): How can the validated agile best practice framework be refined further based on the feedback received to produce a more refined framework?

Based on the fourth objective, to develop a tool for ITPM, the following RQs were formulated:

Research Question 4(a): How can the agile best practice framework be used as a guide and tool by the agile practitioners to create greater success in managing APs?

The objectives and the RQs have been summarised in Figure 1.3.

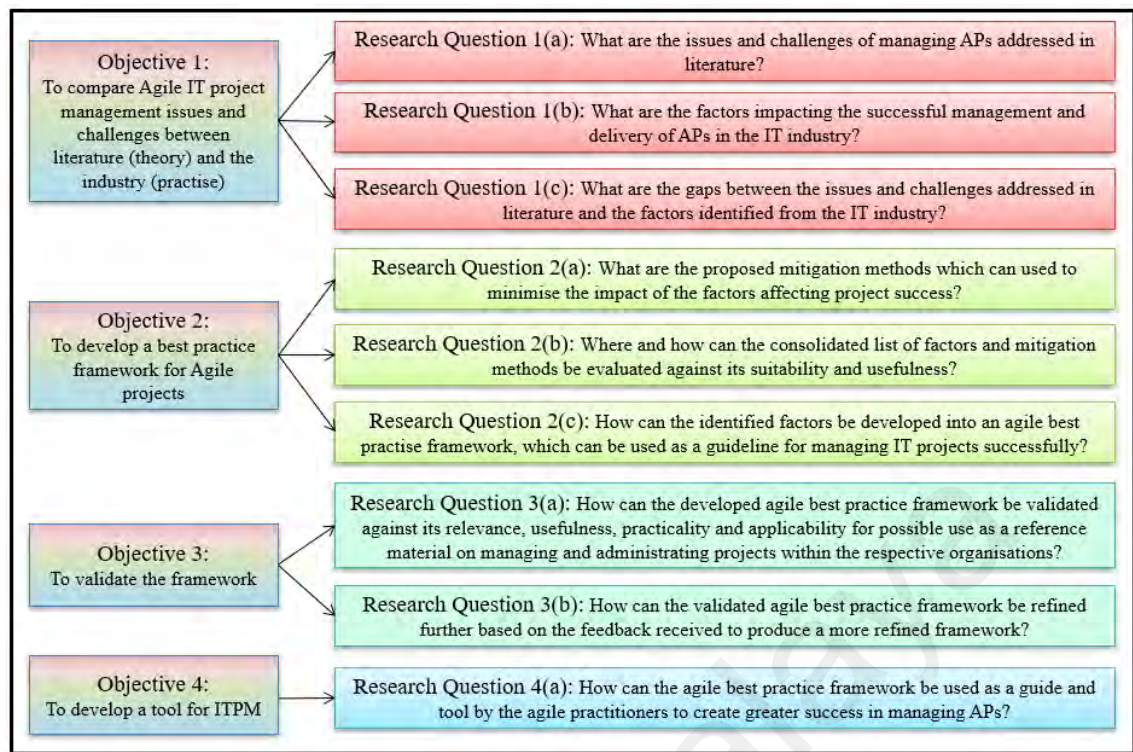


Figure 1.3: Flow diagram showing the research objective and the RQs

1.7 Research Method

In order to fulfil the objectives of this research and to address the research questions, the following research methods will be undertaken:

1. An SLR will be conducted to identify the issues and challenges of managing APs addressed in existing literature.
 - a. Based on the issues and challenges addressed in the literature, a list of factors impacting agile project (AP) success will be compiled and categorised.
 - b. The identified factors will be analysed based on most frequently addressed in literature.
 - c. A group of between 40 to 50 practitioners will be identified within the industry, with a minimum of at least five years of experience managing projects, both traditional and APs.

- d. A questionnaire will be developed based on the compiled factors to verify the issues and challenges with the agile practitioners, and ranked using a 7-point Likert scale analysis method, capturing additional factors from the participants.
 - e. A second questionnaire will be developed with the additional issues and challenges and will be ranked by the agile practitioners, according to its criticality and impact to APs, using a 7-point Likert scale analysis method.
 - f. The rankings obtained from both the questionnaires will be consolidated to obtain a holistic summary of both the existing (from existing literature) and new issues (from the agile practitioners).
2. A GT study will be undertaken to determine the factors impacting project success in the IT industry.
 - a. A selected group of about 300 experienced agile practitioners will be identified from the IT industry.
 - b. An initial questionnaire will be developed and distributed to the identified industry practitioners for voluntary participation.
 - c. Factors impacting project success will be solicited from the participating agile practitioners.
 - d. A series of interview sessions will be conducted with the participants to solicit further information to arrive at a compiled list of factors impacting project success.
 - e. The factors will be consolidated using the Delphi technique to produce a list of unique factors.
3. Results from both the SLR and GT will be compared to identify the gaps between literature and the industry, further identifying proposed mitigation methods from a panel of industry practitioners.

4. An agile best practice framework will be developed along with mitigation methods for the management of IT projects.
5. The framework with the relevant mitigation methods will be evaluated via an expert review process using scenarios developed from historical data from the industry.
6. The framework will be validated against a set of criteria's, for use as a reference material on managing APs within the IT organisations.
7. The validated framework will be refined based on the feedback received from the industry experts.
8. The refined framework will be developed into a tool presenting a general checklist with document templates to be presented to the agile practitioners as a guide for managing APs.
9. Findings from the validation of the model will be documented to determine its (expected) contribution to the APM industry and to determine its current limitations for further research work in this area.

The ROs and RQs have been mapped into the various research methods employed, shown in Figure 1.4.

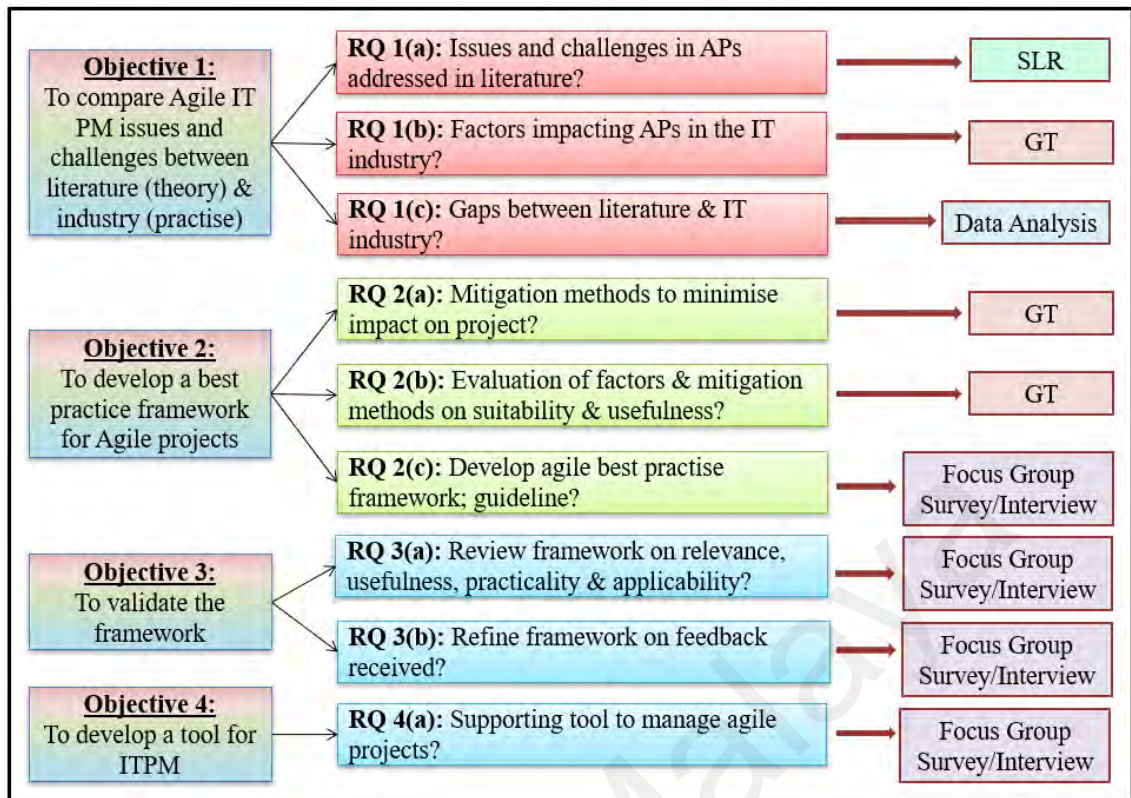


Figure 1.4: Research methods employed based on the ROs and RQs

1.8 Significance of the Study

The study contributes to the literature on the relationship between issues and challenges of managing IT projects and the success factors toward the management of successful IT projects in an agile environment. This study could provide support to IT organisations implementing agile methods to incorporate the agile best practice framework to create greater success in projects, with improved project outcomes, delivering increased value back to the business or the organisation.

Developing a perceptive understanding of the relationships between the success factors and the issues and challenges faced by projects, and the corresponding impact towards the successful management of IT projects is imperative because most studies treat success factors individually, separate from the issues and challenges of projects, and fail to “analyse the interaction between them and the possible consequences” of each against the

other (Belassi and Tukel, 1996, p. 142). Favourable results of this study could be used by organisations in incorporating, embedding or adapting the agile best practice framework into their PMgmt methodology through their existing PMO, to manage IT projects in an Agile environment.

1.9 Nature of the Study

The study will initially study existing literature via an SLR, intending to identify the issues and challenges addressed in literature. The next step is to independently identify the issues and challenges faced by the agile practitioners in the IT industry via a GT. The results from both the SLR and GT will be compared and analysed to identify the gaps between them. Using a non-experimental and descriptive research design, three sets of questionnaires were developed to solicit the relevant feedback from the industry. Further responses were solicited from the industry practitioners in several interview sessions. A 7-point Likert scale analysis will be used to obtain the rankings from a group of practitioners on the factors identified in literature, and obtain newly identified factors. Factors affecting the successful management of APs will be captured from a different group of practitioners. The results from the various sources of data collected will be analysed, to be developed into an agile best practice framework, along with proposed mitigation methods.

1.10 Assumptions

The following assumptions were made for this study:

1. The scope of the SLR study will provide sufficient means to capture the issues and challenges in projects as discussed in literature.

2. The scope of the GT research is sufficient in soliciting feedback from the industry to allow this study to compare them against the issues and challenges obtained from literature, and to make the necessary gap analysis.
3. The compiled mitigation methods against the identified issues and challenges are sufficient in its contributions towards the formulation of the best practice framework, which will contribute to the successful completion of IT projects.
4. Individuals participating in the questionnaires have the appropriate skills and the required level of experience enabling them to contribute to the study.
5. Respondents providing input on the critical success factors, referred to as the agile practitioners, have significant professional experience in managing APs and are able to contribute significantly towards the development of the issue mitigation model.
6. Respondents have provided honest feedback based on their actual experience and skills involving APs and general PMgmt techniques.
7. During the discussion and interview process with the respondents, they were all in a neutral state of mind and there were no biasness in the responses provided.
8. The interview sessions conducted via different methods and medium, during different days and different times of the day will not impact the consistency of the feedback received from the participants.
9. The responses obtained are based on general projects managed against global standards and are not reflective of a singled out project scenario, which does not exist as a general concern amongst the broader perspectives of projects and PMgmt.

1.11 Limitations

The following limitations were acknowledged for this study. These limitations may reduce or refute the potential over-all findings beyond the present study:

1. The participants of the surveys and the contributors for this study may not represent the complete scenario of all projects, all industries and all functions. The study will attempt to identify a comprehensive list of participants, with the believe that sufficient amount of contribution can be obtained.
2. A majority of the respondents are from Asia Pacific countries, as such the other regions, namely Africa, America and Europe may not have been sufficiently represented. Given the advent of the management IT projects outsourced to the Asia Pacific region, this phenomenon could be acceptable, but still open for challenges.
3. The respondents self-declared as having significant experience in managing IT projects, but there is no appropriate method or process to verify or certify their level of experience. There were no means of attestation.
4. The responses provided by the practitioners to the various questionnaires are expected to be valid and representing the true environment and the actual scenario in the industry. There was no means of validating the responses further to verify them as appropriate and valid.
5. The level of understanding by the participants towards this study may not be sufficient, given their busy schedule due to their seniority, and the environment which is fast paced. This research does not validate this scenario, instead it accepts the involvement of the participants at their own time and level of effort invested in their respective participation.
6. The amount of time spent by the practitioners in validating the mitigation model is assumed to be sufficient, which may be questionable as the duration spent for validation may differ from one practitioner to another, which may not have been consistent.

1.12 Summary

This chapter discussed the background of this research, highlighting the problems associated to the administration and management of projects, in both traditional and agile environments. Many projects have failed in the traditional environment, with a smaller number of failed projects recorded in the agile environment. However, the number of challenged projects are rather consistent across both agile and traditional projects, making it crucial for the challenges along with its mitigation methods be identified, to achieve greater project success. Issues in PMgmt, involving the methodology and its processes, has also been a cause of project failures, triggering this study in an attempt to identify the prominent issues and challenges in projects, along with proposed mitigation methods. It has been learned that poor implementation of PMgmt processes and principles results in project failures. Failure to mitigate the project issues and challenges on a timely manner contributes to many fallbacks in projects.

The purpose of this study was established, which is to identify the issues and challenges in projects, along with mitigation methods, which will enable the formulation of a best practice framework for the successful management of projects. This will be achieved by using two prominent research methodologies, an SLR (Chapter 4) and a GT research (Chapter 5). The significance and nature of the study is to develop an insightful understanding of the relationships between issues and challenges and project success factors. The findings are discussed (Chapter 6), with the formulation of the framework (Chapter 7) and its evaluation (Chapter 8) and validation (Chapter 9) methods described.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview

PMgmt is a widespread arena and is confronted with many challenges in the attempt of upholding proper and just methods of performing the tasks within its discipline (Ciric et al., 2018; Cicmil et al., 2016; Špundak, 2014; Flyvbjerg, 2013). In the process, the leaders who are responsible for the successful administration and transferal of projects from its commencement to its closure are also accosted with great challenges. As per the purpose of this study defined in Chapter 1 (Section 1.4), to identify the documented issues and challenges faced by APs, a literature review will be undertaken to identify the common issues and challenges in both literature and in the industry. This chapter first attempts to study the literature associated to PMgmt, distinguishing it from product management. The term project will be defined, and the role of the person managing projects, known as the Project Manager (PM) will be elucidated. The various significant PMgmt methods, or methodology, will then be described and analysed, visiting the common samples of the various methods available to manage projects, along with the role of the team or group of people responsible for the proper governance of projects, generally referred to as the PMO.

The traditional PMgmt methodology will be compared against the APM method, producing a comparison between them, particularly highlighting the project success elements presented by the Agile method. The failure factors of the traditional method will be identified, along with the success factors of the agile method, from which the critical success factors will be identified. The two popular variation of PMgmt methods will be visited, namely the “Traditional” and the “Agile” approaches. The latter will be further elaborated, visiting the current popular methodologies. A comparison will be contrived

between the traditional and agile method of managing projects, with a critical analysis on the challenges faced by the agile methods, whilst emphasising the success factors of agile methods. In an effort to help increase the success rates of IT projects, this study seeks to determine, based on the experience and perceptions of the practitioners who have used both the agile and waterfall methodologies, the validity of the published (literature) and identified (from the industry) CSFs and its magnitude of contribution to successful projects. In line with this overall purpose, this study also seeks to investigate the extent to which the identified CSFs are associated with project success for Agile IT projects. In summary, this chapter is envisioned to meet the initial objectives proposed in Chapter 1 (Section 1.5), to identify and analyse the issues and challenges of managing APs in literature, to be able to answer the RQs (Section 1.6). As per the first objective, this chapter will attempt to identify and analyse the issues and challenges of managing APs in literature, compiling them into factors of success within an agile environment.

2.2 Project Management (PMgmt)

PMgmt is the both the science and art of managing all parts of the project to achieve the organisational or project objectives and mission, within the budgeted cost, specified time and predefined quality specifications; working effectively and efficiently, with high levels of ethics, in a changing project environment (Kohli and Chitkara, 2007; Kerzner, 2017; Meredith et al., 2017). The term “PMgmt approach” is often seen to be used as a set of guidelines and principles which set out the definition of how specific projects are administered and managed (Introna and Whitley, 1997; Iivari et al., 2000; Kerzner, 2017). Improving project performance by ensuring successful administration, management and delivery of IT projects remains a high priority of almost all project communities and organisations (Yardley, 2002; Wysocki, 2007; Standish Group, 2010; Diegmann, 2016).

In attempting to address this with the aim of increasing project effectiveness and efficiency, PMgmt methodologies are recurrently employed (Wells, 2012). With the burden and demand for the successful delivery of projects in the conceding business environment, new PMgmt methodologies are progressively being developed, employed, and personalised as a means of supporting and guiding the planning, execution and delivery of projects (Thamhain, 1994; Charvat, 2003; Morris and Pinto, 2004; Davies and Hobday, 2005; Sauer and Reich, 2009).

The four main causes of project failures, as reported by the Ministry of Statistics and Programme Implementation, of the Government of India are; (1) Insufficient project formulation, (2) Lack of appropriate contract planning and management, (3) Poor planning for enactment, and (4) Deficiencies in PMgmt during execution (Kohli and Chitkara, 2007; Stretton, 2018). This is an indication of improper project setup and planning, which emphasises on improper contract management for projects involving third party contracts directly impacting project execution and deliverables. The indication is also for poor PMgmt, which involves project governance and the methods in which the project is managed (Špundak, 2014; Stretton, 2018).

Schwalbe (2010) stressed the importance of top management commitment, emphasizing that the best way to slay a project is to suppress or deny the required financial support, eradicate the supply of human resources, and refute the visibility of the project. This is a clear indication that top management must shed grace over the project. The top management, executives or the leadership team must first be interested in the project, in order to obtain buy-in, as they can be an instrumental cause of project failure if they are not convinced that project outcomes will benefit the organisation's goals and objectives. The PMgmt framework derived by PMI represents a set of rules, which defined the method and its processes, along with the relevant templates for the operational use during

the project lifecycle (Introna and Whitley, 1997; Office of Government Commerce, 2002; PMI Standard, 2017). The framework shown in Figure 2.1 (PMI Standard, 2008) presents itself as a general guide for managing all types of projects (IT, Construction, Civil, Electrical, Mechanical, and Administrative projects) and to foster project governance.



Figure 2.1: PMgmt Framework

Source: PMI Standard, 2008

The framework shows 9 Knowledge Areas, which have been expanded to 10 in the later editions, with the addition of the “Stakeholder Management” knowledge area (PMI

Standard, 2017). Organisations usually adopt the framework and tailor them to their specific requirements, depending on the industry, nature of projects and the objectives of the organisation.

2.3 Product Management

Product management is deemed as a key success factor for IT products as it extends through the entire life-cycle, ensuring the fulfilment of organisational, business and technical perspective (Ebert and Brinkkemper, 2014). It is therefore important to understand the perspectives of Product Management in order to be able to properly position the knowledge and perspectives of the task of PMgmt. According to Ebert and Brinkkemper (2014), Product Management has various interfaces to many business processes and a variety of stakeholders across the project life-cycle, focusing on consistency and value-positioning across the various releases of the product, while being the principal driver for requirements engineering. Ebert and Brinkkemper (2014) concluded in their research that with increasing harmonisation of a precise, consistent, and empowered product management role, the success rate of projects in terms of product quality, schedule accuracy, and project duration predictability improves. Product life cycles are decreasing in almost all technology-intensive industries as the competition increases with globalisation (Jou et al., 2010) of businesses and projects. This gives rise to rapid development of products, hence the need to employ aggressive PMgmt methods.

Many software companies look too much on projects, technology and features, and not enough on value, market understanding and products, resulting in only 52% of the original requirements appearing in the final release of the product (Ebert and Brinkkemper, 2014; Ebert, 2012). The study found that it is mostly caused by ineffective organisations not

having a distinct product owner with assigned business accountability on the accomplishment of the project goals and objectives. Having a broader perspective of new product development, in a similar study conducted by Cooper (2004) against 105 organisations from various industries identified that the top 20% of organisations deliver 79% of their new products on time, while the average for all organisations deliver only 51% of their new products on time. The connection between product development, business strategy, sales and marketing efforts appear as the dominant challenge in many IT organisations (Cusumano and Yoffie, 1998; Ebert, 2007). Figure 2.2 describes the relationship of various types of integrated projects against a product life-cycle as described by Ebert (2009). It highlights the differences between the management of a product and a project. In this scenario, projects are seen as temporary string of efforts, or endeavours undertaken to create, maintain and sustain a products life-cycle.

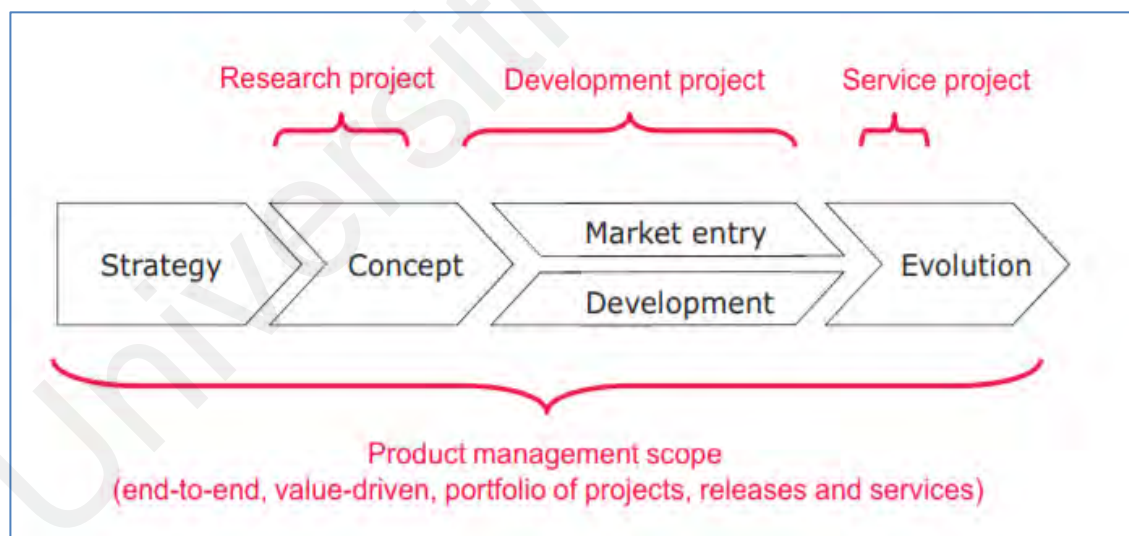


Figure 2.2: Product Management Scope

Source: Ebert and Brinkkemper (2014)

Therefore, Ebert and Brinkkemper (2014) conclude that the difference between project and product management is its focus on delivering one specific product within the perspectives of time, budget, and quality. Ebert and Brinkkemper (2014) further

mentioned that the person managing the product, referred to as the product manager, looks to the overall market success and evolution of the product together with its subsequent releases and related services.

In maximising business value, the product manager is regarded as the person who leads and manages one or several products from the inception state to the phase-out state (Ebert and Brinkkemper, 2014). The value of the product, in an economic perspective, forms the basis for comparison, in the perspectives of the cost of the products (Ebert, 2012). As the value is expressed in monetary terms, equating to the cost of the product (or service), it is determined by the amount of available supply and the level of existing demand. Business value is the value of a product against a respective business, which is also directly dependent on the value prescribed by the customer, which is the perceived value in a given market, or simply called the 'market value' (Ebert and Dumke, 2007). The product manager is responsible for the entire value chain of a product, including the life cycle of the product (from inception to phase-out).

2.4 Difference between PMgmt and Product Management

Projects are managed as part of the process of developing, creating, or producing a Product. A product may have different projects at different phases of the product. However, a project may also have several products as its deliverable. Hence, the relationship may not be as straight forward as we would imagine it to be. Wysocki et al. (1995) have illustrated the difference between PMgmt and product management, summarising them as shown in Table 2.1 for the various tasks and the different phases they are categorised in.

Table 2.1: Difference between PMgmt and product management

Phases	Description of Tasks	PMgmt	Product Management
Scope the Project	<ul style="list-style-type: none"> • State the problem/opportunity • Establish the Project Goal • Define the Project Objectives • Identify the Success Criteria • List Assumptions, Risks, Obstacles 	<ul style="list-style-type: none"> • Request Initiation • Business Requirements • Success Criteria 	<ul style="list-style-type: none"> • Establish New Product Objectives • Set Financial Goals • Establish Success Criteria
Develop Detailed Plan	<ul style="list-style-type: none"> • Identify Project Activities • Estimate Activity Duration • Determine Resource Requirements • Construct/Analyse the Project Network • Prepare the Project Proposal 	<ul style="list-style-type: none"> • Develop Functional Requirements • Establish Phase Review Schedule 	<ul style="list-style-type: none"> • Develop New Product Development Plan
Launch the Plan	<ul style="list-style-type: none"> • Recruit and Organise Project Team • Establish Team Operating Rules • Level Project Resources • Schedule Work Packages • Document Work Packages 	<ul style="list-style-type: none"> • Identify the Development Team • Build the System 	<ul style="list-style-type: none"> • Conduct Business Analysis • Conduct Competitor Analysis • Develop Marketing Strategy
Monitor/Control Progress	<ul style="list-style-type: none"> • Establish Progress Reporting System • Install Change Control Tools/Process • Define Problem Escalation Process • Monitor Project Progress vs. Plan • Revise Project Plan 	<ul style="list-style-type: none"> • Monitor Progress • Subsystem Test • Acceptance Testing 	<ul style="list-style-type: none"> • Monitor Product Progress • Track Performance against Objectives • Initiate Production and Sales Plan • Test Market
Close Out the Project	<ul style="list-style-type: none"> • Obtain Client Acceptance • Install Project Deliverables • Complete Project Documentation • Complete Post-Implementation Audit • Issue Final Project Report 	<ul style="list-style-type: none"> • Evaluation • Post-Project Review 	<ul style="list-style-type: none"> • Release Product to Product Management

Source: Wysocki et al. (1995)

As per the scope of this research, it will be concentrated on the term “Project”, and the task of PMgmt, with the knowledge on the distinction between a product and a project, and between the role of product management and PMgmt.

2.5 The Project

The CHAOS reports have identified the current state of project success rates across organisations, observing that project failure rates have remained high and rather stable

across over a decade of research, in spite of much higher visibility and importance placed on project performance (The Standish Group, 2011). As Pinto and Slevin (1988) observed, there were a limited number of topics which were frequently discussed in the field of PMgmt, but non-evident on the agreement of these articles as a contributing factor for project success (Pinto and Slevin, 1988). Traditional measurements of project success focused on the triple constraints of scope, cost, and time, necessitating projects to be produced with sufficient quality, mainly in terms of its functionality (Atkinson, 1999; Kerzner, 2003; Kerzner, 2019). Nevertheless, project success is often defined in a broader context, as opposed to the limits of the general concepts of the triple constraints. Munns and Bjeirmi (1996) noted that, as dictated by a majority of literature during the time of their study, projects end when they are delivered to the customer, at which point the task of PMgmt will be deemed to have ended. The wider post-project activities, mainly consisting of operational activities which will affect the delivered outcome of the project is not well-thought-out (Munns and Bjeirmi, 1996), further neglecting or giving less emphasis on project closure activities.

Traits for a successful project as discussed by Whitten (2005) are as follows:

1. Prepare that a PM's responsibility is far broader than first assumed.
2. PM is best placed as a "Dictator", democracy would not work in projects. Primary reason for PM failure is that they are too soft and have difficulties making tough decisions.
3. Each team member must focus on their respective domain of responsibilities. Extra credit work should not be pursued at the expense of own responsibilities and commitments within the domain of responsibility.

4. The micro-management leadership style is highly offensive, and if required, should only be used in rare instances. Those micro-managed lose their deepest passion and sense of accountability.
5. Accountability should be charged onto individuals, not onto teams
6. All organisations usually have the people they need, just that they may not be sufficiently trained.
7. Ask for help as articulately and as early as possible. Projects and organisations need to create a work environment where asking for help is encouraged rather than frowned upon.
8. Assigning a mentor helps greatly in ridding bad practices and habits, and adapting good ones. Mentors are expected to know the best practices available, and able to create some of their own best practices. Mentors should be accessible when needed.
9. Decrease over-reliance on emails, while increasing person-to-person communication.

Jugdev and Müller (2005) discovered the demand for a more holistic approach to measuring success based on their review on relevant literature on project success over a 40-year period. Researchers were seen to be more prominently measuring success based upon the organisational impact of the project deliverables, rather than the success of merely meeting the triple constraints. Thomas et. al. (2008) stated that measuring project success is not straightforward. There were some examples where the original objectives of the project were not met, but the client was highly satisfied, while there were also other examples where the initial project objectives were met, but the client was quite unhappy with the results (Thomas et. al., 2008). Shenhar et al. (1997b), in making a comparison over the three conventional dimensions of project efficiency of time, budget and scope, believed that scope may possibly have the largest role in determining project success.

Thus, scope is not only an aspect of project efficiency, but also a determinant of customer satisfaction (Shenhar et. al., 1997b).

2.6 The Project Manager (PM)

Kohli and Chitkara (2007) suggested 10 roles of a PM; (1) Figurehead role, (2) Leadership role, (3) Liaison role, (4) Monitoring role, (5) Disseminating role, (6) Representative role, (7) Entrepreneurial Role, (8) Disturbance handling role, (9) Resources allocating role, and (10) Negotiating role. Apart from these 10 suggested roles, PMs are seen to be taking up a further expanded role during the recent times, including the role of a financial controller, human resource manager, budgeting coordinator, relationship manager, and many other roles (DuBois et al., 2015; Loufrani-Fedida and Missonier, 2015; Meng and Boyd, 2017; Hodgson and Paton, 2016). Apart from the expectations of possessing these roles, a high level of ethical and intellectual capabilities are expected of current PMs (Bredillet et al., 2015).

Taylor (2006) highlighted the six major categories on the skills required by a PM in managing successful projects, based on a report on “problems with PMgmt and the skills needed to cope with them (Posner, 1987)”, written by Professor Barry Z., Executive Development Centre, Leavey School of Business and Administration, Santa Clara University. The six skills required are namely; (1) Communication skills – listening, persuading (negotiating), (2) Organisational skills – planning, goal setting, analysing, (3) Team Building skills – empathy, motivation, creativity, (4) Leadership skills – set example, energetic, vision, delegates, positive attitude, (5) Coping skills – flexibility, creativity, patience and persistence, and (6) Technological skills – experience, project knowledge.

Taylor (2006) professed eight specific challenges faced by PMs in the task of managing projects, which are; (1) inadequate resources, (2) unrealistic schedules, (3) unclear goals and senior executive direction, (4) uncommitted team members, (5) inadequate planning, (6) communication breakdowns, (7) goal and resource changes, and (8) interdepartmental conflicts. He further emphasised that the first three may be the major contributors. “Organisations are forced into having to do more with less in order to be competitive. In reality, it is more likely that inadequate resources occur because of poor planning or inefficient usage of available resources” (Taylor, 2006). “Unrealistic deadlines occur all too often, usually imposed by the organisation because it is reactively responding to a need or because it is promising earlier delivery in a bid to make the company appear more attractive competitively” (Taylor, 2006). Taylor (2006) adds that the biggest problem encountered in PMgmt is obscure and vague goals and ambiguous senior executive direction. “The most difficult task often is simply determining what the customer wants. Many customers themselves do not know what they want. Which usually results in several expensive false starts” (Taylor, 2006). The ability to ensure cross functional capabilities within the team is becoming a crucial trade in PMs (Hoda and Murugesan, 2016).

The level of commitment from the PMs, and the corresponding support they receive from the leadership team of their organisation, is a very important factor in helping PMs lead projects successfully. Without commitment from the leadership or executive team, many projects are anticipated to fail (Schwalbe, 2010). Depending on the nature and type of projects, regular and special approvals are required by the PMs on a timely manner, which is usually attained through the cooperation from key stakeholders in other parts of the organisation, where the PM’s may require mentoring and coaching on possible leadership issues. (Schwalbe, 2010).

Wysocki et al. (1995) described five main competencies required to be an effective PM, which are: (1) Business Achievement Competencies, (2) Problem-solving Competencies, (3) Influence competencies, (4) People-management competencies, and (5) Self-management competencies. These competencies are elaborated in Table 2.2.

Table 2.2: Competencies required to be an effective PM

Category	Competencies	Description
<i>Business Achievement Competencies</i>	Business awareness	Link project to business objectives, to solve a business problem
	Business partner orientation	Regular meet with business partners to gather full understanding of their needs and concerns
	Commitment to quality	Efficient ways to do things, enforcement of high standards. Monitor performance
<i>Problem solving Competencies</i>	Initiative	Innovative and creative approaches to problems faced
	Information gathering	Identifies all groups to be impacted by project and involves them, obtain sufficient factual project related information
	Analytic thinking	Overall project plan with work breakdown
	Conceptual thinking	Context of a broader view, anticipates and plans for the future
<i>Influence competencies</i>	Interpersonal awareness	Getting to know team members to understand the motivation factors
	Organisational awareness	Support of key stakeholders, proactive group engagement
	Anticipation of impact	Manage expectations, consider short and long term implications
	Resourceful use of influence	Develop strategies, involve team members in detailed planning
<i>People management competencies</i>	Motivating others	ensure team members understand project goals, provide opportunities and rewards
	Communication skills	plan ahead for meetings, ensure common understanding
	Developing others	assignments and training for team members
	Monitoring and controlling	maintain detailed master plan
<i>Self-management competencies</i>	Self confidence	confronts problems, takes a firm stand in the face of opposition
	Stress management	controls own feelings and behaviour
	Concern for credibility	maintain credibility by consistent delivery, stay on top of project details
	Flexibility	adjust readily to changes in the workplace

Source: Wysocki et al. (1995)

According to Whitten (2005), PMs responsibilities which are often weakly pursued includes the following:

- Appointment of a project sponsor with the establishment of an effective relationship
- Adopting/defining PMgmt best practices for the project
- Ensuring client or customer participation
- Obtaining commitments and accountability from relevant stakeholders
- Escalating project-related issues to mitigate them for timely closure
- Managing scope creep by enforcing effective change control processes
- Aligning the project plan to the project sponsor, executives, client or customer
- Independently driving the project towards its successful completion, with non-compromised accountability

2.7 PMgmt Methodology

PMgmt methodology is defined by PMI as a set of rules, techniques, templates, procedures, methods, and best practices used on a project (PMI Standard, 2017). Regarded as a set of PMgmt principles and guidelines that can be tailored and applied to specific situations, they can be anywhere between a simple list of tasks, to a more detailed definition of the tools and techniques involved in approaching the project specifics (Charvat, 2003). From the perspectives of “knowledge”, Gane (2001), defined PMgmt methodology as a repository of knowledge about the tasks, tools, techniques, deliverables, and the roles assigned during the course of the project, along with the additional knowledge of aligning these knowledge areas to suit the specific projects. Introna and Whitley (1997) defined the term “PMgmt methodology” as a set of structured tools and techniques employed for solving specific problems. Matos et al. (2019) argued that the

socio-political aspects are far more critical to a project's success than PMgmt tools and techniques. In a more elaborative definition, PMgmt methodology is defined as any form of principle, which the PMgmt team relies on, to deliver project results successfully (Cockburn, 2002; Cockburn, 2004). Brinkkemper (1996) defined PMgmt method as a pre-defined set of rules and directions, which are structured to manage projects, construed by specific ways of thinking. PRINCE2, being regarded as one of the most widely used PMgmt methodology, in Europe and other parts of the world alike, is defined as a “structured PMgmt method”, partially consisting of a well-defined set of processes and techniques (Office of Government Commerce, 2002; Office of Government Commerce, 2009).

The ultimate goal of a PMgmt methodology is to increase the probability for the delivery of successful projects (Kerzner, 2017). The goal of a methodology is to attain high standards of quality in project deliverables, using a simplified process, while attaining greater control via an improved method (Nelson et al., 1998). A good PMgmt methodology is expected to guide the PM and the project team members through a set of activities, which are seen to be controlled, properly managed, and clearly visible to foster the achievement of the project results (Office of Government Commerce, 2009). Good PMgmt practices promote project success, while poor PMgmt usually attracts project failures (Nasir et al., 2015). Project success can also be attained by creating and maintaining a business case, and keeping it up to date (Einhorn, 2019). The PMBOK (PMI Standard, 2017) presents a generic model for both IT and non-IT projects, but it is not seen as a perfect model to ensure (software) project success, as an incorrect set of activities and processes may be applied to projects (Nasir et al., 2015). Nasir et al. (2015) asserted that the processes and activities adopted from PMBOK should be chosen carefully, to address the critical success factors of projects.

2.8 The Project Management Office

The PMO is considered as part of an organisational structure, adopting an appropriate methodology, or a combination of several methodologies, established to promote and possibly improve the use of PMgmt practices, to enable the organisation to achieve high levels of productivity (Monteiro et al., 2016; Szalay et al., 2017). A PMO assumes an integrating role to facilitate, coordinate and support project activities across projects, programs, portfolios, and the organisation (Paton and Andrew, 2019). Taylor (2006) suggests that the five core functions of a PMO are; (1) Practice management, (2) Infrastructure management, (3) Resource integration, (4) Technical support, and (5) Business alignment. The list of activities suggested by Taylor (2006) are:

- 1) PMgmt Methodology – to establish policies and procedures, training and clearly defined operating expectations.
- 2) Project Governance – to assume the role of a consultative or controlling PMO.
- 3) Resource management – applicable in a controlling PMO.
- 4) Mentoring – coaching, communicating, listening, and acquiring organisational knowledge.
- 5) Project Portfolio Management – aligning the projects to fit the organisational goals and objectives, and the charter of the program and portfolio.
- 6) PMgmt Tools – evaluate and implement tools that add value, with a caution not to change tools (especially software) merely because new ones become available.
- 7) Assessment – on the project health, competencies, and capabilities.
- 8) Training and Education – extend the PMgmt capabilities.
- 9) Planning support – assist in requirements definition and developing technical approaches

- 10) Customer relationship – interface with the client or customer
- 11) Standards and Metrics – issuance of consistency in the quality of projects
- 12) Organisation and Structure – selection of the most appropriate PMO model in the organisation, complementing its goals and vision.
- 13) Career Development – helping PMs and team members on career paths.
- 14) Project Auditing – attempting to determine the true health of projects.
- 15) Vendor/Contractor Relationships – managing subcontracts and vendors.
- 16) Project Knowledge Management – due to the expected mobility of the workforce, global business structure, and lack of time in acquiring knowledge.
- 17) Facilities and Equipment Support – supplying facility and equipment, shared by various projects to maximise usage and minimise idle time
- 18) Team Development – formation of the project team
- 19) Project Recovery – establishing a dedicated team with experienced PMgmt personnel to assist troubled projects with probabilities of failure.
- 20) Business Performance – monitoring project performance and viability.

As a dynamic organisational entity, the PMO is a significant contributor in reaching the strategic achievements of organisations, becoming the focus for the tasks of professionals in the organisation, and of PMgmt-related activities, usually operating in multi-project environments (Szalay et al., 2017). Over time, the PMO has evolved to become a central repository for tools and methodologies, thus being regarded as an asset (Darling and Whitty, 2016). A PMO usually assists PMs and project teams throughout the organisation in implementing PMgmt principles, practices, methodologies, tools, and techniques, further providing a framework for organisations (Nasir et al., 2015; Hobbs, 2007; Kaufman and Korrapati, 2007; Dai, 2001; Block and Frame, 1998), however it may not necessarily ascertain project success.

2.9 Traditional PMgmt Methods

Traditional PMgmt methods are generally seen as approaches which are normative and rational, with the general assumption that projects appear in a linear form, are predictable with clear boundaries, and are perceived to be relatively simple, positioning the planning activities, even the detailed level planning tasks, as easily achievable (Andersen, 2006; Boehm, 2002; Boehm and Turner, 2003; Gabriel, 1997; Cicmil et al., 2009; Collyer et al., 2010; DeCarlo, 2004; Leffingwell, 2007; Saynisch, 2010; Shenhar and Dvir, 2007; Wysocki, 2007). Many authors in the current environment stress that a single method cannot be used to manage all project types, due to the increasing complexity of projects, along with the comprehensive demands of the stakeholders (Aguanno, 2004; Chin, 2004; Shenhar and Dvir, 1997a; Shenhar and Dvir, 2007; Wysocki, 2007). It is becoming very challenging to use one fixed method which can be standardised to manage all types of projects, creating a certain level of variation in the methods and processes employed. The measure of project size in traditional projects are usually appropriated by either the size of the project team (Aguanno, 2004; Boehm, 2002; Boehm and Turner, 2003; Cockburn, 2002; Fowler, 2002; Highsmith, 2004; Highsmith, 2010), the intricacy and capacity of the project requirements (Boehm, 2002; Coram and Bohner, 2005), or the length and complexities of the project schedule (Coram and Bohner, 2005).

The other major underlying setback of the traditional approach is the assumption that projects, and the environment which they are in, are separate entities which should be dealt with separately, instead of perceiving them as co-related entities (Aguanno, 2004; Cicmil et al., 2009; Shenhar and Dvir, 2007). The environment in which the project is managed and executed is a crucial determinant to the performance of the project. Due to

the inability to define project goals clearly and visibly, it has imposed great challenges in creating complete project plans at the outset of projects (Chin, 2004; DeCarlo, 2004; Shenhar and Dvir, 2007). Whatever extent to which we attempt to define the project goals, it can never be complete. Even if project definitions are clearly defined by one person, it may be translated differently by the varying audience, based on their level of understanding, technical capabilities, skills, knowledge, beliefs and level of comprehension of the language. The traditional approach to managing projects are deemed inappropriate for the current project environment due to the structural complexity of projects, the inability to properly defining project goals, and the constraints imposed by the project schedule. The traditional PMgmt methods and approaches, requiring a certain degree of formal documentation, are deemed more apposite throughout any given period of the project (Boehm, 2002; Coram and Bohner, 2005).

The various objections to the traditional PMgmt approaches, along with the growing requests' for continuous innovation, have impacted all industries; and additionally, with the current cost reduction trends, have resulted in the advent of organisations and professionals seeking for renewed or improvised PMgmt approaches (Aguanno, 2004; Conforto and Amaral, 2015). The demand for new approaches is more often seen to be connected with software projects, particularly within the engineering and development arena of software (Aguanno, 2004; Boehm, 1996; Beck et. al., 2001). Change is regarded as inevitable in today's environment, and as these new approaches are seen to embrace changes, or as being enriched by the concept of adaptability (to changing requirements), it complements the current drawbacks of not being able to establish a complete project plan at the beginning of projects, especially in complex projects (Andersen, 2006; Leffingwell, 2007; Shenhar and Dvir, 2007). That is the reason why new approaches emphasises on project execution as the main agenda, in contrast to the traditional

approach which emphasises on thorough planning instead (Chin, 2004; DeCarlo, 2004; Leffingwell, 2007; Beck et. al., 2001). To strengthen the argument, the non-traditional approaches stresses on the ability of the project team members' communication and collaboration traits, in addition to their common expected ability to follow the process dictated by the respective method or approach (Aguanno, 2004; Cockburn and Highsmith, 2001; Collyer et al., 2010; Coram and Bohner, 2005; DeCarlo, 2004; Cockburn and Highsmith, 2001).

New PMgmt approaches appear harmonised with the creation of new approaches to software engineering and development projects. These new approaches have often been associated with being different from the traditional approach, all known and distinguished by several different names. The name most often used is "agile" (Aguanno, 2004; Chin, 2004; Highsmith, 2004; Highsmith, 2010). Analysing these various "new" approaches, the extreme, lean and adaptive approach dictates a very similar underlying concept (DeCarlo, 2004; Wysocki, 2007; Shenhar and Dvir, 2007; Virine, 2008; Wysocki, 2007). The common understanding amongst these approaches is the ability of them being able to provide the projects with avenues to quickly adapt to changes during the various stages of the project lifecycle (Aguanno, 2004; Boehm and Turner, 2003; Shenhar, 1999; Shenhar and Dvir, 2007), hence the concept of being agile. DeCarlo (2004) emphasised that Adaptability is the key characteristic for APs.

2.10 Agile Project Management Methods

PMgmt methodologies, in the context of software development projects, have evolved from predictive (such as the waterfall approach), to iterative and incremental (such as the Rapid Application Development and Rational Unified Process), and to agile approaches

(such as Scrum, Kanban, and Extreme Programming). As the popularity of agile adoption increases, organisations develop the inclination to adopt and scale the agile approach and PMgmt practices (Turetken et al., 2017). APM is a method used to manage projects which requires deftness, and is able to adapt to a constantly changing environment, empowering the project team to cope with these changes (Conforto et al. 2016; Ahmad et al., 2015; Sheffield and Lemétayer, 2013; Ben-David et al., 2012; Augustine et al., 2005). APM has gained a wide array of attention from the practitioners and general public audience alike, as it is considered an appropriate PMgmt approach for today's projects, compared to the traditional PMgmt approach; applied in practice as PMgmt methodologies, often tailored to specific needs of the project organisation (Špundak et al., 2011). According to Zhang et al. (2007), agile methods are simply a set of approaches that are interactive, incremental, and collaborative. Augustine et al. (2005) defines APM as the ability to manage and adapt to change. Shifting the focus away from PMs, to team dynamics, has enabled empowerment of teams, leading to prominence of agile practices (Jacobson, et al., 2013). Agile approaches are more often regarded as a cryptographical method, as opposed to the requirements engineering method, where knowledge sharing is seen as a critical function which ensures the necessary level of documentation is prepared (Paetsch, et al., 2003). In 2001, the "Agile Manifesto" was written by practitioners who proposed many of the Agile development methods. The manifesto states that Agile development should focus on four core values as follows (Beck et. al., 2001; Dybå and Dingsøy, 2008; Krehbiel et al., 2017):

- 1) individuals and interactions over processes and tools
- 2) working software over comprehensive documentation
- 3) customer collaboration over contract negotiation
- 4) responding to change over following a plan

Uncertainty exists when actions are required, deprived of knowledge of the possible outcomes, and when the probabilities of their manifestations are unknown (Wied et al., 2020). In comparison to the traditional PMgmt approach, APM is considered more appropriate in the current project environment, tailored to specific needs of organisations, while being interactive, incremental, and collaborative (Stettina and Hörz, 2015; Špundak et al., 2011; Zhang et al., 2007). The basis of the agile approach is iterative in nature (DeCarlo, 2004; Haas, 2007). DeCarlo (2004) sets up his Flexible Project Model with four iterative phases; (1) Visionate, (2) Speculate, (3) Innovate, and (4) Re-evaluate, and with a closing phase as Disseminate. Highsmith (2004) instead, proposed five phases of the APM approach, listed as follows:

- 1) Envision (define vision, project scope, and project organisation)
- 2) Speculate (develop model defined by the product characteristics and time constraints, and iteration plan for vision implementation)
- 3) Explore (deliver tested parts in short time and continuously search for a way to reduce project risk and uncertainty)
- 4) Adapt (check deliverables, current situation, and team behaviour to adapt, if necessary)
- 5) Close (close project, create lessons learned, and celebrate).

Benediktsson and Dalcher (2005) argued that the project scope could be altered by up to 30% during each iteration. Therefore, in addition to helping in building the final project scope, the iterative approach supports, by way of quicker execution of the overall project; delivering early benefits and serving to achieve greater controls over project uncertainties (Benediktsson and Dalcher, 2005). Aguanno (2004) similarly states that the main advantage of using the agile approach is the reduction of risk of not properly defining the

project scope, and the consequent risk of deterioration in product quality; attaining a better command in project control and fostering better project communication.

On the other hand, adversaries of the agile approach usually notice that such approaches are merely defences against the principles of PMgmt (Rakitin, 2001), and that there is still a lack of pragmatic evidence towards the successful submission of the agile approaches (Coram and Bohner, 2005; Conforto and Amaral, 2015; Leybourne, 2009). Boehm and Turner (2005) quantified that probably the most important challenges of the agile implementation imply to organisational constraints, and they therefore distinguish obstacles in the areas of people management, and the development and business processes. Ambler (2013) proposed an Agile Life Cycle Process model with three main process areas; (1) Initiation, (2) Development and (3) Maintenance and Support, emphasising on structured PMgmt throughout the life cycle process. The model, shown in Figure 2.3 illustrates that project governance is achieved across all levels of the process, involving a wide range of project stakeholders.

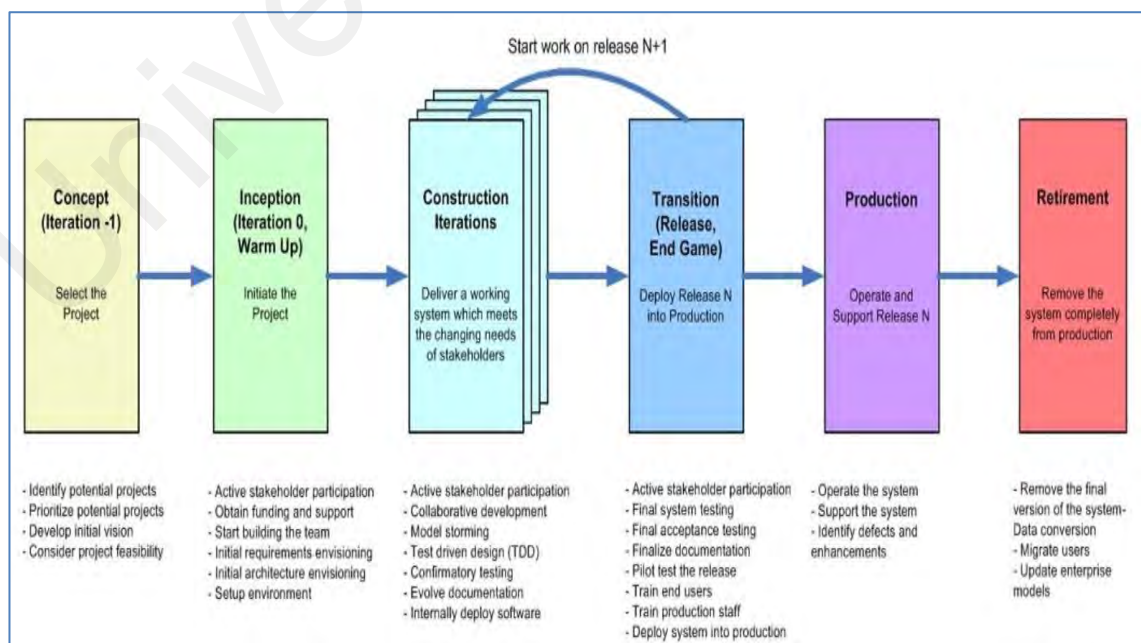


Figure 2.3: High-level Agile System Development Life Cycle (SDLC)

Source: Scott W. Ambler (Ambler, 2018)

Two significant trends: agile method and geographical distribution, emerged in software development practice in the last decade. These trends were combined to enable the use of agile methods in the geographically distributed contexts (Pries-Heje et al., 2005; Agerfalk and Fitzgerald, 2006; Holmström et al., 2006; Armour, 2007; Sutherland et al., 2007; Paasivaara et al., 2008). Agile methods have become more popular for use within Multi-National Companies (MNCs) due to their geographically disbursed nature, with high likelihood of its projects to be geographically distributed. Thus, multi-national companies and larger organisations begun looking at agile methods to benefit from both the trends.

In an empirical study conducted by Dybå and Dingsøyr (2007), the description of the main agile development methods have been summarised in the following context. These methods are mostly classified as popular agile methods (Anand and Dinakaran, 2016; Anwer et al., 2017).

1. **Crystal methodology:** Designed and developed by Cockburn (2002, 2004), with seven characteristics: frequent delivery, reflective improvement, osmotic communication, personal safety, focus, easy access to expert users, and requirements for the technical environment (Cockburn, 2002). The framework includes three factors that influence methodology selection/design: communications load (based on staff size), system criticality, and project priorities. The method is characterised by its incremental and self-adaptation processes, having two mandatory rules: (a) incremental development with cycles not exceeding four months, and (b) requirement for team members to hold reflection workshops (pre-increment, mid-increment and post-increment) for self-adaptation of the method.
2. **Dynamic Systems Development Method (DSDM):** Divides projects in three phases: the pre-project phase (before), the project life-cycle phase (during), and the post-

project phase (after). Stapleton (2003) described nine principles underlying the DSDM methodology: (1) User Involvement, (2) Empowering the Project Team, (3) Frequent Delivery, (4) Addressing Current Business Needs, (5) Iterative and Incremental Development, (6) Allow for Reversing Changes, (7) High-Level Scope baselined before the Start of Project, (8) Testing throughout the Lifecycle, and (9) Efficient and Effective Communication

3. **Feature-Driven Development (FDD):** A combination of model-driven and agile development, emphasising upfront design and planning (Koch, 2005). It emphasises on the initial object model, division of features into multiple work, and the iterative design for each feature, consisting of two phases: design and development (Palmer and Felsing, 2002). FDD is defined by eight practices: (1) Domain Object Modelling, (2) Developing by Feature, (3) Class ownership, (4) Feature teams, (5) Inspections, (6) Regular build schedules, (7) Configuration Management, and (8) Reporting/Visibility of results.
4. **Adaptive Software Development (ASD):** A complex adaptive system that is composed of three elements: agents (team members and stakeholders), environments (processes, organisations, technologies), and the emergent outcome (product) (Highsmith, 2002). The model consists of three components: Speculate (i.e. plan), Collaborate (i.e. build) and Learn (i.e. review). These three components entail five steps: (1) Project Initiation, (2) Adaptive Cycle Planning, (3) Concurrent Feature Development, (4) Quality Review, and (5) Final Q/A and Release. The first and last steps are executed only once, while the other three steps in between constituting the "Learning Loop" or "Adaptive Cycles" is executed multiple times (Koch, 2005). The ASD life cycle has six basic characteristics: (1) Mission-focused, (2) Feature-based, (3) Iterative, (4) Time-boxed, (5) Risk-driven, and (6) Change-tolerant.

5. **Lean Software Development (LSD):** A set of principles and tools that a software development project can utilise to be lean (Poppendieck and Poppendieck, 2003). LSD is characterised by seven lean principles, encompassing 22 tools: (1) Eliminate waste, (2) Amplify learning, (3) Decide as late as possible, (4) Deliver as fast as possible, (5) Empower the team, (6) Build integrity, and (7) See the whole. The Toyota production system to software development undertook the adaptation of principles from lean production, and recorded significant improvements to its production system.
6. **Scrum:** An agile software development method which has been used to manage regular product development projects (Schwaber and Sutherland, 2011). The key concept of Scrum is the technique of sprinting, referred to as “Sprint”, which is an incremental iteration of 30-day cycles, working with a set of goals. Scrum was designed to focus on situations where it is difficult to plan ahead in projects, with the mechanism for “empirical process control”; where the core element is the feedback loop. Particularly in the software industry, the software application or program is developed in increments by a self-organising team, which are called “sprints”. The cycle starts with planning, and ends with a review. The features which are to be implemented in the system are registered in the form of backlogs. The product owner reviews the backlog items and decides which items should be developed in the following sprint, by setting priorities against the selected backlogs to be developed. A daily stand-up meeting will allow the team members to coordinate their work accordingly. One team member is designated as the scrum master, who is placed in charge of identifying issues or challenges that hinder the team from working effectively and producing the desired results, and is responsible of solving the issues as they occur (Schwaber and Beedle, 2002). In SCRUM projects, the development is highly influenced by the vision of the client (a weakness) and the client involvement

in the development process (a strength). If the expectations are managed well, it will show as a strength, otherwise it will appear as a weakness.

7. **Extreme Programming (XP):** One of the most popular agile software development methods. XP focuses on best practice for development, and it consists of 12 elements of practice: (1) The planning game, (2) Small releases, (3) Metaphor, (4) Simple design, (5) Testing, (6) Refactoring, (7) Pair programming, (8) Collective ownership, (9) Continuous integration, (10) 40-hour week, (11) On-site customer, and (12) Coding standards. The revised “XP2” consists of 13 primary practices, which are: sit together, whole team, informative workspace, energised work, pair programming, stories, weekly cycle, quarterly cycle, slack, 10-minute build, continuous integration, test-first programming, and incremental design. There are also 11 “corollary practices” (Beck, 2000, Beck, 2004). One special aspect of XP is its Facility strategy for communication and cooperative effectiveness. XP recommends that all project members work in a single room with no doors, no offices, and no cubicles. Cockburn (2002) describes the "caves and common" room practice for XP teams where the room has two zones – the "common" area is organised to maximise communication and information transfer, while the "cave" area is organised to allow team members a private place to check email or make phone calls. This ‘Facility’ strategy is very important for the XP model because it makes the whole thing work. XP provides a novel mixture of the existing software development practices (Cockburn, 2002).

2.11 General Principles of Agile Practices

While the described agile methods have their own peculiarities, they all share the same principles as envisioned by their advocates. The Agile Alliance (2001) has identified 12 principles of agile practices as follows:

1. Customer satisfaction through early and continuous delivery of valuable software appear as the agile practitioners' highest priority.
2. Welcoming changing requirements, even late in development, is the Agile process which harnesses change for the customer's competitive advantage.
3. Frequent delivery of working software, from a few weeks to a few months, with a preference to the shorter time scale.
4. Developers and business-incumbents must work together daily throughout the project.
5. Projects should be built around motivated individuals, giving them the environment and support they need, and trusting them to get the job done.
6. Face-to-face conversation is the most efficient and effective method of conveying information to and within a development team.
7. The primary measure of progress is working software
8. As agile processes is expected to promote sustainable development, the project stakeholders should be able to maintain a constant pace indefinitely.
9. Continuous attention to good design and technical excellence enhances agility.
10. The concept of simplicity is essential, dictated as the art of maximizing the amount of pending work.
11. Self-organizing teams produce the best requirements, design, and architectures.
12. The team reflects on how to become more effective at regular intervals, then tunes and adjusts its behaviour accordingly.

As many IT projects are outsourced, either through a shared services organisation, or to a third party vendor, as a means for organisations to concentrate on their core business and hand over the ITPM function to the experts, who would have established in-house PMgmt capabilities. As such, it is also important to address the effects of the outsourcing function on the PMgmt activities. Batra D. (2009) discusses the Agile Manifesto against

an outsourcing environment, describing both the advantages and problems of implementing an agile method within an outsourced environment, illustrated in Table 2.3. Over a study done against the 12 agile manifesto principles, Batra D. (2009) qualifies four principles as feasible agile practices (as per Table 2.3), which are clearly viable.

Table 2.3: Evaluation of current agile Principles in an outsourcing environment

Agile Manifesto Principle	Advantages In an Outsourcing Environment	Problems In an Outsourcing Environment
Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.	Feasible because more resources are available.	
Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.	The lowering of costs because of outsourcing may provide some flexibility in managing changes.	Vendor may not accept late changes. Vendor may not agree to fixed price contract.
Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.	Feasible because more resources are available.	
Business people and developers must work together daily throughout the project.		Temporal and geographic distances may make it more difficult to work with the vendor.
Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.		Difficult to control motivation at the vendor's site. Approximately 49.99% of designers are below average.
The most efficient and effective method of conveying information to, and within, a development team is face-to-face conversation.		Practically impossible between the outsourcing client and vendor.
Working software is the primary measure of progress.	Feasible.	
Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.	Somewhat feasible.	Because of temporal distance, fatigue is inevitable if practices like pair programming are instituted.
Continuous attention to technical excellence and good design enhances agility.		Approximately 49.99% of designers are below average.
Simplicity – the art of maximizing the amount of work not done – is essential.	Feasible.	
The best architectures, requirements, and designs emerge from self-organizing teams.		Cultural disparities between the outsourcing client and vendor may inhibit self-organization.
At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.		Organizational culture may hamper this practice.

Source: Batra D. (2009)

2.12 Comparison between Traditional and Agile Methods

Developed by Royce (1970), the waterfall model has been popular for its relative ease of use. Software programmers have found this model to be efficient for short-term project periods and development of programs that are already stable (Mumford, 2010). The waterfall model documents varying stages of development and facilitates the transfer of a project midway from one team of developers to another (Waterfall Model, 2012). Departing from this traditional model, the agile model identifies various aspects of a problem and its potential solutions (Agile Modelling, 2013). The agile model develops solutions that are considered minimally adequate, with the details relatively minimal to ensure ease of utilisation by a broad scope of audiences (Griffiths, 2007).

For a number of years now, Agile has been proclaimed as a methodology for project planning and execution which addresses many of the failings with the traditional process. Out of the frustrations conceived by multiple practitioners, the Agile Manifesto was created for the purpose of reconsidering the elements of measure by which successful projects are managed in constantly changing environments, and within an unorganised setting. Although the ideas surrounding the Agile philosophy are attractive and logical, there seems to be a lack of empirical validation to date. The contention is whether an Agile-managed project is more likely to succeed than one that relies on traditional approaches. Both traditional and agile approaches are accorded with their respective advantages and disadvantages, so it is not probable to unvaryingly proclaim that one approach is superior to the other (Aguanno, 2004; Andersen, 2006).

The traditional approach is more suitable for projects with clear project goals, scope, and requirements, consequently acquiring the ability to inherit a low level of uncertainty in the project (Coram and Bohner, 2005; DeCarlo, 2004; Fernandez and Fernandez, 2008; Wysocki, 2007). Such projects are not expected to demand heavy involvement of end users (Coram and Bohner, 2005; Wysocki, 2007), while not necessitating a high rate of requirements changes (Shenhar and Dvir, 2007; Wysocki, 2007), instead they should have very low levels of changes in the scope and requirements. In an example discussed by Collyer et al. (2010), it was mentioned that in interviews with 31 PMs from 10 varied industries, Collyer et al. (2010) found that traditional methodologies had difficulties in dynamic environments due to three major types of changes that frequently occurred in projects: 1) goals; 2) materials, resources, tools, and techniques; and 3) relationships with other related projects, services, or products.

The APM approach is envisioned towards its utilisation on managing creative and innovative projects, and projects facilitating process improvements, including the projects involving the development of pioneering, inventive, and innovative products and research based projects (Chin, 2004; Conforto and Amaral, 2015; Highsmith, 2004; Wysocki, 2007). The consequences of using the agile approach on managing projects is that it does not impose on extensive documentation, thus project knowledge may be implicit, which may need to be carefully scrutinised (Boehm 2002; Chin, 2004; Haas, 2007). Due to the significant differences in the agile approach towards projects, compared to the traditional approach, organisations adapting (willingly) the agile environment should be prepared to willingly embrace (frequent) changes to be imposed by the agile approach (Lawrence and Yslas, 2006).

As argued by Serrador and Pinto (2015), numerous authors have pointed to the advantages of the Agile approach, emphasising on customer collaboration over contracts and formal negotiations, individuals and interactions over processes, and responsiveness over rigid planning. However, there are a limited number of large-scale empirical studies to support the contention that Agile methods can improve the likelihood of project success (Serrador and Pinto. 2015). Originally developed for software development, it is still regarded predominantly as an IT phenomenon (Serrador and Pinto. 2015). The then CIO at the Department of Work and Pensions for the UK government, Joe Harley, specified that only 30% of technology-based projects and programs were deemed successful; with an annual budget of £14 billion (Sterling pounds) on public sector IT funded by taxes (Ritter, 2007). This amount was compared by Ritter (2007) as equivalent to building 7000 new primary schools or 75 new hospitals a year. Collyer et al. (2010) commented that “Motorola's multibillion-dollar Iridium project could be considered a success on the basis that it was ‘on time’ and ‘on budget’ from an engineering point of view, but was a catastrophic commercial failure because it did not adjust to what was being learned about the changing business environment.” (Collyer et al., 2010, p. 358). Both the management team and the project team at Motorola failed to see this deficit substance during the course of the project. Expanding the cell phone networks would undercut Iridium's satellite phone business model for Motorola.

Part of the philosophy of Agile methods is that less initial planning is deemed to be better than an evolutionary process, which is regarded as a more efficient process (Dybå and Dingsøyr, 2008). Agile methodologies emphasise on flexible scope, continuous design, accepting design features almost throughout the development phase, embracing change and uncertainty, maintaining consistent customer interaction, and a flexible and open project team organisation, in contrast with traditional PMgmt approaches (i.e. waterfall)

which lacks in these areas. Agile is also deemed as being iterative and incremental, avoiding standard approaches which emphasises a fixed project scope, freeze on design and specification at the early stages of the project, and low levels of customer interaction (Dybå and Dingsøy, 2008). Serrador and Turner (2013) found an “inverted U” relationship between the elements of “planning” and “project success” during their analysis of 1386 projects, in the basis of lapse time of comprehensive planning. It was found that too much effort and time spent on planning can have just as negative impact on project success just as too little can. Though Agile methods are continuously gaining popularity amongst software development projects (Dybå and Dingsøy, 2008), there generally seems to be a lack of research to support the direct success rate of the agile method. Koontz asserted that “no effective manager makes a plan and then proceeds to put it into effect regardless of what events occur” (Koontz, 1958, p. 54), way back in 1958. To further strengthen Koontz’s (1958) argument, Fitzgerald (1996) reported that, on average, 50% of design activities usually occur in phases other than the design phase, which was a part of a review conducted on software development methodology. Thus, the critical issue confronting managers lies in the mismatch between the desire for early specification freeze and fixed plans, with the concomitant need to maintain sufficient flexibility, to modify and alter project plans to address critical business needs.

A close working relationship with the customer or the client, sustaining a significant level of communication, is indeed a necessity, to be able to collect and compile the project requirements in a seamless manner. As opposed to the proponents of the traditional approach, where a bulk, or all of the planning activity, is done upfront, the agile approach dictates a higher amount, and perhaps a more detailed level of planning, which is distributed throughout the various phases of the project lifecycle, being a critical point to recognise. In a study on the review of traditional and agile methods by Boehm (2002), a

comparison was performed between them and it has been deduced that when the project planning function is very detailed and exhaustive, they “.....provide a source of major contention, rework, and delay at high-change levels” (Boehm, 2002, p.65). For an ideal level of planning in projects, Boehm (2002) suggested a balance between the traditional and agile approaches, pointing to a direction of hybrid methods.

There are certain factors in projects which calls for upfront planning, in both traditional and APs alike, which include factors such as core government and legislative regulations, known safety, health and environmental (SHE) factors, the scope and size of the project, predictable security related factors, and in cases where the project team is presented with the luxury of firm requirements upfront. For volatile and turbulent environments, there can be more adherence towards the agile approach, which calls for gradual planning in stages, dictating less upfront planning. To the contrary, Boehm (2002), suggested that the amount of upfront planning will pay-off at the end of the project in terms of the level of project success, which of course, depends on the type and characteristics of the respective project, describing it as a “sweet-spot”. As a matter of fact, extensive and detailed planning may result in a lot of plan rework, resulting in wasted effort, whereas insufficient or less detailed initial planning may impose challenges in the project, or may result in the failure of the project. In performing a study in an XP project, analysing the role of the customer, Koskela and Abrahamsson (2004) discovered that a majority of time was spent on the planning, acceptance testing and retrospective sessions, emphasising the importance of the planning phase in projects. Koskela and Abrahamsson (2004) further affirmed that the planning activity itself consumed more than 40% of the overall effort. Thus, the planning activities appear as an important and crucial element, even in APs, when the principles dictate the reduction of time spent on formal processes in projects.

Customer or client involvement at the early stages of the project, bundled with their continuous stream of involvement, as proposed by the agile approach, will foster valuable inputs from them on project goals, and continuous feedback as the project progresses through its life cycle. This is especially useful during the creation of prototypes, or during modular product development, hence the iterative nature of the agile approach, with regular stakeholder communication, promotes the acceptance of changes from the customers, resulting in amendments to the project scope and requirements, gearing towards a more acceptable and useful deliverable. Compared to traditional methods, agile methods have contrasted practices and principles. Nerur et. al. (2005) summarised the comparison of the main dimensions between traditional and agile software development (Table 2.4), conquered by Dybå and Dingsøy (2008).

Table 2.4: Comparison between Traditional and Agile methods

	Traditional	Agile
Fundamental Assumptions	Systems are fully specifiable, predictable, and can be built through meticulous and extensive planning.	High-quality, adaptive software can be developed by small teams using the principles of continuous design improvement and testing based on rapid feedback and change.
Control	Process centric	People centric
Management Style	Command-and-control	Leadership-and-collaboration
Knowledge Management	Explicit	Tacit
Role Assignment	Individual—favors specialization	Self-organizing teams—encourages role interchangeability
Communication	Formal	Informal
Customer's Role	Important	Critical
Project Cycle	Guided by tasks or activities	Guided by product features
Development Model	Life cycle model (Waterfall, Spiral, or some variation)	The evolutionary-delivery model
Desired Organizational Form/Structure	Mechanistic (bureaucratic with high formalization)	Organic (flexible and participative encouraging cooperative social action)
Technology	No restriction	Favors object-oriented technology

Source: Nerur et. al. (2005) and Dybå and Dingsøy (2008)

Nerur et al., (2005) further described the key issues faced by organisations during the process of adapting the agile methodology, or intend to migrate from the traditional methodology to an agile method, as shown in Table 2.5.

Table 2.5: Key issues in adapting to the agile methodology

Management and organizational
<ul style="list-style-type: none"> • Organizational Culture • Management Style • Organizational Form • Management of Software Development Knowledge • Reward Systems
People
<ul style="list-style-type: none"> • Working effectively in a team • High level of competence • Customer relationships—commitment, knowledge, proximity, trust, respect
Process
<ul style="list-style-type: none"> • Change from process-centric to a feature-driven, people-centric approach • Short, iterative, test-driven development that emphasizes adaptability • Managing large, scalable projects • Selecting an appropriate agile method
Technology (Tools and Techniques)
<ul style="list-style-type: none"> • Appropriateness of existing technology and tools • New skill sets—refactoring, configuration management, JUnits

Source: Nerur et. al. (2005)

In a study to examine the variation between organisations which have adopted the agile method against organisations which have not, Magazinius and Feldt (2011) conducted interview sessions involving 48 respondents from eight organisations, concluding that the contention of keeping up with the planned schedule and cost was quite similar. Magazinius and Feldt (2011) further discovered that the causes of failures were also not indifferent between the two sectors of organisational capabilities (agile and non-agile). Although there has been gradual improvements in the techniques of project estimation

over the last several decades, organisations have indulged in severe cost cutting measures lately, which affects the accuracy of project estimates. This factor may result in the wrong projects being initiated, at the expense of the right projects being placed on hold or even cancelled, with the current projects attracting cost overruns, not due to natural project deficiencies, but due to organisational cost cutting measures and the pressure to reduce costs to increase profit margins. Hummel (2014) discussed the state of agile research, and produced a literature review that identified the existing literature and pinpointed the research gaps. This literature showed that APs were more successful than other approaches (Ambler, 2013; Lalsing et al., 2012; Nasir and Sahibuddin, 2011a; Nasir and Sahibuddin, 2011b). Although agile practices are popular, researchers have not studied it extensively (Lalsing et al., 2012; Melo et al., 2013), and there is limited academic research on the overall agile discipline (Nagle, 2011; Lalsing et al., 2012; Milanov and Njeguš, 2012; Purkayastha, 2014; Pace, 2017; Qamar et al., 2020). Moniruzzaman and Hossain (2013) stated that agile methods have a higher success rate than nonagile methods, but according to Hummel (2014), there is limited literature to show the reason for the dominant success of APs. Hummel (2014) completed a literature review that showed the research gap on agile development practices. These practices link directly to the factors listed by Stankovic et al. (2013). A few agile practices have weak support in the literature, namely collaboration, communication, release scheduling, requirements engineering, tool support, organisational culture, and success factors (Hummel, 2014). Other practices, for example, team characteristics and customer perspective, have more literature than the previously mentioned practices (Hummel, 2014).

Chow and Cao (2008) identified the key success factors for APs. The success factors identify the top critical factors that guarantee the success of a software project. Chow and Cao (2008), as well as Stankovic et al. (2013), listed five groups of critical success

factors for agile software projects: organisational, people, process, technical, and project. Of the many difficulties and challenges to traditional PMgmt, complexity and uncertainty are key to successful software management (Dybå et al., 2014a; Dybå et al., 2014b; Mahadevan et al., 2015; Tanner and von Willingh, 2014; Usman et al., 2014). Project success might seem like an obvious determination to make; however, success remains the focus of significant debate (Shenhar et al., 1997b). Some scholars even note the possibility that project success can never be determined as a result of improper planning, management, and methodologies (Al-Ahmad et al., 2009).

The PM's traditional role of planner and controller must be altered to that of a facilitator who directs and coordinates the collaborative efforts of those involved in development, thus ensuring that the creative ideas of all participants are reflected in the final decision (Highsmith, 2003). The biggest challenge here is to get the PM to relinquish the authority he/she previously enjoyed (Nerur et al., 2005). Furthermore, it is vital that PMs establish identifiable and coherent criteria for success and the measures to evaluate success. These criteria and measures must be agreed upon by stakeholders (Watson, 2009). By better understanding the causes of project failure, project success can be achieved through instituting preventative measures (Nelson, 2005). Somers and Nelson (2001) defined CSFs as "those factors that are necessary to meet the desired deliverables of the customer on a project" (p. 3). The primary critical success factors include cost, scope, and timeline. In addition, critical success factors involve quality, the appropriateness, and timing of user acceptance signoffs (Hirshfield, 2010). To foster a more likely scenario of success, the critical success factors need to be addressed (Nasir et al., 2015) by identifying the challenges faced by current projects.

2.13 Challenges with the Agile Method

Participants at the 2004 USC-CSE (University of Southern California – Centre for Software Engineering) Annual Research Review identified three categories of real and perceived barriers to implementing agile processes, as described in Table 2.6.

Table 2.6: Barriers to Implementing the Agile Process

Significant issues		Problems only in terms of size or scope	
1	Resource loading, slack, timekeeping, capital evaluation	1	Configuration management
2	Required colocation, customer access	2	Earned value tools: Agile focuses on features and business value, traditional focuses on activities
3	Non-functional requirements	3	Stakeholder sign-off requirements
4	Documentation	4	Planning documentation
5	Critical design reviews (milestones)	5	Deployment, life cycle support (training): Long-term life cycle sustainment, decay rate of tacit knowledge
6	Contractual and source selection issues	6	Risk management
7	Interfacing/integration with other methodologies/disciplines	7	Contracted/planned inch-pebble milestones
		8	Process QA/standard processes
8	Predictability, perfect knowledge	9	Process standards (IEEE, DoD, EIA)
9	Statutory/regulatory constraints	10	Designing for the battle, not the war
10	HR policies and processes	Non-Problems	
11	System interface control	1	Quality assurance systems
12	Roles, responsibilities, and skills	2	Agile inadequate for managing defects
13	Agile work on legacy systems	3	Refactoring is rework
14	Formal requirements	4	Agile is monolithic
15	System engineering V-process model	5	Quantitative management
16	Maturity assessments	6	Extension/effectiveness of automatic testing to acceptance/system integration
17	Traditional engineering measurements	7	Perception that agile is extreme or a fad; not responsible
18	Cost estimation	8	APs are unmanaged

Source: Boehm and Turner (2005)

Boehm and Turner (2005) identified that people issues, management attitude and logistical issues are critical factors in the implementation of APM, emphasising on colocation of agile teams to foster a typical agile workspace. Change Management is the other critical issue (Nasir et al., 2015; Fewell et al., 2009; Boehm and Turner, 2005) as change is likely to happen during the development phase of projects (Ben-David et al., 2012). Many agile methods suggests onsite customers, significant customer interaction and feedback, and customer input for acceptance testing, with particular attention to process matching and customer education, necessary for a smooth and seamless transition (Momeni and Martinsuo, 2019; Conforto et al., 2016; Boehm and Turner, 2005). Although many factors are discussed in various literatures, there are limited information to determine which of these factors mostly affect the PMgmt practitioners in the industry, and the common mitigation methods used in the IT industry.

PMs in most agile methods play two primary roles: protector and coach (Boehm and Turner, 2005), and act as a barrier between the organisation and the team to minimise unnecessary perturbation during a sprint or development cycle and provide experienced technical help when necessary. While many traditional managers also fill these functions, agile methods particularly focus on them (Boehm and Turner, 2005). The third most critical issue described by Boehm and Turner (2005) is the **logistical issues** which directly affect people in agile environments, and dictates that agile teams must nearly always be co-located to cater for a typical agile workspace which requires pair-programming stations, walls for status charts and assignments, a layout that allows team members to easily converse to share information, and sufficient equipment to support continuous integration and regression testing. **Change Management** is the other critical issue emphasised by Boehm and Turner (2005) as change management experts often describe the organisational antibodies that begin to gather as soon as something new appears in the

existing culture. Concerns of inadequacy or obsolescence surface, jealousy about assignments and business accoutrements is aroused, and defence mechanisms rapidly deployed, which can result in several destructive behaviours, including the cultural crucifixion of change agents or early adopters and the deliberate sabotage of projects through direct or indirect methods (Boehm and Turner, 2005).

The Agile Alliance (2001) decrees that motivated project team members, given the required level of support and trust (Mac Donald, 2020; McLaren and Loosemore, 2019), is expected to produce a self-organising team giving continuous attention to technical excellence with the ability to produce unsurpassed architecture, requirements and design. Coherent team-work amongst a group of carefully selected individuals prompts trust and promotes transparency, which is also significant to project success (Lehtinen and Aaltonen, 2020; McLaren and Loosemore, 2019), expecting to adopt simplicity, and regularly reflecting on past behaviour and experience, to foster a behaviour tuned towards the agile way. However, these principles does not promise an algorithm for project success. Due to the lack of mainstream understanding on what constitutes project governance and success, its literature appears largely diffuse (ul Musawir et al., 2020). Some employees will simply refuse to use new methods, termed as nonplayers, can disable any team, and appear to be damaging in an agile environment. Agile teams rely heavily on trust and shared tacit knowledge to support pair programming and shared ownership, which makes moot any efforts to measure the results (Boehm and Turner, 2005). Apart from the people within the organisation or the project team, the project stakeholders, particularly the customers will be affected by the introduction of agile methods, and might be required to play significantly different roles. Many agile methods require (or at least strongly suggest) onsite customers, significant customer interaction and feedback, and customer input for acceptance testing, with particular attention to

process matching and customer education deemed to be necessary for a smooth and seamless transition (Boehm and Turner, 2005). In an attempt to address the most critical issue, which is the people issue, Boehm and Turner (2005) suggests practices that can help reduce or eliminate the people related issues as presented in Table 2.7. These can be regarded as best practices in managing projects in an agile environment.

Table 2.7: Suggested Practices (mitigation steps) to address (eliminate or reduce) People Issues within an Agile environment

Suggested Practices to Address People Issues within APs (Boehm and Turner, 2005)		
No.	Practices	Description
1	Understand how communication occurs within project teams	This is key to incorporating agile practices and teams. This is also key in AP success as the agile method emphasises on a good communication protocol at all stakeholder levels.
2	Educate stakeholders	Countering mythology through education is an ancient, honoured tradition. Learn as much as you can and share it with customers, managers, and practitioners. Engaging speakers to discuss experiences or specific methodologies can help, but beware the possibly negative impact of true believers.
3	Translate agile and software issues into management and customer language	Engaging upper management and customers in fruitful discussion of software issues is often difficult because of the “eyes glaze over” response. When you discuss technical issues with not-as-technical-as-you people, remember to describe issues in terms that the audience can easily connect with.
4	Emphasise value	Software engineering has traditionally been value-neutral—every requirement, test case, object, or defect has been essentially equally important. Agile methods emphasise value in two ways. First, they negotiate and prioritise requirements so that expectations are managed and timeboxing can work. Second, they acknowledge the value of each team member, the team as an entity, and the products the team produces to the organisation and the customer.
5	Pick good people and reward the results of pilot projects	You don’t need to create a dream team, but definitely eliminate the level-ones in your pilots. Show your appreciation for the team’s work, regardless of the outcome. The team members put their reputations on the line for the organisation, leaving themselves vulnerable to the organisational antibodies. Don’t minimise that effort.
6	Reorient the reward systems	The reward system needs to be positioned to recognise both individual and team contributions.

Source: Boehm and Turner (2005)

Chow and Cao (2008) generated 19 failure factors based upon the research conducted on APM. APs come with a set of challenges and problems that are different from those faced by projects following a traditional methodology (Miller, 2013). These challenges and problems can be directly related to failure factors, which are comprehended as the issues faced by APs. These 19 failure factors were derived from four categories: (1) Organisational, (2) People, (3) Process, and (4) Technical (Chow and Cao , 2008), as shown in Table 2.8, and described in the following context.

Table 2.8: AP Failure factors

Dimension	Failure Factor
Organisational	1. Lack of executive sponsorship
	2. Lack of management commitment
	3. Organisational culture too traditional
	4. Organisational culture too political
	5. Organisational size too large
	6. Lack of agile logistical arrangements
People	7. Lack of necessary skill-set
	8. Lack of Pgmt competence
	9. Lack of teamwork
	10. Resistance from groups or individuals
	11. Bad customer relationship
Process	12. Ill-defined project scope
	13. Ill-defined project requirements
	14. Ill-defined project planning
	15. Lack of agile progress tracking mechanism
	16. Lack of customer presence
	17. Ill-defined customer role
Technical	18. Lack of complete set of correct agile practices
	19. Inappropriateness of technology and tools

Source: Chow and Cao (2008)

(A) Organisational factors

This category dominates the list of problems cited in the literature, and includes executive/management issues, organisational culture issues, organisational size issues, and logistic issues, as described in the following sections.

1. Lack of executive sponsorship or management commitment: Since agile methods call for a radical departure from typical software development process, a loss of executive sponsorship (Reel, 1999) or lack of management commitment, or inappropriate management attitude (Boehm and Turner, 2005) as well as non-flexible management style (Nerur et al., 2005) would negatively affect the success of an AP.
2. Organisational culture too traditional or political: According to Nerur et al. (2005), “organisational culture has a significant impact on the social structure of organisations, which in turn influences the behaviour and actions of people...Culture exerts considerable influence on decision-making processes, problem-solving strategies, innovative practices, information filtering, social negotiations, relationships, and planning and control mechanisms” (pp. 75-76). Thus, an organisational culture which is too traditional, namely relying heavily on the old way of developing software and running IT in general, will have trouble in implementing APs (Boehm and Turner, 2005; Nerur et al., 2005). Two other areas which also fall under this category are politics (Cohn and Ford, 2003) and inappropriate performance measurement/reward system (Boehm and Turner, 2005; Nerur et al., 2005) since the agile way is more conducive to teamwork reward, which may cause political friction between groups and individual performers.
3. Organisational size too large: Agile methods call for close and frequent communication between project team members, such as daily stand-up meetings, and also rely heavily on trust and shared tacit knowledge; therefore, in organisations with very large teams taking on an AP, even if they break up into smaller teams-of-teams, the project teams may have problems communicating and synchronizing (Boehm and Turner, 2005).
4. Lack of agile logistical arrangements: Agile methods generally require collocation of team members and customer representatives, with specific facility arrangements, so

attempts of distributed development between distant geographical sites will not work (Cohn and Ford, 2003). Lack of agile-oriented logistics do directly affect people in agile environment, since “typical agile workspace requires pair-programming stations, walls for status charts and assignments, a layout that allows team members to easily converse to share information, and sufficient equipment to support continuous integration and regression testing” (Boehm and Turner, 2005).

(B) People factors

People factors include issues related to not only employees (AP team members) but also management and customers, as described in the following sections.

1. Lack of necessary skill-set: The failure of a software development project may be due to inadequate technical skills on the part of the developers (Reel,1999), and this is especially true for APs where rigorous techniques such as pair programming, continuous testing and daily integration, make this problem more profound (Cohn and Ford, 2003; Boehm and Turner, 2005).
2. Lack of PMgmt competence: Agile PMs need to be versatile to be successful, as they play the role of both coach and leader, so a lack of competence and knowledge on their part will make the failure more likely (Nerur et al., 2005). Sometimes mistakes are made by ignoring best practices (Reel, 1999) or by micromanagement (Cohn and Ford, 2003).
3. Lack of teamwork or cooperation: Teamwork is central in any software development projects, and in agile world it is even more so, so it is a critical failure if the AP team doesn't work effectively as a team (Nerur et al., 2005). The non-cooperation atmosphere may foster resistance against agile from groups or individuals (Reel, 1999; Cohn and Ford, 2003; Boehm and Turner, 2005). Even one single dissenter in a team may render an agile software project ineffective (Larman, 2004).

4. **Bad customer relationship:** Since it is almost mandatory for APs to work closely with customer representatives throughout the project, customer relationship is paramount – it requires “commitment, knowledge, proximity, trust, and respect” (Nerur et al., 2005, p. 76). As a result, any friction between the project team and the customer will jeopardise the project. Even a misunderstanding or a non-alignment between project leadership and customer will pose problem to the whole team (Larman, 2004).

(C) Process factors

Problems in process factors can be summarised in three areas: project elements, progress tracking mechanism, and customer role. Following are the details.

1. **Ill-defined project scope, requirements, and planning:** The execution of a software development project may be problematic if the project scope is ill-defined (Reel, 1999). As for requirements, problems arise when they are too informal in many APs, which is hard for software engineering validation/verification functions (Boehm and Turner, 2005). Finally, as far as planning is concerned, schedule being unrealistic (Reel, 1999) or predictive planning being followed (instead of agile methods' adaptive planning) will also cause trouble down the road (Larman, 2004).
2. **Lack of agile progress tracking mechanism:** In APs, a manager cannot track progress the same way as in plan-driven projects where a manager simply asks if the necessary documents have been produced (Cohn and Ford, 2003). Indeed, projects which do not have agile's rapid-pace progress measurement techniques will encounter problems: "Traditional earned-value processes are difficult if not impossible to apply to agile work because of work breakdown structure inadequacies and the flexibility timeboxing requires" (Boehm and Turner, 2005, p. 34).
3. **Lack of customer presence or Ill-defined customer role:** APs almost always require at least one customer representative be available on site full-time, so if an AP does not

include this customer role it will fail (Larman, 2004). For larger projects a whole customer team may be needed on-site, so even the assumption of a single customer representative being on-site is erroneous (Larman, 2004). Finally, ill-defined customer role (i.e. the customer having no decision-making authority or having no acceptance-test ownership) will also bring failure (Larman, 2004).

(D) Technical factors

Problems due to technical factors include (a) lack of complete set of agile practices, and (b) inappropriateness of technology and tools. Specifically:

1. Lack of complete set of correct agile practices: Larman (2004) points out a number of "how to fail" mistakes in APs related to technical aspects, such as the lack of Quality Assurance team integration, upfront unit test design, refactoring, and incorrect pair programming practices.
2. Inappropriateness of technology and tools: A software development project must be able to avoid problems caused by technology changes (Reel, 1999). Using inappropriate technology or tools will invite failure. For example, in APs, "companies that rely solely on mainframe technologies may find it difficult to assimilate agile methods compared to those that use Object Oriented (OO) development techniques...Organisations planning to adopt agile methodologies must invest in tools that support and facilitate rapid iterative development, versioning/configuration management, J-Units, refactoring, and other agile techniques" (Nerur et al., 2005, p. 77).

Apart from the 19 failure factors identified by Chow and Cao (2008) as listed in Table 2.8, other researchers have discussed a number of failure factors in literature, which are discussed in the following context.

Miller (2013) pointed out that the issues are within the five categories; (1) communicating; (2) managing day-to-day operational problems; (3) gaining buy-in from management, customers, and team members; (4) changing culture and mindset; and (5) gaining experience and making it work. One of the root causes of failure in projects is communication, either a lack in communication, or a miscommunication. The characteristics of developers within an Agile team should include amicability, talent, skill, and communication (Lalsing et al., 2012). Looking at issues from the perspectives of the Agile team members, they are unwilling to commit to a decision and rely on the Scum master for decisions. Lack of commitment on a decision was an issue raised by many (Drury et al., 2012). In the area of software development, the team often fail to manage expectations and this can cause issues between the teams and the customer (Lalsing et al., 2012). Naturally, APs run at high speed and in high-pressure environments, and its value can quite often best be realised by near-real-time feedback. Timely, practical, and actionable reporting is key to Agile's success (Tilk, 2016). Providing visibility can help avoid situations (issues) in PMgmt (Drury et al., 2012). Especially in APs, the visibility of the projects should be crystal clear.

Technology and tools play a critical role in the successful implementation of a software development methodology. Organisations planning to adopt agile methodologies must invest in tools that support and facilitate rapid iterative development, versioning/configuration management, refactoring, and other agile techniques. Of course, tools alone cannot make software development successful, as people must be trained to use them correctly (Nerur et al., 2005). Two aspects of agile IT infrastructure can be conceived: an IT platform amenable to rapid development and deployment of localised business systems to support local business needs, and application support for agile

communication and collaboration. Tools such as videoconferencing and bulletin boards, are vital in Globally Distributed System Development projects by providing virtual space for communication and collaboration among distributed members (Lee et al., 2006b). In the more recent settings, social media supporting personal and group messaging functions, voice calls, video calls and multi-party conference calls can assist in rapid and constant communication amongst the project team members.

2.14 Success Factors in APM environment

Merely managing a project to completion does not dictate project success, as there are many other elements which dictates project success. The completed project needs to first fulfil the scope and requirements, delivered on time and budget, satisfying the needs of the various stakeholders, and also many other dimensions of success. Müller and Turner (2007) conducted a study on the competencies of PMs, and on how they impact the success of projects, identifying 10 dimensions of project success related to PMs' competence levels. Dvir et al. (2003) conducted a study highlighting the four measures impacting project success, which includes 'meeting the goals identified during the project planning stage', the 'project benefits to the End-user', the 'project benefits to the Contractor', and finally the 'Overall success level of the project'. Dvir et al. (2003) identified that there was a close relationship between these four success measures, further inferring that these projects have been regarded as successful for all its stakeholders, as per the perceived success levels.

The connection between project success levels and the agile approach of managing projects was deemed as the relevance and professed project quality against organisational objectives. To conclude the findings, project success is determined by the level of

conformance to organisational goals and objectives. From the portfolio management perspectives, when projects are initiated, there will be fundamental concerns on whether the projects are aligned with the organisational goals, as exhibited by the organisations' portfolio of projects (Martinsuo, 2013).

The perceived degree of project complexity will also impact project success. Complexity, from the perspectives of projects, as suggested by Miller and Hobbs (2005) refers to the functional variations inhibited by the projects. The complexity in projects is also believed to be contributed by the number of variable elements or tasks which are interrelated, the level of complications it inherits, and the amount of elaborative work it demands, coupled with the level of involvement it commands (Baccarini, 1996; Miller and Hobbs, 2005). Pinto et al. (1993) suggested that project success is related to the agile approach from the perspectives of the level of experience of the project team, asserting the evidence from literature on the correlation between the level of experience of the project team and their background in project work, who are more proficient in performing their roles, more efficient in completing their tasks, and their ability to work with their teams in a collaborative manner to produce a high levels of output.

An analysis was done against the initial 19 issues identified by Chow and Cao (2008), along with the additional issues and challenges identified in other initial literature study and the relevant success factors were identified, as tabulated in Table 2.9. Further analysis will be conducted on the issues and challenges in the governance and management of APs, via an SLR, which will be elaborated in Chapter 4.

Table 2.9: Success Factors based on the Issues identified for managing APs

Dimension	Success Factor
Organisational	Strong executive support
	Committed sponsor or manager
	Cooperative organisational culture instead of hierarchal
	Organisation placing high value on face-to-face communication
	Organisations where agile methodology is universally accepted
	Collocation of the whole team
	Facility with proper agile-style work environment
	Reward system appropriate for agile
People	Team members with high competence and expertise
	Team members with great motivation
	Managers knowledgeable in agile process
	Managers who have light-touch or adaptive management style
	Coherent, self-organizing teamwork
	Good customer relationship
Process	Following agile-oriented requirement management process
	Following agile-oriented PMgmt process
	Following agile-oriented configuration management process
	Strong communication focus with daily face-to-face meetings
	Honouring regular working schedule – no overtime
	Strong customer commitment and presence
	Customer having full authority
Technical	Well-defined coding standards up front
	Pursuing simple design
	Rigorous refactoring activities
	Right amount of documentation
	Regular delivery of software
	Delivering most important features first
	Correct integration testing
	Appropriate technical training to team Project
	Project nature being non-life-critical
	Project type being of variable scope with emergent requirement
	Projects with dynamic, accelerated schedule
	Projects with small team
	Projects with no multiple independent teams
	Projects with up-front cost evaluation done
Projects with up-front risk analysis done	

Source: Chow and Cao (2008) and various other literature

2.15 Limitations with existing work in PMgmt

The existing PMgmt methods have many limitations, contributing to project failures and a large percentage of challenges in projects. These limitations are accorded to the improper or ineffective implementation of PMgmt methodologies, where the processes

dictated by the method may be inappropriate. Organisations are continuously in a quest to identify effective PMgmt models and processes to attain greater success rates in projects. Project failures are predominantly caused by the poor implementation of PMgmt processes and principles, and the failure to mitigate the project issues and challenges in a timely manner (Ebert and Paasivaara, 2017; Hidalgo, 2019). There is an absence of a holistic method to identify the issues and challenges, and to provide the necessary mitigation advice to improve project success rates. There is generally an absence of a best practice framework modelled against the issues and challenges faced by PMgmt practitioners in managing projects.

The review of literature identified that the most prominent issues in PMgmt are related to people issues, management attitude, logistical issue and change management (Lalsing et al., 2012; Drury et al., 2012; Guerra, 2010; Silviu and Schipper, 2014; Farashah et al., 2019; McHugh et al., 2012; Tilk, 2016; Joslin and Müller, 2016; Hochmüller and Mittermeir, 2008). Resolving people issues is seen to be critical in improving the management of project personnel, particularly the engineering and development personnel, being vital for the adoption and integration of agile methods and practices into the processes. Conduct of the project stakeholders are at the heart of the agile movement, making it important to ensure that people issues in PMgmt do not impose limitations on hindering project success. Management attitude, contributing as the next most critical issue, dictates that the migration from traditional to agile management attitudes can be difficult. The nature of APs, requiring multitasking characteristics of the agile team members, may be difficult to impose if the managers associate employees with specific roles and do not complement the agile principle of multiple roles of project team members. In APs, the PM plays two primary roles, which are of a coach and bridge between the organisation and the team. The logistical issues directly affect people in agile

environments, and dictates that agile teams must nearly always be co-located to cater for a typical agile workspace. Change Management, as another critical issue, is critical in ensuring the APs remain relevant and the deliverables are acceptable and useful by the customers or clients. Concerns on the behaviour of project stakeholders can result in several destructive events, including the deliberate sabotage of projects through direct or indirect methods.

There is generally a lack of documented guidance or checklist on what stage of the project to heed the various project advisory. For example, the appropriate PMgmt method need to be implemented at the beginning of the project, either before or during the project initiation phase, and not during the design or development stages. The right attitude needs to be instilled in the project stakeholders prior to conceiving the expectations of their proper compliance towards the principles set out. As many organisations are adopting hybrid methods which consist of the combination of both agile and traditional methods, there is no proper model which describes the mapping between these methods, and the categorisation of the factors into the respective and relevant categories. The identified limitations have been summarised in Table 2.10.

Table 2.10: Summary of limitations with existing work in PMgmt

Limitations with existing work in PMgmt:	
1	Improper or ineffective implementation of PMgmt methodologies
2	Poor implementation of PMgmt processes and principles
3	Failure to mitigate the project issues and challenges on a timely manner
4	Absence of a holistic method to identify the issues and challenges
5	Absence of a best practice framework modelled against the issues and challenges
6	Lack of adoption and integration of agile methods and practices into the PMgmt processes
7	Lack of principles in the migration from traditional to APM methods
8	Lack of best practice advisory against the various stages of the project
9	Lack of proper mapping of traditional and agile methods for hybrid projects
10	Absence of proper categorisation of the factors against the respective categories

Source: Various literature

With these concerns, the researcher exerts the need to identify, compile and study the issues and challenges in both literature and directly from the industry, and to identify appropriate, relevant and practical mitigation methods to battle these issues and challenges to produce greater success in projects. With the identification of these issues and challenges, the factors of project success can be summarised and further developed into a best practice framework, which can be used by the PMgmt practitioners as a guide during the administration and management of IT projects.

2.16 Summary

This section addressed the initial literature review on the general perspectives of PMgmt and product management, while narrating the roles and responsibilities of a PM and a product manager, highlighting the differences between them. The various definition of a project was explored, along with the various PMgmt methodologies and the PMO. The traditional methods were described, eventually concentrating on the most popular agile methods of PMgmt, looking specifically at the general principles of agile practices.

A comparison was established between traditional and agile methods, identifying the challenges befalling APs while delineating the success factors towards reducing project failures. The general limitations with existing work in PMgmt was then discussed, which summarises the general literature review of this study and its resulting proposal on the relevant activities towards the formulation of a best practice framework to manage IT projects in an Agile environment.

Based on the findings obtained, the 19 failure factors generated by Chow and Cao (2008), which were also related directly to being the issues and challenges of APM, were found

to be the most exhaustive list, which were also found in various other literature. Together with the additional issues and challenges identified from other literature obtained in the preliminary literature review, a total of 37 issues and challenges were compiled, which will be used as the basis for this study. These findings will be used as the basis to fulfil objective 1, by providing the answer to research question 1(a), which is the compilation of issues and challenges in literature. This will be further elaborated in Chapter 4 (SLR).

Universiti Malaya

CHAPTER 3: METHODOLOGY

3.1 Overview

This chapter will first present the philosophical foundation of this research, which is based on a qualitative type of research, employing the interpretive approach to achieve the ROs described in Section 1.5, in Chapter 1. The research steps and design is then described, with the findings obtained from the preliminary literature review, in Chapter 2. The formulation of the questionnaire will then be presented, showing the tabulation of ratings by the participants of the questionnaire survey. An analysis is done against the participants of the questionnaire survey with the analysis of the initial findings discussed. These findings are analysed with subject matter experts (SMEs) to produce the foundational context of the study for further analysis using the proposed research methodologies as described in Chapter 4 (SLR) and Chapter 5 (GT).

3.2 Philosophical Foundation of the Research

Philosophical research is categorised as a qualitative type of research, being subject to the collection of extensive narrative data in a naturalistic setting, on many variables over an extended period of time, to gain insights not possible using other types of research methods (Merriam, 1988; Merriam, 1998, Merriam and Grenier, 2019). Merriam (1988) suggested six assumptions of qualitative research as: (1) being descriptive; (2) involving fieldwork; (3) concerned primarily with processes rather than outcomes; (4) inductive, enabling researchers to build abstractions, concepts, theory, and hypotheses from the details; (5) placing the researcher as the primary instrument for data collection and analysis; and (6) primarily interested in the meaning (i.e. how people make sense of their life, experiences, and their structures of the world). As this study is dealing with

investigating and compiling PMgmt issues from practitioners in the industry, the most suitable approach for the present study is philosophical.

This research is based on a qualitative foundation, which is found to be best suited when attempting to identify certain philosophical facts on a particular subject, from a particular group of people, on the basis of their understanding and interpretation of that subject. A qualitative research is an effort to understand situations in their uniqueness, usually undertaken due to either the lack of theory or when existing theory is seen to be inadequate in providing the required level of explanation of a phenomenon (Patton, 1985; Merriam, 2002). The findings in this study will be deemed as conclusive, as a qualitative research is not expected to be prolonged into future unknown scenarios, instead it is expected to extract the current perspectives of the concept or subject, at time the research is conducted; not attempting to predict what may happen in the future, but to understand the nature of the setting in the current scenario. A combination of quantitative research will also be employed to certain parts of the research, particularly the SLR study, where the quantitative approach is used to determine the general overview of the critical factors for PMgmt. Upon the completion of the SLR study, a GT research is used with a qualitative approach in obtaining the PMgmt factors from the practitioners in the industry.

The research philosophies are driven by the differences of assumptions we make upon them. There are three research assumptions described by Saunders (2011), that determines the research philosophy, which are: (1) ontology, (2) epistemology, and (3) axiology. "Ontology" refers to assumptions about the landscape of reality in which the researcher sees and studies the research objects, which include organisations, management, individuals work-life, organisational events, and artefacts. (Saunders, 2011). In a PMgmt environment, the objects may include the dedication and behaviour of

project team members towards achieving project governance, the conduct of management towards the implementation of processes and the achievement of project results and deliverables. As an example, resistance to change in project scope may be considered a negative element within the organisation, infusing solutions in identifying the stakeholders who resist change, in an attempt to instil correctional procedures to alter their behaviour towards accepting or embracing change. “Epistemology” concerns the assumptions we make about the knowledge we obtain, and the reasoning on what constitutes valid, acceptable, and legitimate knowledge, and how that knowledge can be communicated to others (Burrell and Morgan, 2006; Saunders, 2011). The knowledge obtained from participants of the study may not be consistent in terms of the manner in which the questions are prescribed, the answers obtained, and how they are summarised and recorded between one respondent to the other. The data may be collected on different days, at different times of the day, and in different circumstances of which the respondents may be in, which may affect the depth and comprehensiveness of the responses. This assumption takes all responses, irrespective of how they are provided or presented, as valid responses in contributing to this study. The variety of acceptable epistemologies provides a wide choice of methods than can be used. Despite this diversity, it provides for the consumption of the researchers own epistemological assumptions that will govern the information to be obtained from the prospective respondents, which will be considered legitimate in this study. “Axiology” refers to the role of values and ethics within the research process, encompassing how the researchers deals with their own values and the values of the participants, is of prodigious importance towards producing credible results (Saunders, 2011). This study places paramount importance on data collected, where personal individual interactions are immensely valued, compare to general stereotyped feedback.

Within the philosophical foundation of a qualitative research, this study employs the interpretive approach in obtaining information to fulfil the ROs and answer the RQs by employing the GT approach, based on the assumptions that social reality is shaped by human experiences and social contexts (Bhattacharjee, 2012). This approach, popularly known as interpretivism or interpretivist, is centred around the interpretation of elements of the study with the integration of human interests (Research Methodology, 2011). Using the interpretive approach, this study is intending to first obtain the common issues and challenges in the administration and management of projects from existing literature, which will provide the means of setting the stage for obtaining the human experience and social context of the subject from the industry practitioners. The information obtained from the PMgmt practitioners are interpreted accordingly by the researcher to identify the gaps between literature and the industry, and to compile the unique issues from both of these contexts to formulate the foundation of the framework. Practitioners with a reasonable level of experience are expected to provide the relevant feedback based on their experience and understanding of the concepts and practices in the industry. The researcher, expected to have the relevant expertise and knowledge to be able collect the correct information and use the correct methods of analysis to produce the intended outcome, acts as the primary instrument for data collection and data analysis. The researchers understanding is expanded through verbal and nonverbal communication, formal and informal discussions, meetings, and interviews; being able to process information immediately, clarify the materials obtained, summarise the findings, verify the accuracy of the interpretation, and explore unusual or unanticipated responses for further analysis and conclusion.

3.3 Research Design

A mixed method, being a combination of qualitative and quantitative methods, have been employed in this study. The quantitative method was first prescribed in the SLR study to identify the existing factors from literature, to be ranked by a preliminary group of practitioners (Chapter 4). Secondly, a qualitative approach using GT was used to identify PMgmt issues and challenges from the industry practitioners (Chapter 5). A comparison will be made between these findings to identify the gaps between literature and the industry, presented and discussed in Chapter 6 (Findings and Discussion). Based on the findings, a comprehensive list of factors will be compiled, used as key input for the formulation of the proposed framework (described in Chapter 7). A critical analysis is performed to analyse the level of impact and the mitigation methods which can be employed to attain greater project success. Critical analysis can be defined as the intellectually disciplined process of actively and skilfully analysing the information obtained under the subject under study, by analysing, conceptualising, and evaluating the information gathered from the selected audience. It could also be a process where the information can be generated through observation, experience, reflection, reasoning, or a series of communication (Neville, 2005).

A consolidated and unique list of factors, and their corresponding mitigation methods, are used to produce the proposed framework (Chapter 7), which will be evaluated by a panel of identified experts to improvise the framework against the dimensions of approach, deployment, and results (described in Chapter 8). The improvised framework, along with the supporting tool, will be validated using another panel of experts (Chapter 9); using the criteria's of relevance, usefulness, practicality, appropriateness, consistency, understandability, ease-of-use, adaptability, and adherence; against the perspectives of

organisation, leadership team, management team, PM, project team, and customer or client. The research design of this study is summarised in Figure 3.1.

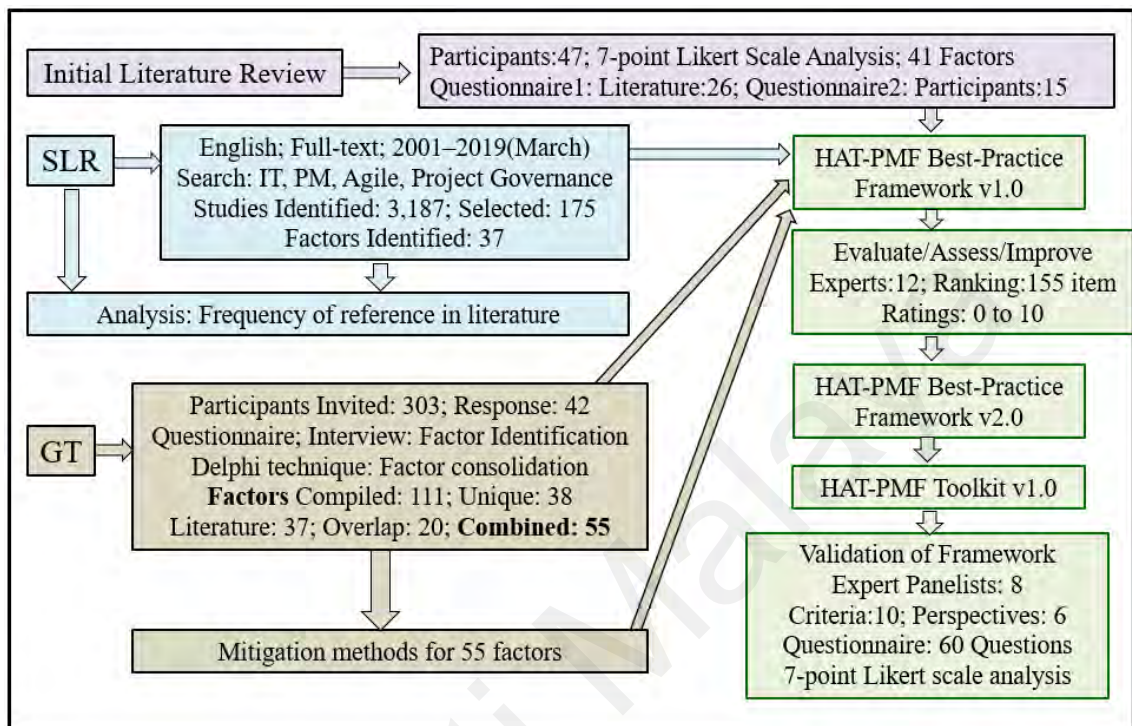


Figure 3.1: Research methods employed in this study

The various research methods employed in this study are described in the following context:

1. Preliminary Literature Review to capture the identified issues and challenges in literature (books, publications, journals, and articles): 26 issues and challenges identified (described in Section 3.4).
2. Identification of suitable and relevant industry practitioners from the Oil and Gas industry providing group IT services to participate in a preliminary questionnaire survey (described in Section 3.6).
3. Questionnaire development on a 7-point Likert scale, to solicit feedback from a group of industry practitioners on the rankings against the issues and challenges based on the level of impact to project success (described in Section 3.5).

4. Identification of new issues and challenges in ITPM from the questionnaire respondents: 15 additional and unique ITPM issues and challenges obtained from 47 participants.
5. SLR to properly analyse literature and identify a comprehensive list of issues and challenges of Agile ITPM: 37 unique agile ITPM issues and challenges identified from 175 selected studies.
6. Analysis of the frequency of reference by literature on the 37 unique agile ITPM issues and challenges.
7. Identification of suitable and relevant industry practitioners, who were involved in the management of traditional and APs, as participants in the GT research: 303 qualified practitioners invited; with 42 practitioners who participated voluntarily.
8. Identification of issues and challenges affecting the industry practitioners via the GT research: 111 ITPM issues and challenges captured, producing 38 unique agile ITPM issues and challenges via a Delphi technique.
9. Combination of the agile ITPM issues and challenges from literature (37) and the industry (38), producing a combined and unique list of 55 agile ITPM issues and challenges.
10. Soliciting mitigation methods from the industry practitioners for the unique list of 55 issues and challenges through several rounds of meetings, using the Delphi technique to obtain agreement and standardise the mitigation methods.
11. Developing an agile ITPM best practice framework, intended for use by project practitioners as a guide and/or checklist when managing projects, to achieve (greater) project success: Hybrid-Agile-Traditional Project Management Framework version 1.0 (HAT-PMFv1.0), shown in Appendix AD.
12. Evaluation of the agile best practise framework on a 3-dimensions of Approach, Deployment and Results with a panel of 12 SMEs against 159 items, capturing ratings

between 0 to 10, and further refining the framework to include the relevant feedback to create an improvised framework: Hybrid-Agile-Traditional Project Management Framework version 1.0 (HAT-PMFv2.0) , shown in Appendix AJ.

13. Developing the support toolkit, which is intended to be used with the agile best practice framework: Hybrid-Agile-Traditional Project Management Framework (HAT-PMF) Toolkit version 1.0.
14. Validation of the agile best practise framework against 10 criteria's and 6 perspectives with a panel of 8 SMEs, formulating a questionnaire on a 7-point Likert scale with 60 questions.

3.4 Preliminary Literature Review

This study utilises part of the findings from the study done by Chow and Cao (2008) as the basis of identifying issues with APM. Chow and Cao (2008) generated 19 failure factors (described in Chapter 2, and shown in Table 2.8) based upon the research conducted on APM. An additional 7 factors were broadly identified from other literature (Lalsing et al., 2012; Drury et al.,2012; Tilk, 2016; Nerur et al., 2005; Lee et al., 2006b) as an outcome of the preliminary literature review, to produce a total of 26 failure factors. These 26 failure factors were discussed with the industry practitioners (senior agile practitioners), along with the categories pointed out by Miller (2013), which have been tabulated in Appendix C. The initial framework for the design of the questionnaire was derived from the combined 26 failure factors, which were distributed to the AP practitioners to obtain feedback (ranking) through a questionnaire.

The preliminary literature review was conducted on available literature and academic studies published from 1999 to 2016, both years inclusive (Appendix L and Appendix

M), performed on journals from various online databases, namely Cambridge Journals, Oxford University Press Journals, IEEE Explore, Science Direct, Scopus, Web of Science, JSTOR Archive, SAGE Journals, ProQuest, EBSCOhost, and a few other databases. The searches were performed based on the following keywords, including a combination of them:

1. Project
2. Project Management (PMgmt)
3. Project Management Office (PMO)
4. Agile
5. Software
6. Information Technology (IT)

The different combination of keywords and the search results obtained from the search conducted in year 2015 are shown in Appendix L (General Database Keyword Search in Year 2015). A further search in year 2016 was performed on selected databases with high yielding results, which are shown in Appendix L (General Database Keyword Search in Year 2016). A summary of the search results from various databases are tabulated in Appendix M (Summary of General Database Keyword Search). As a result of the SLR, 111 out of 2,618 papers were selected (Appendix N) as describing issues and challenges in agile methods of PMgmt, success factors leading to greater success in projects delivered, and the processes and methods of governance within a PMO. Most of the papers employed discussions specific to ITPM, focusing mostly on agile methods within the scope. Most of the identified research papers encompasses issues and challenges in the process of managing APs, proposed factors of improvement of the process or technique, and general discussions around the successful use of agile methods to manage APs.

3.5 Formulation of the Questionnaire

The research was conducted on the basis of a case study, developed into a questionnaire-based survey to gather feedback from the industry practitioners (Appendix F, Appendix G and Appendix H). The case study approach is suitable when the boundaries between a phenomenon and its context are unclear (Benbasat et al., 1987; Yin, 2003). The survey can be considered as a descriptive survey and thus provides a descriptive analysis (i.e. frequencies and cross tabulation). According to Oppenheim (1996), descriptive surveys are not intended to explain or to show causal relationships between variables, but they focus on describing what proportion of a sample has a certain opinion or how often certain events occur, that is, are associated with each other. According to Allen and Seaman (2007), the use of Likert scales in a survey instrument is the most common and acceptable design format for providing a rating. The Likert scale used in this study provided the same scale and range of responses for each item in the survey instrument. Finstad (2010) argued that a 5-point scale may be inaccurate, proposing the use of a 7-point scale to ensure greater level of accuracy, while promoting ease-of-use and producing a better reflection of the participants' true evaluation. A 7-point Likert scale was used to individually capture the impact each of the 26 identified failure factors had on the various APs managed by the practitioners, tabulated with the following description in the columns preceding the issue:

- Likert scale 1: Least Critical
- Likert scale 2: Very Less Critical
- Likert scale 3: Less Critical
- Likert scale 4: Moderately Critical
- Likert scale 5: Critical

- Likert scale 6: Very Critical
- Likert scale 7: Extremely Critical

The last column captures the average rankings based on a computation of all the rankings received from the 47 respondents, divided by the number of respondents as follows:

$$\text{Average Ranking} = \frac{\text{Sum Total of all the Individual Rankings (R)}}{\text{Total Number of Respondents (N)}}$$

$$\text{Average Ranking (A)} = \frac{R^1 + R^2 + R^3 + R^4 + \dots + R^N}{N}$$

Where; R = Ranking, N = Total number of respondents

There were two questionnaires constructed; the first questionnaire (Questionnaire 1A – Appendix F) captured the initial 26 issues identified from literature (Appendix C), while the subsequent questionnaire (Questionnaire 1B – Appendix G) captured 15 additional issues and challenges addressed by the agile practitioners (Appendix D). The responses to the questionnaires were captured in a controlled environment by the researcher, while the respondents were individually briefed about the survey, the scale ratings and their expected inputs. An interview session was organised by the researcher with each of the respondents over a period of three months. As the respondents were all located in different cities, within different countries, in different regions around the world, the method of a skype conference (provided as a standard tool in the organisation) call was established with each of them. The availability of all respondents over a skype conference call bridged the gap of geographical disbursement and also the ability to have a one-to-one conversation with all the respondents. Each of the 26 issues were discussed with each

respondent, and their rating were captured by the researcher into an MS-Excel spreadsheet. The advantage of this method was that the researcher was available to explain each issue to the respondent and ensure they were aligned with the understanding prior to submitting their ratings. Once the ratings were provided, the respondents were engaged in a summary discussion to revisit the ratings and ensure they were confident with the rating responses provided.

During the first survey conducted, the respondents were also requested to contribute to additional issues which they deemed important and relevant, but not listed in the initial list of the 26 issues identified in the literature by the author. The additional issues were collected, compiled and distributed to all the respondents via electronic mail (email) in an attempt to filter the duplicates and create a unique list of issues based on the Delphi Technique, to give the respondents another opportunity to add or refresh the list with additional issues. Finally, an agreed list of 15 additional issues were finalised, and these were used to formulate Questionnaire 1B (Appendix G).

A second round of interview sessions were organised by the researcher with each of the respondents over a period of two months to populate the second questionnaire developed consisting of the additional 15 issues captured from the practitioners. Again, the same method prescribed earlier, a skype conference call was again established with each of them. Each of the 15 issues were discussed with each respondent, and their ratings were captured by the researcher into an MS-Excel spreadsheet. As per the process during the first survey questionnaire, once the ratings were provided, the respondents were engaged in a summary discussion to revisit the ratings and ensure they were confident with the responses provided. Both the questionnaires have also been combined to show a single questionnaire (Questionnaire 1C – Appendix H) with all 41 issues listed in Appendix E.

The previously obtained rankings from both Questionnaire 1A (Appendix F) and Questionnaire 1B (Appendix G) separately were pre-populated into Questionnaire 1C (Appendix H) and sent to the respective respondents for their verification. Upon checking and obtaining verification and agreement from all 47 respondents, for us to use the same data previously provided, a consolidated Likert scale analysis was created to perform re-ranking of the factors accordingly.

The rankings results from the survey conducted on Questionnaire 1 (Appendix F) were tabulated into an MS-Excel spreadsheet, where the rankings from all 47 respondents were computed to obtain the average ranking for each of the initial 26 issues (Appendix I). The rankings from the survey conducted on Questionnaire 1B (Appendix J) were also tabulated into an MS-Excel spreadsheet, where the rankings from all 47 respondents were computed to obtain the average ranking for each of the additional 15 issues (Appendix D). Both the responses from Questionnaire 1A (Appendix I) and Questionnaire 1B (Appendix J) were combined to be able to see an overview of all the rankings in a single view (Appendix K), and to generate a combined Likert scale analysis summary. This time around, the rankings of all the 47 respondents against the combined issue list of a total of 41 issues was obtained. Based on the average ranking results obtained, the highest was used as the most critical, while the lowest was used as the least critical issue, and a tabulation of final rankings from one to 41 was tabulated. Final ranking of “one” indicating to be the most critical and “41” as the least critical (Appendix I).

3.6 Participants of the Study

As a preliminary survey, corresponding to a preliminary literature review, participants were selected from an MNC which had global presence. The selected MNC is an IT

service provider, providing general IT services (general IT management, ITPM, end user computing, network, hosting, and storage) to the 'Oil and Gas' industry. The selected MNC has 2 regional hubs located in Asia Pacific (Bangalore, India) and The United States of America (Houston), with presence in most countries all over the world. Their global projects are usually handled by the regional hubs, while the more localised projects are handled by the respective local offices in the respective countries. The study initially targeted 55 respondents, consisting of agile practitioners with various levels of APM experience and skills. However, the final number of participants was only 47 as the other eight targeted respondents were not able to participate due to many reasons (i.e. busy work schedule, resignation, transfer, and other personal reasons).

In total, this survey study and questionnaires solicited and compiled data from 47 participants (Appendix O) covering four regions (Africa, Americas, Asia Pacific and Europe). Within these four regions, it involves participants from eight countries (Canada, China, India, Malaysia, Netherlands, Nigeria, United Kingdom and The United States of America). Within these countries, the survey study spans across 13 cities (Bangalore, Beijing, Calgary, Cyberjaya, Hague, Houston, Kolkata, Kuala Lumpur, Lagos, New Orleans, Rijswijk, Rotterdam, and Wythenshawe).

Fowler (2002) mentioned that the use of simple random sampling gives you a model of the population with each individual given equal probability of being selected. The respective information are reflected in Table 3.1, Figure 3.2, Table 3.2, Figure 3.3, Table 3.3 and Figure 3.4 in the following context.

Table 3.1: City where the Survey Participants are located

City where Survey Participants are located		
Location by City	No. of Participants	Percentage
Bangalore	16	34.0%
Beijing	1	2.1%
Calgary	1	2.1%
Cyberjaya	2	4.3%
Hague	1	2.1%
Houston	15	31.9%
Kolkata	2	4.3%
Kuala Lumpur	1	2.1%
Lagos	2	4.3%
New Orleans	1	2.1%
Rijswijk	3	6.4%
Rotterdam	1	2.1%
Wythenshawe	1	2.1%
Total:	47	100%

The majority of the survey participants are located in Bangalore, India (34%) and Houston, United States of America (31.9%), as the global hubs are located in these 2 locations. Both the global hubs constituted to the majority (65.9%) of the survey participants, while the other participants are from the various country-based offices.

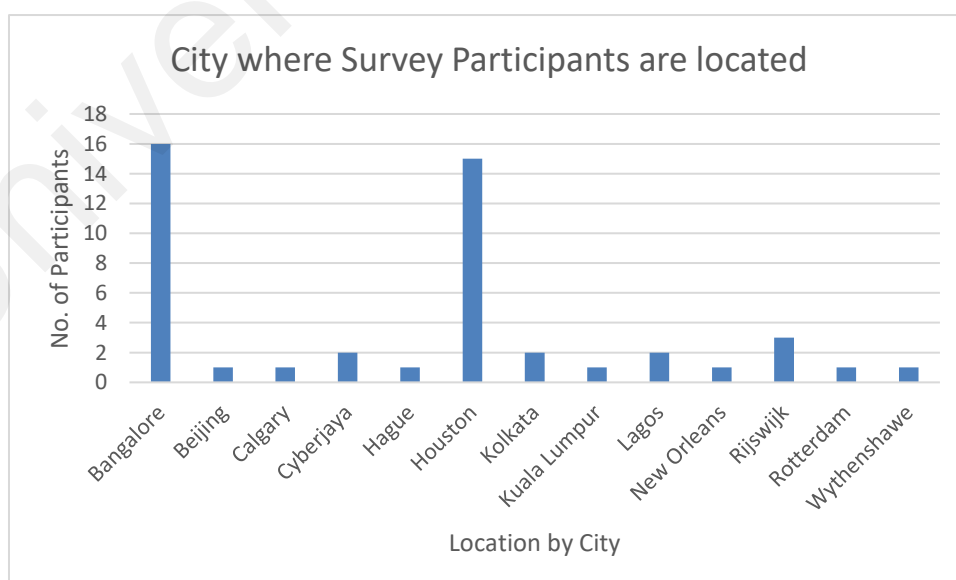


Figure 3.2: Bar Chart showing the City where the Survey Participants are located

As for the country of location of the survey participants, a majority of 18 participants (38.3%) are from India (Bangalore and Kolkata), followed by 16 survey participants from the United States of America (Houston and New Orleans). The high number of participants are from both of these countries, which are the global IT hubs of the organisation. The survey participants from both these countries (India and United States of America) make out a total of 34 participants (72.3%).

Table 3.2: Country where the Survey Participants are located

Country where Survey Participants are located		
Location by Country	No. of Participants	Percentage
Canada	1	2.1%
China	1	2.1%
India	18	38.3%
Malaysia	3	6.4%
Netherlands	5	10.6%
Nigeria	2	4.3%
UK	1	2.1%
USA	16	34.0%
Total:	47	100%

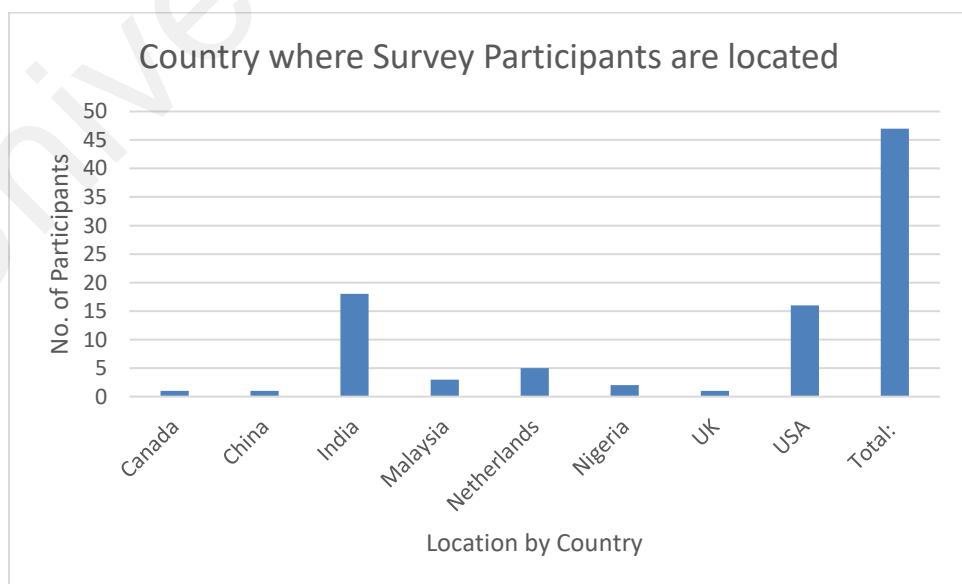


Figure 3.3: Bar Chart showing the Country where the Survey Participants are located

Respectively, the majority of the survey participants are from the Asia Pacific region, making up a count of 22 (India, Malaysia, and China), while the second majority are from the Americas region (United States of America and Canada). Participation from the Europe and Africa region was low.

Table 3.3: Region where the Survey Participants are located

Region where Survey Participants are located		
Location by Region	No. of Participants	Percentage
Africa	2	4.3%
Americas	17	36.2%
Asia Pacific	22	46.8%
Europe	6	12.8%
Total:	47	100%

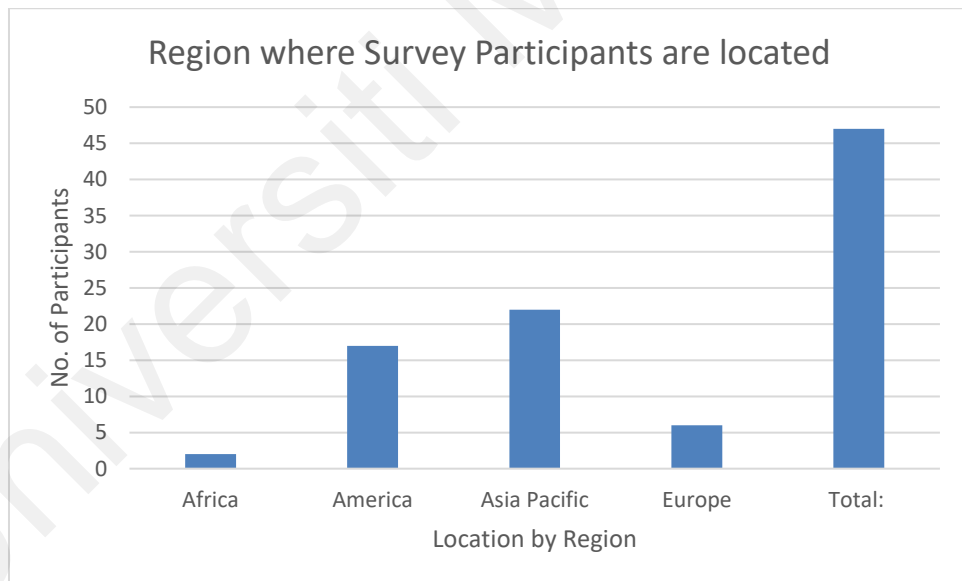


Figure 3.4: Bar Chart showing the Region where the Survey Participants are located

The study involved participants from the ages 21 to 60, who were categorised into four age groups (21 to 30, 31 to 40, 41 to 50 and 51 to 60), shown in Table 3.4 and Figure 3.5 respectively.

Table 3.4: Age Group of the Participants of the Study

Age Group of Survey Participants		
Age Group	No. of Participants	Percentage
21 to 30	4	8.5%
31 to 40	10	21.3%
41 to 50	25	53.2%
51 to 60	8	17.0%
Total:	47	100%

The majority of the participants are from the “41 to 50” age group which makes out more than half of the population (53.2%), while the second highest majority is from the “31 to 40” age group (21.3%). Most of the participants were from the age group of 41 to 50 as the participants were selected based on their vast level of experience, and they are expected to be in senior and/or managerial positions.

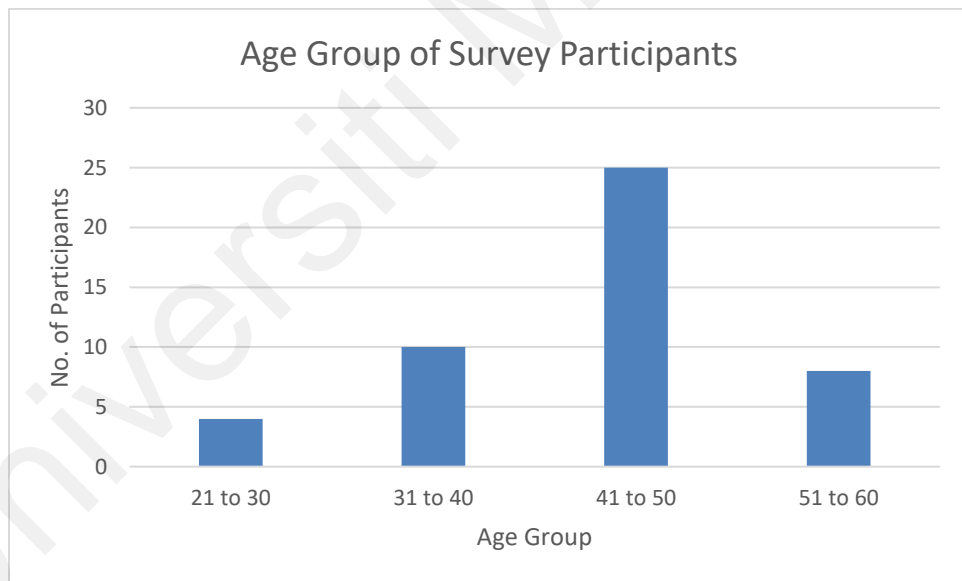


Figure 3.5: Bar Chart showing the Age Group of the Participants of the Study

At the time the survey was conducted, the participants had a minimum of three years, spanning to a maximum of 30 years of overall industrial working experience. The statistics are shown in Table 3.5 and Figure 3.6 respectively.

Table 3.5: Total Working Experience of the Participants of the Study

Total Working Experience of Survey Participants		
Years of Experience	No. of Participants	Percentage
03 to 05	3	6.4%
06 to 10	5	10.6%
11 to 15	10	21.3%
16 to 20	18	38.3%
21 to 25	9	19.1%
26 to 30	2	4.3%
Total:	47	100%

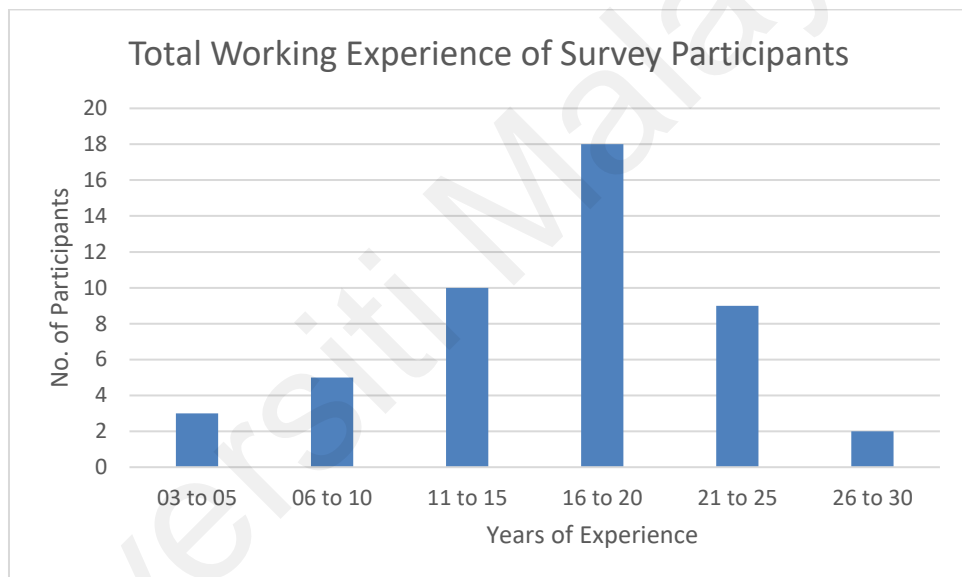


Figure 3.6: Bar Chart showing the Total Working Experience of the Participants of the Study

A large number of participants have between 16 to 20 years of overall working experience in the industry, while the second highest have between 11 to 15 years of overall working experience in the industry. A majority of the participants (38.3%) have between 16 to 20 years of experience, while the second highest group (21.3%) possess between 11 to 15 years of experience. This is also an expected scenario as the recruitment criteria was for participants with a cast number of years of experience. A total of 11 participants (23.4%) are deemed to be highly experienced (21 to 30 years) and their contribution has been very

valuable to the study. The survey also captured the number of years of experience the participants specifically had in the area of PMgmt, as shown in Table 3.6 and Figure 3.7 below.

Table 3.6: Total Overall PMgmt Experience of the Participants of the Study

Total Experience in PMgmt		
Years of Experience	No. of Participants	Percentage
00 to 02	2	4.3%
03 to 05	7	14.9%
06 to 10	13	27.7%
11 to 15	18	38.3%
16 to 20	7	14.9%
Total:	47	100%

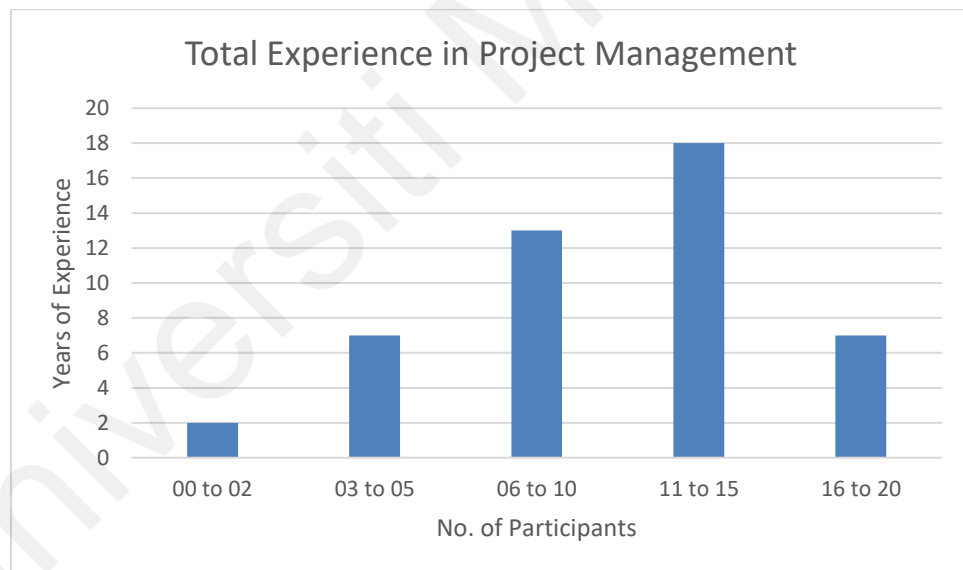


Figure 3.7: Bar Chart showing the Total Overall PMgmt Experience of the Participants of the Study

A total of 25 participants(53.2%), consisting of more than half of the participants, claimed that they had more than 10 years of experience in overall PMgmt, at the time the survey was conducted. Out of which, seven participants (14.9%) claimed to have between 16 to 20 years of experience in the area of PMgmt and appear to be experts in the arena, and are assumed to be expert contributors to the study. The survey also attempted to capture

the respective years of experience within the delineation of the Traditional and Agile PMgmt area. Table 3.7 and Figure 3.8 described the level of experience of the survey participants in the Traditional PMgmt area.

Table 3.7: Years of Working Experience of the Survey Participants in Traditional PMgmt

Experience in Traditional PMgmt		
Years of Experience	No. of Participants	Percentage
00 to 02	3	6.4%
03 to 05	8	17.0%
06 to 10	15	31.9%
11 to 15	15	31.9%
16 to 20	6	12.8%
Total:	47	100%

The majority of the survey participants (63.8%) possess between six to 15 years of experience in traditional PMgmt, where 15 participants (31.9%) have between six to 10 years of experience, and another 15 participants (31.9%) have between 11 to 15 years of experience within this discipline.

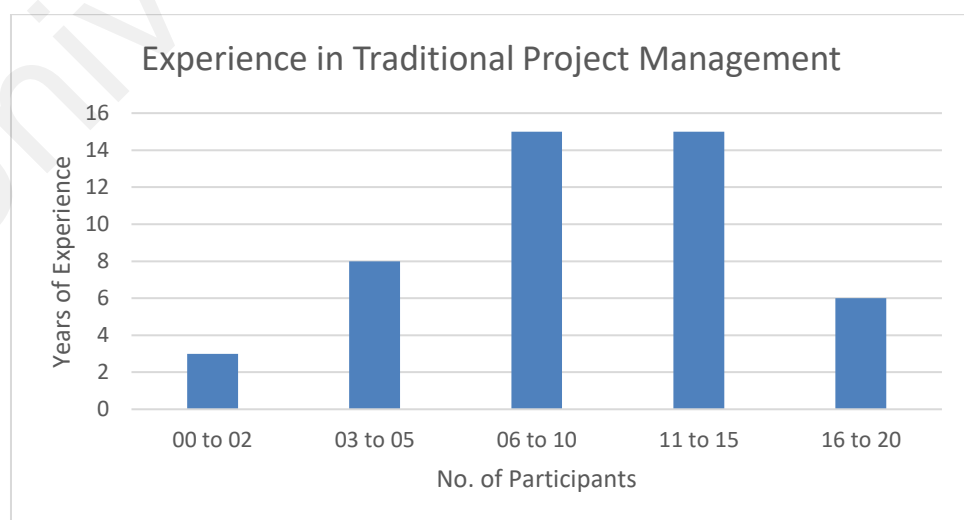


Figure 3.8: Bar Chart showing the Years of Working Experience of the Survey Participants in Traditional PMgmt

Looking closely at the years of working experience in the area of APM (Table 3.8 and Figure 3.9), a majority of 20 survey participants (42.6%) possess between six to 10 years of relevant experience.

Table 3.8: Years of Working Experience of the Survey Participants in APM

Experience in APM		
Years of Experience	No. of Participants	Percentage
00 to 02	8	17.0%
03 to 05	9	19.1%
06 to 10	20	42.6%
11 to 15	8	17.0%
16 to 20	2	4.3%
Total:	47	100%

Ten participants (21.3%) claim to have more than 10 years of experience in managing APs and working in the APM environment.

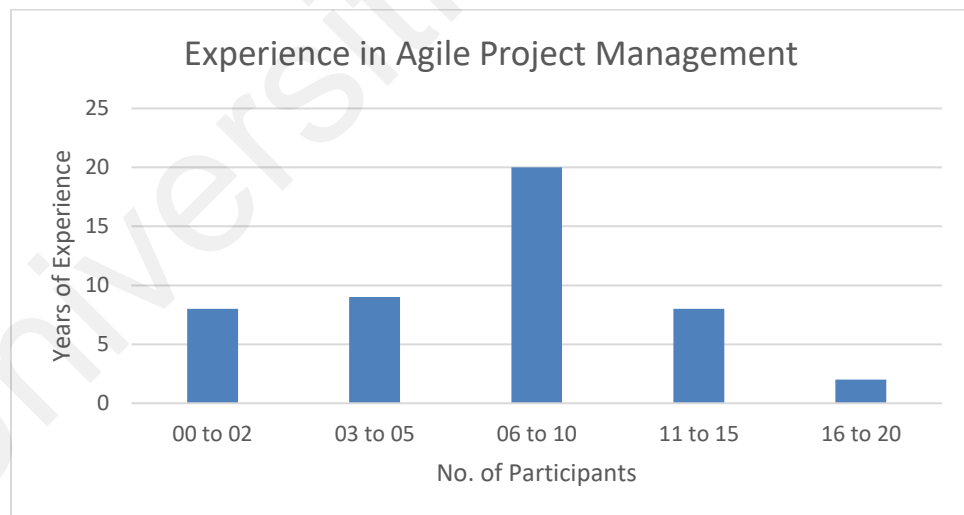


Figure 3.9: Bar Chart showing the Years of Working Experience of the Survey Participants in APM

As an overall understanding from the participants, there is a high likelihood that the participants are involved in managing projects of both nature (traditional and agile) in parallel, hence the total number of years of experience in managing APs and traditional

projects may not equal to the total overall number of years of general experience in the PMgmt arena.

3.7 Summary

The philosophical foundation of this study was described, selecting a qualitative research foundation based on an interpretive approach. The research steps was described, which involves a mixed research methodology of a SLR and a GT research. A preliminary literature review on PMgmt, particularly in the area of traditional and APs was performed, as described elaboratively in Chapter 2, addressing the issues and challenges in APM for IT projects. The questionnaire was designed and filled by the selected participants of the survey, with the responses compiled to produce a preliminary level of findings, which will be the foundation for this study to be researched further using the prescribed research methodologies. Several discussions were held with the practitioners where each issue was discussed to capture the detailed description of the issue and the possible methods of mitigating the issue. Generally, an issue should be avoided altogether by employing the method of prevention. An example of an issue which can be prevented is the lack of technical abilities of the team members, where it can be avoided by ensuring all team members recruited into an AP is skilled and knowledgeable, or the necessary training to be provided to equip the members with the skills required to run and manage a particular project prior to its commencement. For issues which can't be avoided for some reason, then the impact of the issue against the project should be minimised. Examples of issued which cannot be avoided would include forceful government regulations, financial status of the organisation, economic conditions of the country, and many more issues which are beyond the control and boundaries of the project.

As the survey process was performed against a dedicated group of participants, and the existing issues and challenges from literature was provided to them in the form of Questionnaire 1A (Appendix F), it was felt that the data obtained from the practitioners were not sufficient to create a model or framework. The findings were not found to be comprehensive enough to produce the intended framework, and further research was required to obtain more relevant and substantive data to support the study. The data obtained was used only as preliminary findings, with an intention to dwell deeper into a more structured literature review process, an SLR, which is described in Chapter 4. The SLR will be used to identify, select, evaluate, and interpret the relevant studies available in literature (Kitchenham et al., 2015), to identify the issues and challenges discussed in literature. An SLR is used as it is appropriate to summarising existing research, identify gaps in the existing literature, and to position new research (Kitchenham et al., 2015). The subsequent GT study is aimed at identifying the issues and challenges faced by agile practitioners in the industry, described in Chapter 5. The study further intends to present a comprehensive list of the prominent issues and challenges with the aim of helping them understand these issues and challenges and to provide them with the ability to mitigate the issues and achieve greater success in managing their projects to achieve greater success. GT is best suited for studying people related issues, as APM is dominantly a people-intensive approach, when researchers are looking for a theory grounded in data (Parry, 1998) or would like to investigate and find out the actual phenomenon on the ground, as opposed to what is contained in literature.

The findings of both the SLR and GT are discussed in Chapter 6. The formulation of the proposed best practice framework is discussed in Chapter 7. The model is evaluated by an expert review team, and the feedback is used to produce an improvised best practice framework in Chapter 8 (Evaluation of the Framework). A support tool is provided to

complement the agile best practice framework, where both are validated by an expert review team, which is described in Chapter 9 (Validation of the Framework). The final chapter (Chapter 10) concludes this thesis by responding to the ROs and RQs, the contributions of the thesis derived from the SLR and GT methods, and the overall research contributions, and concluding the chapter with the limitations of this research and proposed future work.

Universiti Malaya

CHAPTER 4: SYSTEMATIC LITERATURE REVIEW

4.1 Overview

Attempting to identify the documented issues and challenges faced by APs within the literature, as part of the purpose of this study defined in Chapter 1 (Section 1.4), this chapter indulges in reviewing the literature in an exhaustive manner, by following the prescribed research methodology of an SLR. The steps, processes, and findings of the SLR, conducted to identify the issues and challenges in the governance and management of APs in the IT environment, are described in this chapter. The research method will be described in detail, along with the search strategy, screening of the initial resulting studies and the method of extraction of data from the selected studies.

This chapter will address a part of the first objective as described in Section 1.5 (Chapter 1), further to what has been identified in the preliminary literature review in Chapter 2, to systematically identify the available literature over the last two decades and select the relevant literature to produce a comprehensive list of issues and challenges in managing agile and traditional projects, including hybrid projects. As described in Chapter 3 (Methodology), this chapter presents the first phase of the research method, which is the SLR. The second phase of the research method, using the GT approach, will be presented in Chapter 5, with a comparison of the findings and the relevant discussions documented in Chapter 6. The formulation of the framework (version 1) will be described in Chapter 7, along with an evaluation of the framework to produce an improvised framework (version 2) as described in Chapter 8, and to further produce a support tool, intended to be used with the framework. The improvised framework and support tool will be validated by a panel of experts, as described in Chapter 9.

4.2 Background and Related Work

There is a high rate of failed and challenged IT projects, which could be mitigated by increasing the organisational PMgmt maturity level, possibly by the means of implementing a PMO, identifying and emphasising on the success factors (Standish Group, 2015; Standish Group, 2019; Ibbs and Reginato, 2002; Kerzner, 2019; PMI Standard, 2017; Kaur and Singh, 2016), as described in Chapter 2. Traditional PMgmt methods focus on comprehensive planning, reducing the need for changes in the project whereas agile methods is expected to tolerate change, focusing on customer interaction and less on detailed planning and documentation (Boehm, 2002; Augustine et al., 2005, 2005; Miller, 2013; Ciric et al., 2019). This study focuses on APs and is aimed at identifying the documented issues and challenges faced by APs within the literature. The study further intends to present these issues and challenges to APs practitioners with the aim of capturing additional issues in the APM industry. The population for the research is targeted at Practitioners of PMgmt practices with relevant credentials in PMgmt (i.e. PMP, PgMP, PfMP, PMI-ACP, Prince2, and other relevant credentials) and an average of five to 10 years of experience in either assuming a role in the PMO or as a PM, managing APs, involved in the management of both Traditional and Agile projects. The core of the study is around the failing projects and mitigation techniques to reduce the number of failed projects, and possibly to convert them into successful projects.

Carrillo et al. (2010) asserted that it is important to establish real factors that are in accordance with the characteristics of the key players of the project (project practitioners/manager/team), in order to adopt a methodology. As an example of the success factors for a satisfactory methodology we can consider: getting an agile methodology which must be applied to any project, using a PMgmt tool that helps to automatise tasks like reporting and gathering information for project status, work with

program managers or intermediate leaders who are responsible of tracking the project status and provide training for the project participants (Carillo et al., 2010). Hence, the importance of taking literature back to the practitioners to verify the project issues and challenges, and if possible, to qualify additional relevant issues and challenges with an intention of identifying mitigation methods to (minimise project failures and) achieve project success. Pazderka and Grechenig (2007) commented that those working with virtual teams are faced with challenges in the context of PMgmt maturity models, establishes a strategy how these models can be extended to address these challenges, further identified a set of best practices for virtual team collaboration that can be integrated into current maturity models. However, there was an absence of a thorough analysis of the project challenge areas to refine them into mitigations steps in order to formulate best practices for PMgmt maturity models, as per the proposed future work (Pazderka and Grechenig, 2007). This research will analyse the issues and challenges amongst the practitioners in a global environment, mostly working in virtual teams across a geographically spread team, to deliver a common objective for the customer.

On the other hand, a more recent research carried out by Stankovic et al. (2013) was limited to a particular country (Yugoslavia) and the survey participants were mixed, and were not specifically related to APs or were themselves agile practitioners, proposing a research targeted specifically at agile practitioners in a global setting (and not confined to a particular country). The study by Chow and Cao (2008) failed to obtain results for some of the elements of success factors (upon applying specific mitigation steps to the identified issues and challenges), not being able to yield specific results on certain factors namely executive support, sponsor commitment, agile logistical arrangements, and a few other factors deemed critical for project success, emphasising on extending the study to bridge the gap, and to be able to obtain a greater variety of success factors. On the other

hand, a more recent research carried out by Stankovic et al. (2013) was limited to a particular country (Yugoslavia) and the survey respondents were mixed, and were not specifically related to APs or were themselves agile practitioners, proposing a research targeted specifically at agile practitioners in a global setting (and not confined to a particular country). Another study by Nasir and Sahibuddin (2011b) identified 26 critical success factors for software PMgmt, compiled from 43 literary publications, which may not be reflective of the challenges faced by the PMgmt practitioners on the ground. A more recent study by Hoda and Murugesan (2016) identified eight agile software PMgmt challenges advocating self-organising teams, proposing to analyse the strategies to overcome these challenges, specifically pointing to personal characteristics of project team members, the role of the team, role of the managers in providing an optimum level of guidance and support, customer demand for unsystematic changing requirements, addressing country specific cultures, and addressing risk arising from external dependencies. These challenges will be scrutinised in this study to obtain feedback from the industry practitioners, and to propose mitigation strategies either in this study or in immediate future work to be carried out. The research undertaken by Gregory et al. (2016) to identify the challenges faced by agile practitioners, with the intention to further strengthen existing studies, was conducted against a limited group of audience in three cities in Europe (London, Manchester and Rome) and in a face to face style interaction during pre-scheduled agile conferences. The study proposed future research with a larger and varied audience, consisting of different levels of practitioners (not just managers), towards a broader geographic setting, and the utilisation of additional methods of data collection (workshops, round-table discussion, focus-groups) to be able to arrive at more comprehensive findings.

4.3 Method

The preliminary foundation of the study is based on the research performed by Chow and Cao (2008), analysing various research work (Cohn and Ford, 2003; Larman, 2004; Boehm and Turner, 2005; Nerur et al., 2005), and gathering survey data covering 109 Agile projects from 25 countries, conducted amongst Agile professionals (members of the Agile Alliance and its user groups), identifying 19 failure factors in APs. The results identified three critical success factors for APs: (1) Delivery Strategy, (2) APM Techniques, and (3) Team Capabilities (Chow and Cao, 2008). Chow and Cao (2008) advocates that the review of both failures and successes in the literature will be beneficial in identifying the possible success factors in APM, as failures are caused by the issues and challenges faced by projects, and are deemed to be able to contribute to the understanding of how to avoid project pitfalls. The study failed to collect evidence on some critical success factors advocated by current literature, such as: (1) executive support, (2) sponsor commitment, availability of agile logistics. Chow and Cao (2008) acknowledged several limitations of their study, which include: (1) not representative of all methods that were considered Agile, (2) possible bias toward the XP method, (3) survey participants' subjective biases towards Agile, (4) lack of independent, non-Agile advocates in the survey, (5) small sample size, opposed to the large and growing Agile community, and (6) low representation of US-based project.

The study also includes 18 additional issues and challenges identified in the SLR. The combined 37 factors will be analysed to attain the top 10 most addressed factors in literature, concluding that project governance is the most addressed factor, followed by various people related factors as the PM and team members are seen to be key in attaining AP success. A leadership team which supports the implementation of agile methods by providing sponsorship and funding, combined with a dedicated and trustworthy project

team who are empowered to control the project, and who are given the means to maintain a close relationship with the project stakeholders and customers with the required level and frequency of communication is a winning combination for project success. The proper understanding of the values and principles of the agile method will help the project team deliver the right and expected solution to the customer.

A summary of the 2-phased method employed in the SLR is shown in Figure 4.1, and described in the following context.

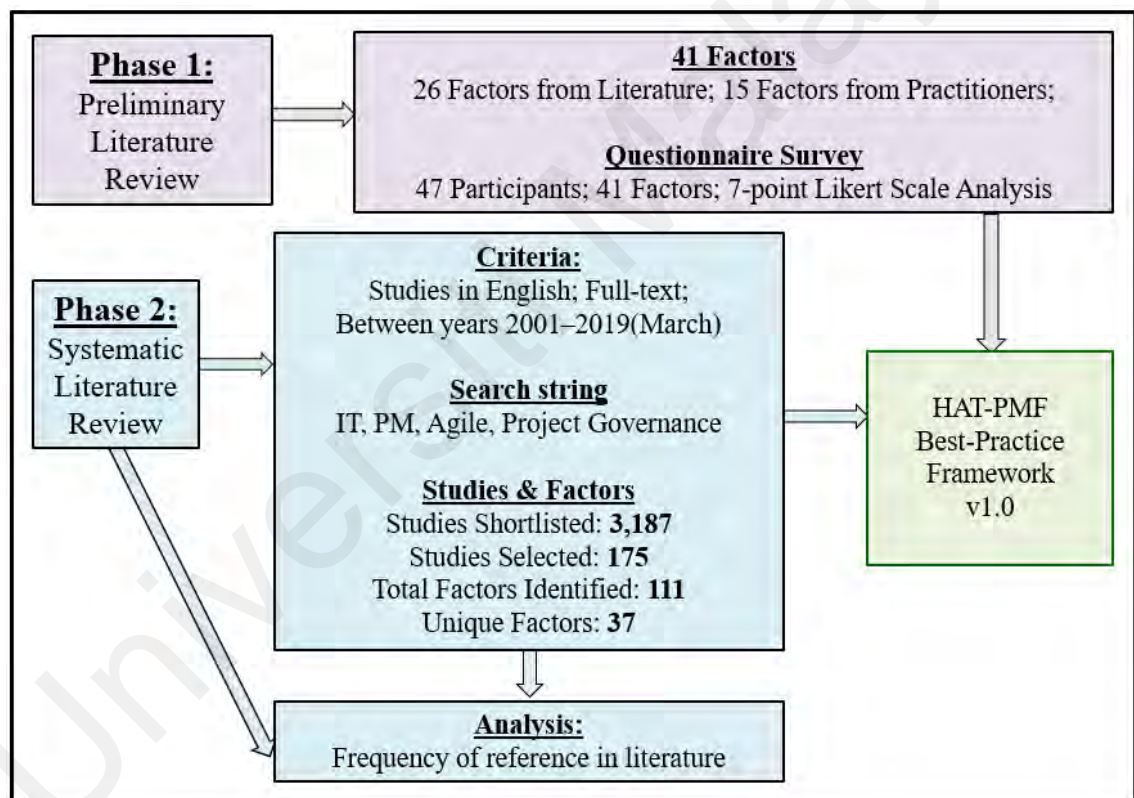


Figure 4.1: Two-phased data extraction approach from literature

Phase 1

1. Preliminary literature review to identify an initial list of issues and challenges associated to the governance and management of APs (described in Chapter 2): 26 factors identified from literature.

2. Questionnaire survey to capture other (new) issues and challenges from the practitioners, and to obtain ranking on the complete list of issues and challenges: 15 new issues and challenges recorded from the practitioners, with rankings against the combined list of 41 issues and challenges by 47 participating practitioners from an IT service provider within the 'Oil and Gas' industry.

Phase 2

3. SLR study performed against relevant online databases, which includes publications, journals, periodicals and conference proceedings: shortlisted an initial compilation of 3,187 relevant studies, further selected 175 most relevant studies for further analysis.
4. Analysis of the selected studies to identify and select the relevant factors impacting agile projects in IT, from which, 37 unique factors were identified for further review and discussions.
5. Analysis on the frequency of reference of the selected list of 37 factors against the 175 selected and relevant studies.

4.4 Research Questions on SLR

As described by Kitchenham et al. (2015), an SLR is conducted with the purpose of identifying, selecting, evaluating, and interpreting the relevant research available in literature, providing answers to a particular topic, area of interest, phenomenon, or to some prescribed RQs. The method is appropriate for summarising existing research, with the intention of identifying gaps in the existing literature, and to provide a background for the positioning of new research (Kitchenham et al., 2015).

This study presents the results of an SLR of issues and challenges in the governance and management of APs. The review is positioned in the field of software engineering, and utilises the literature from PMgmt in the specific field of IT.

The specific RQs related to the SLR study (denoted with SLR-RQ) are as follows:

SLR-RQ1: What are the reported issues and challenges associated to the governance and management of APs?

SLR-RQ2: What AP (success) factors are addressed or discussed in literature?

SLR-RQ3: How frequently are these (success) factors addressed in literature over the last two decades?

SLR-RQ4: What is the yearly trending of these factors over the last two decades?

The topic of general PMgmt could provide an exhaustive list of (success) factors, and provide a wider arena of RQs. However, these four questions were chosen as they are expected to trigger future research based, and to form the basis of the subsequent work in this research, on grounded work to identify how these issues and challenges impact the practitioners in the industry (Chapter 5). The RQs are not intended to overlap each other, instead they are intended to complement each other in gradually arriving at the intended results to act as a supporting artefact for the follow-up study which the researcher will undertake. In the context of this research, issues and challenges refer to the problems associated to managing projects (negative impact), while factors refer to the aspects which can impact the project either positively (success factors) or negatively (failure factors).

4.5 Search Strategy

The study was conducted using specific selected databases subscribed by the academic institution at the time the research was conducted, while the other databases were excluded from the search, as they were either found to be irrelevant (subject, field, interest, or area), or did not yield the expected results. The digital search engines and the particular algorithm used in the academic institution could have been less efficient, and may not have been set-up properly as compared to the later versions of search engines developed and used currently. The researchers were also limited to the cloud connectivity protocol and speed of the internet connection at the academic institution of the researchers. To determine which studies were included, and which studies were not included, the inclusion and exclusion criteria's were defined.

The inclusion criteria's were:

1. A range of studies conducted between 2001 until March 2019. The date range was defined as the Agile Manifesto was defined and published in 2001, from which time the research on APM had been conducted.
2. Online databases subscribed by the academic institution of the researchers.
3. The search was limited to 18 databases (described in section 4.5.3).
4. Academic Journals, Conference proceedings, Periodicals.
5. Studies produced in "English" language only.
6. Studies available in full text and retrievable online.
7. The subject was related to the governance and management of APs, within the topics of Agile, IT (including Software Development), Project Governance and PMgmt.
8. Selected studies on general ITPM topics, which are not specifically related to the agile environment or which discusses the agile approach.

The exclusion criteria's were:

1. The studies conducted and published prior to the year 2001 (before the Agile Manifesto was defined and published).
2. Databases related to: Health, Medical, Music, Sports, Art, Language, Architecture, Chemistry, Biology, Law, Mechanical Engineering, and other non-IT related fields.
3. Studies in any other language other than the "English" language.
4. Studies not available in full text (i.e. studies with only abstract or summary available).
5. Studies non-retrievable online (due to restrictions on retrieving and/or downloading the full contents of the studies).
6. The subjects not directly related to the governance and management of APs.
7. Studies not related to the IT or Software Development industry.
8. Studies not addressing PMgmt related topics.
9. Duplicate studies (identical articles which are selected and retrieved, which are obtained from 2 or more databases)

The initial searches was executed in 2015 and 2016. The first search (Keyword Search 2015) was initiated in August 2015, and analysis work was conducted for a duration of 8 months. The second search (Keyword Search 2016) was executed in April 2016, and the analysis work was conducted for a duration of 6 months.

4.5.1 First Keyword Search 2015

The search conducted in 2015 was executed against 6 databases: (1) Cambridge journals, (2) IEEE Explore, (3) Oxford University Press Journals, (4) ProQuest Education Journals, (5) SAGE Journals, and (6) ProQuest Dissertations and Theses Global. The search string defined was: (("project" AND "management") OR ("project" AND "management" AND "office") OR ("agile" AND "project" AND "management") OR ("agile" AND "project"

AND “management” AND “office”) OR (“software” AND “project” AND “management”) OR (“software” AND “project” AND “management” AND “office”) OR (“IT” AND “project” AND “management”) OR (“IT” AND “project” AND “management” AND “office”) OR (“Information” AND “Technology” AND “project” AND “management”) OR (“Information” AND “Technology” AND “project” AND “management” AND “office”) OR (“agile” AND “software” AND “project” AND “management”) OR (“agile” AND “software” AND “project” AND “management” AND “office”)). The total results obtained for the above string against all 6 databases were close to 13 million (12,938,041) studies. As the search results was found to be too exhaustive, the researchers only selected search results for (“agile” AND “software” AND “project” AND “management” AND “office”) for further analysis, resulting in a total of 538,011 studies. The detailed search results are shown in Appendix L, with the number of studies selected for analysis marked in ‘red’ font. The search results were too exhaustive and the researchers found a very broad variation of topics in the selected studies, based on the title and keywords, which resulted in a second round of search within a different set of databases, with only IEE Explore included, due to its relevance.

4.5.2 Second Keyword Search 2016

The search conducted in 2016 was executed against 7 databases: (1) Academic Search Elite @EBSCOhost, (2) Association for Computing Machinery (ACM) Digital Library, (3) Business Source Elite @EBSCOhost, (4) Cambridge Journals Online, (5) Directory of Open Access Journals, (6) Directory of Open Access Scholarly Resources, (7) IEEE Explore. The search string defined was: (“project”) OR (“IT” AND “project”) OR (“IT” AND “project” AND “management”) OR (“IT” AND “project” AND “management” AND “office”) OR (“project” AND “management”) OR (“project” AND “management” AND “office”) OR (“software” AND “project”) OR (“software” AND “project” AND

“management”) OR (“software” AND “project” AND “management” AND “office”) OR (“Information” AND “Technology” AND “project”) OR (“Information” AND “Technology” AND “project” AND “management”) OR (“Information” AND “Technology” AND “project” AND “management” AND “office”) OR (“agile” AND “project”) OR (“agile” AND “project” AND “management”) OR (“agile” AND “project” AND “management” AND “office”) OR (“agile” AND “software” AND “project” AND “management”) OR (“agile” AND “software” AND “project” AND “management” AND “office”)). The total results obtained for the above string against all 7 databases were slightly more than 2.5 million (2,560,819) studies. As the search results were still found to be too exhaustive, the researchers only included selected search results within the respective databases for further analysis, resulting in a total of 4,150 studies. The detailed search results are shown in Appendix M, with the number of studies selected for analysis marked in ‘red’ font. The search results were found to be more relevant and with only a slight variation of topics in the selected studies, analysed based on the title, abstract, and keywords.

Subsequent searches were conducted in 2017, 2018 and 2019, to capture the latest studies as they are published and made available in the online databases. The analysis work was undertaken for the entire duration (2017 to 2019), and the number of journals were added as they were identified, to form the final number of search results as of the end of March 2019 (2019 search), when the database and keyword search activities were concluded.

4.5.3 Final Keyword Search 2019

The search conducted between 2017 and March 2019 was executed against 18 selected databases: (1) ABI/INFORM Complete @ ProQuest, (2) Academic Search Elite @EBSCOhost, (3) Association for Computing Machinery (ACM) Digital Library, (4)

Business Source Elite @EBSCOhost, (5) Cambridge Journals Online, (6) Directory of Open Access Journals (DOAJ), (7) Directory of Open Access scholarly Resources (ROAD), (8) IEEE Explore, (9) JSTOR Archive, (10) Networked Digital Library of Theses and Dissertations (NDLTD), (11) Open Access Library, (12) Oxford University Press Journals, (13) SAGE Journals, (14) SAGE Research Methods, (15) Science Direct, (16) Scopus, (17) SocIndex with Fulltext @EBSCOhost, and (18) Web of Science (Appendix P).

The search string defined was: (“project”) OR (“IT” AND “project”) OR (“IT” AND “project” AND “management”) OR (“IT” AND “project” AND “management” AND “office”) OR (“project” AND “management”) OR (“project” AND “management” AND “office”) OR (“software” AND “project”) OR (“software” AND “project” AND “management”) OR (“software” AND “project” AND “management” AND “office”) OR (“Information” AND “Technology” AND “project”) OR (“Information” AND “Technology” AND “project” AND “management”) OR (“Information” AND “Technology” AND “project” AND “management” AND “office”) OR (“agile” AND “project”) OR (“agile” AND “project” AND “management”) OR (“agile” AND “project” AND “management” AND “office”) OR (“agile” AND “software” AND “project” AND “management”) OR (“agile” AND “software” AND “project” AND “management” AND “office”). The total results obtained for the above string against all 18 databases were almost 60 million (59,314,801) studies. As the search results was extremely exhaustive, the researchers only included selected search results within the respective databased for further analysis, resulting in a total of 2,618 studies. The detailed search results are shown in Appendix N, with the number of studies selected for analysis highlighted in ‘amber’. The search results were found to be relevant, based on the title, abstract, and keywords.

Recent developments on the review and analysis of agile methods pointed to Scrum, XP, FDD, DSDM, LSD, ASD, Crystal, and Kanban as popular methods (Anand and Dinakaran, 2016; Anwer et al., 2017; Papadakis and Tsironis, 2018). Hence, an additional search string: (“scrum” OR “extreme programming” OR “feature driven development” OR “dynamic system development method” OR “lean software development” OR “adaptive software development” OR “crystal” OR “Kanban”) was used. Due to the availability of access to the online PMO Journals, this database was also added for the search of the studies, and a total of 569 additional relevant studies were identified based on title and keyword suitability, arriving at a final total of 3,187 studies selected from a total of 19 databases.

4.6 Search Analysis

For the 3,187 (2,618 + 569) combined number of studies which were shortlisted based on the title and keyword, the abstract of the studies were first reviewed for relevance as the first filter to exclude studies which were not relevant for this study. The remaining studies were then reviewed based on the introduction and conclusion, for further exclusion. Based on relevance of the abstract, introduction, and conclusion of the shortlisted studies, a total of 191 studies were selected, with the remaining 2,996 studies excluded from this study.

From the selected 191 studies, three studies were excluded further as they were duplicates (identical studies found in different databases), bringing the total down to 188 studies as the final list of studies for the conduct of this study. A second review was done on the selected studies by reading through the studies, and after careful consideration, 13 studies were excluded based on irrelevance and the inability to contribute to the intended findings of this study, bringing the total number of studies down to 175 (Appendix Q). From the

19 databases used to search for the studies, the 175 selected journals were reverse mapped to eight originating databases: ACM, EBSCOhost, IEEE Explore, Open Access Library, PMO Journals, ProQuest Journals, SAGE Journals, and ScienceDirect. The number of selected journals from the eight respective online databases, along with the percentage, have been tabulated in Table 4.1 and Figure 4.2.

Table 4.1: Number of studies obtained from the respective Databases

Database	No. of Studies	Percentage
ACM	22	12.5
EBSCOhost	23	13.1
IEEEExplore	48	27.3
OpenAccessLibrary	4	2.3
PMO Journals	10	5.7
ProQuest Journals	4	2.8
SAGE Journals	2	1.1
ScienceDirect	62	35.2
TOTAL:	175	100

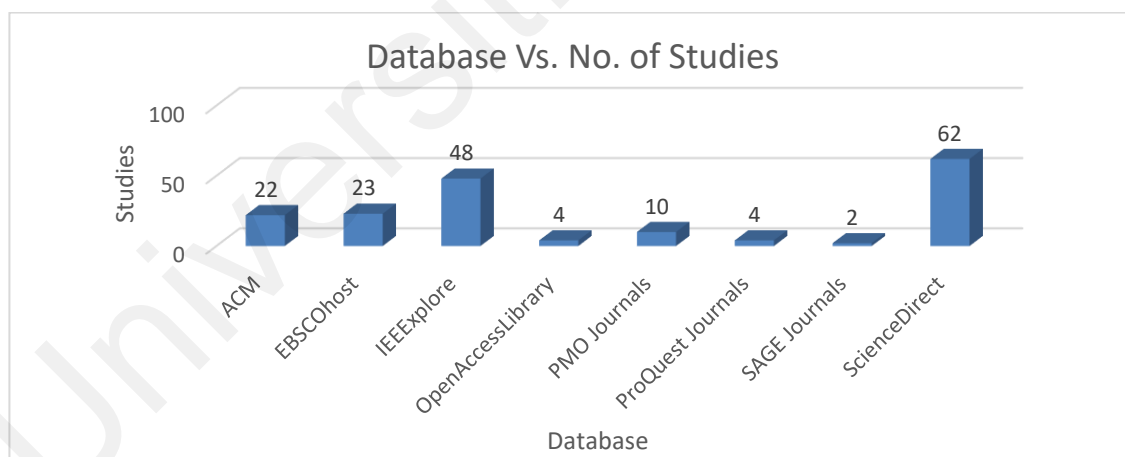


Figure 4.2: Number of studies obtained from the respective Databases

The highest number of journals was extracted from ScienceDirect (62 studies or 35%) and IEEEExplore (48 studies or 27%), with a moderate number (about 13% each) from EBSCOhost (22 studies) and ACM (23 studies). The newly added database yielded a comparatively high number of studies (10 studies), which is almost 6% of the selected

studies. Open Access Library and ProQuest Journals has 4 studies each, while the lowest number of only 2 studies (about 1%) was obtained from SAGE Journals.

Amongst the selected studies, there were five categories: Conference Proceedings, Journal, Periodicals, Symposium Proceeding and Workshop Proceeding. 117 studies (66.9%) of the studies are from the Journal category. The second highest contributor is from Conference Proceedings which contributed to 24% of the selected studies (42 studies). The other three categories (Periodicals, Symposium Proceeding and Workshop Proceeding) contributed to a small percentage (5%, 1% and 3% respectively) as shown in Table 4.2. The number of studies for each of these categories have been described graphically in Figure 4.3, which clearly shows that the biggest contribution of studies are from Journals, followed by Conference proceedings. Both of these categories jointly make up 90.9% of the selected studies.

Table 4.2: Number of studies obtained against the category of studies

Category of Studies	No. of Studies	Percentage
Conference Proceeding	42	24.0
Journal	117	66.9
Periodical	9	5.1
Symposium Proceeding	2	1.1
Workshop Proceeding	5	2.9
TOTAL:	175	100

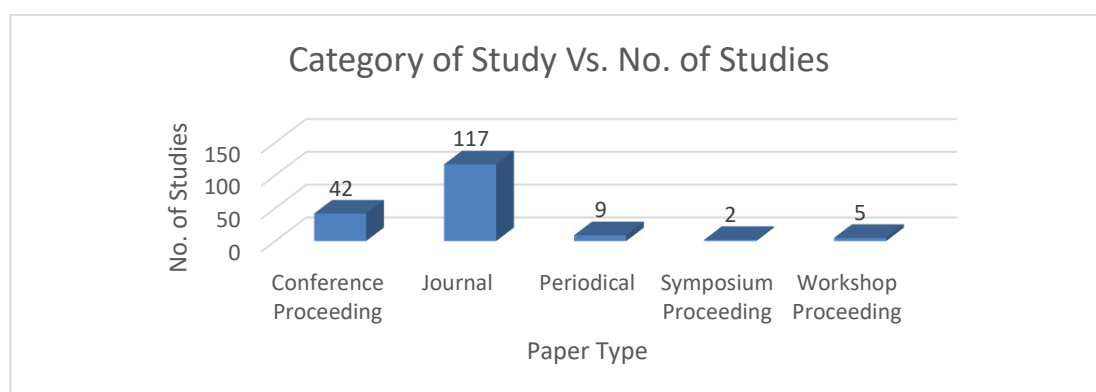


Figure 4.3: Number of studies obtained against the category of studies

4.7 Data Extraction

The data extraction is done in two phases (as summarised in Figure 4.1). The first phase was done during the preliminary literature review, identifying 41 factors that affects the successful governance and management of APs (Appendix C, D and E), which was used as a reference material for the SLR. The second phase of data extraction was carried out from the selected 175 studies from the SLR, where each study was reviewed and the relevant factors were identified and compiled into a list of factors, which were compared against each other to produce a unique list of 37 factors. The list if 37 factors were used as the basis to review the 175 selected studies again carefully to identify which amongst the identified factors are discussed or addressed in the respective studies. The data was then mapped into a matrix, and the frequency of reference to each of the factors in the selected studies was identified and tabulated into a table, to identify the most frequently addressed factor. The factors are then listed from the most frequently addressed to the least frequently addressed (described in Section 4.8). The intention is to then translate these factors into probable issues and challenges for the following research work undertaken by the researchers in the form of a GT research (Chapter 5).

4.8 Results

This section will discuss the results obtained in the SLR of the 175 selected studies, originating from eight databases, and further describe the method of identifying the factors impacting the successful governance and management of APs. A second pass was done to re-verify the identified factors against the selected studies to gauge the frequency of the 37 identified factors being addressed in 175 the selected studies.

4.8.1 Identification of Issues and Challenges

APs come with a set of problems that are different from those faced by projects following a traditional methodology (Miller, 2013). These problems can be directly related to issues and challenges, which are comprehended as the issues and challenges faced by APs. Chow and Cao (2008) generated 19 issues and challenges based upon the research conducted on APM. These 19 issues and challenges were derived from four categories: (1) Organisational, (2) People, (3) Process, and (4) Technical (Chow and Cao, 2008), which has been described in Section 2.13, and summarised in Table 2.8 (Chapter 2). Based upon the review of the 175 selected studies in the SLR, a further 18 issues and challenges were identified, translated to a total of 37 factors impacting the successful management and administration of APs.

4.8.2 Summary of Issues and Challenges

Table 4.3 summarises the 19 issues and challenges as identified by Chow and Cao (2008).

Table 4.3: AP Issues and challenges

Category	Issues and Challenges (Failure Factors)	
Organisation	1. Lack of executive sponsorship	2. Lack of management commitment
	3. Organisational culture too traditional	4. Organisational culture too political
	5. Organisational size too large	6. Lack of agile logistical arrangements
People	7. Lack of necessary skill-set	8. Lack of PMgmt competence
	9. Lack of teamwork	10. Resistance from groups or individuals
	11. Bad customer relationship	
Process	12. Ill-defined project scope	13. Ill-defined project requirements
	14. Ill-defined project planning	15. Lack of agile progress tracking mechanism
	16. Lack of customer presence	17. Ill-defined customer role
Technical	18. Lack of complete set of correct agile practices	19. Inappropriateness of technology and tools

Source: Chow and Cao (2008)

Based on the literature reviewed within this SLR study, 18 additional issues and challenges were captured, as they were described in the respective studies as imposing an impact to the agile practitioners in the industry when managing projects. These additional 18 issues and challenges are listed as follows:

1. Lack of understanding of the Agile method values (and principles) – Ebert and Paasivaara (2017) stressed that it is important for the project stakeholders to understand the values of the Agile methods. An example quoted was to ensure from the start that everybody understands the reasons for change and why it's important, as the lack of knowledge and communication about the change increases the resistance to change (Ebert and Paasivaara, 2017).
2. Leadership Team reluctant to invest on Agile method – Yang et.al. (2016) mentioned that support from the management is an important factor in the successful implementation of Agile methods.
3. Lack of budget to implement Agile methods – Support from the management, and the availability of necessary budget are important factors in the implementation of Agile methods (Yang et.al., 2016).
4. Lack of communications – One of the root causes of failure in projects is communication — either a lack thereof, or miscommunication. The characteristics of developers within an Agile team should include amicability, talent, skill, and communication (Lalsing et al., 2012).
5. Lack of commitment – Drury et al. (2012) commented that Agile team members are unwilling to commit to a decision and often rely on their superiors (i.e. Scrum master, team leader, PM or project lead) for decisions. Lack of commitment on a decision was an issue raised by many (Drury et al., 2012).
6. Inability to manage expectations from stakeholders – Lalsing et al. (2012) emphasises the differing levels of expectations from the various project stakeholders, and the need

to manage these expectations. Software development team often fail to manage expectations, and this can cause issues between the teams and the customer (Lalsing et al., 2012).

7. Resistance to change from stakeholders – As supported by Guerra (2010), a competitive advantage can be created by welcoming changes rather than resisting them. Hence, the resistance to change could be detrimental to the success of project.
8. Managers reluctant to participate - too comfortable with current practices – The PM is an important change agent in an organisation for the realisation of more sustainable business processes and practices (Silvius and Schipper, 2014). A PM with lack of skills and knowledge will be reluctant to participate actively in the agile process.
9. Lack of PM's with formal PMgmt certification – Farashah et al. (2019) emphasises that PMgmt certification, coupled with experience and professionalism, is an important aspect that influences self-efficacy and performance, leading to project success.
10. Lack of understanding (trust) between team members – According to McHugh et al. (2012), trust requires team members to believe that their colleagues possess the knowledge, competence, and integrity to complete their assigned tasks, which is enhanced when team members help each other. In order to achieve this, the team members must have similar levels of understanding (be in the same wave-length).
11. Lack of creativity and problem-solving skills – McHugh et al. (2012) argue that creativity is one of the core behavioural elements of the PM (or the project team), as they need to explore problems and issues from different and unexplored angles to develop new and innovative solutions (McHugh et al., 2012).
12. Lack of regular and timely reporting – Tilk (2016) asserted that APs quite often run at high speed and in high-pressure environments, and value can best be realised by near-real-time feedback. This can be directly accorded to regular and timely project

reporting. Timely, practical, and actionable reporting is key to AP success (Tilk, 2016).

13. Lack of complete project visibility – Drury et al. (2012) stated that complete project visibility is a key factor to avoiding issues in projects. Providing visibility can help avoid situations (issues) in projects (Drury et al., 2012).
14. Lack of project governance – Joslin and Müller (2016) emphasised that project governance, which has grown exponentially in popularity since 2005, is an important factor in project success. Ambler (2009) asserts that a lean approach based on enablement, collaboration, and motivation is required to effectively govern agile teams.
15. Lack of customer (user) collaboration – Hochmüller and Mittermeir (2008) mentioned that close cooperation (collaboration) with the customer is common to all agile methods. A customer representative can be appointed to represent the customer in circumstances where the customer is not able to allocate the required time and presence in the project. The customer representative is required to be in charge of knowing and understanding all essential requirements and cope with problems like tacit knowledge of colleagues, prioritisation of requirements, integration of different user views, expressing user stories, and so on (Hochmüller and Mittermeir, 2008).
16. Lack of knowledge on tools – Nerur et al. (2005) mentioned that tools play a critical role in a methodology, and further supports that tools alone cannot make software development successful, but people must be trained to use them correctly. Organisations planning to adopt agile methodologies must invest in tools that support and facilitate rapid iterative development, versioning/configuration management, JUnits, refactoring, and other agile techniques (Nerur et al., 2005).
17. Lack of communication support tools – Lee et al. (2006b) argues that application support for agile communication and collaboration is an important aspect of the agile

IT infrastructure. Tools such as videoconferencing and bulletin boards, are vital in Globally Distributed System Development projects by providing virtual space for communication and collaboration among distributed members (Lee et al., 2006b).

18. Lack of software (tool) to support Agile methods – Lloyd et al. (2017) identified gaps in managing requirements changes and keeping track of project status (especially in a distributed environment) and proposes automation in means of a tool to support these functions.

These additional 18 issues and challenges have been summarised in Table 4.4.

Table 4.4: Additional AP Issues and challenges

Category	Issues and Challenges (Failure Factors)	
Organisation	1. Lack of understanding of the Agile method values (and principles)	2. Leadership Team reluctant to invest on Agile method
	3. Lack of budget to implement Agile methods	
People	4. Lack of communications	5. Lack of commitment
	6. Inability to manage stakeholder expectations	7. Resistance to change from stakeholders
	8. Managers reluctant to participate	9. Lack of PMs with formal PMgmt certification
	10. Lack of understanding (trust) between team members	11. Lack of creativity and problem-solving skills
Process	12. Lack of regular and timely reporting	13. Lack of complete project visibility
	14. Lack of AP governance	15. Lack of customer (user) collaboration
Technical	16. Lack of knowledge on tools	17. Lack of communication support tools
	18. Lack of software (tool) to support Agile methods	

Source: Various literature

The specific issues and challenges identified by Chow and Cao (2008), and the additional prominent issues and challenges identified from various other literature are combined into a list of 37 Issues and challenges, with the description from the perspectives of AP governance and management, as understood from the selected studies, summarily described in Table 4.5.

Table 4.5: Combination of identified AP Issues and challenges

Category	Issues and Challenges	Brief Description
Organisation	1. Lack of executive sponsorship	The leadership team are either not supportive or not willing to endorse the agile program.
	2. Lack of management commitment	The management team are not committed in support of the implementation of the agile methods of working.
	3. Organisation culture too traditional	Traditional phase-gate thinking and practice in the organisation which hinders the progress of the agile practice.
	4. Organisation culture too political	Organisation culture impacted by political agendas which affects decision making and agile practices.
	5. Organisation size too large	Organisation is too large and widespread to be able to adapt the agile methods fast and with ease.
	6. Lack of agile logistical arrangement	Agile require logistical arrangements to be able to support the method (i.e. proper office planning for colocation of team and communication support for daily meetings).
	7. Lack of understanding of the Agile method values (and principles)	The value and principles of agile methods need to be well understood prior to embarking on implementing them, as it requires a different kind of mindset and process control
	8. Leadership Team reluctant to invest on Agile method	Leadership team of the organisation are not willing to allocate time and budget for the implementation of agile methods.
	9. Lack of budget to implement Agile methods	The unavailability of the necessary budget to implement agile methods (i.e. office reorganisation, travel expenses for face to face meetings, and management time to understand and implement the method).
People	10. Lack of necessary skill-set	The lack of skills of the stakeholders of APs (i.e. soft skills to be able to participate and contribute positively to the team, people skills to manage the team, and technical skills for design and implementation).
	11. Lack of PMgmt competence	The lack of PMgmt skills and competence to be able to tactfully contribute to the successful management of APs.
	12. Lack of teamwork	Not able to work in a team and be a team player, to contribute effectively to the team.
	13. Resistance from groups or individuals	Certain groups (i.e. management, customer, product team, marketing team and the user community) or individuals (project stakeholders) are not cooperating, thus providing resistance.
	14. Bad customer relationship	Not able to maintain a positive customer relationship, creating an unpleasurable environment with the customer.
	15. Lack of communications	Not able to articulate individual and group thoughts properly, resulting in unfavourable communication protocol, which will be a hindrance to project progression.
	16. Lack of commitment	Unable to get commitment from the stakeholders in fostering an independent and empowered working condition.
	17. Inability to manage stakeholder expectations	Not able to manage the expectations of certain stakeholders, either by not involving them, misunderstanding their requirements, or being able to deliver what is expected.
	18. Resistance to change from stakeholders	The stakeholders (i.e. the project team, customers, testers, managers, and representatives from other departments) are in their comfort zone and not able accept and foster change, in a changing environment.
	19. Managers reluctant to participate	The Managers (departmental, or leadership team representatives) are not willing to completely participate, which could be caused by disability to believe in agile methods.

Source: Various literature

Table 4.5, continued

Category	Issues and Challenges	Brief Description
People	20. Lack of PM's with formal PMgmt certification	PMs not possessing formal certification which accredits them as qualified and able PMs.
	21. Lack of understanding (trust) between team members	The team members are not in the same thoughts and wavelength; hence it becomes difficult to achieve a common understanding, causing a lack of trust amongst each other.
	22. Lack of creativity and problem-solving skills	Inability to be creative and solve problems, or issues as they arise, hence unable to resolve those issues properly and timely, causing a delay in the deliverables.
Process	23. Ill-defined project scope	The project scope is not properly understood, hence not properly defined.
	24. Ill-defined project requirements	The project requirements are either not understood, or not captured accurately by the project team, or the customers are not able to dictate the requirements accurately.
	25. Ill-defined project planning	Unable to see the whole picture and plan precisely, or the failure to include all relevant stakeholders to gather relevant input for the planning process.
	26. Lack of agile progress tracking mechanism	Slack in tracking the progress of the project, probably by not maintaining a project schedule or the disability to use the project schedule properly as a guide to track the progress of the project, or suite of projects (programme).
	27. Lack of customer presence	The customer is either absent (not participating) or their presence is limited, not being able to have the correct amount of customer feedback during the development phase.
	28. Ill-defined customer role	The customer role is not defined properly, hence causing a disjoint between what the customer is expected to do versus what the customer wants to or is able to do.
	29. Lack of regular and timely reporting	The project progress, and mainly the issues and challenges not reported on a regular basis, causing a lack of knowledge on the progress of the project and to be able to determine if the project will attain success of slack along the way.
	30. Lack of complete project visibility	The project is not clear and the deliverables are not firm, causing a lack of visibility in the project to key stakeholders.
	31. Lack of AP governance	Projects not properly governed by the methods implemented, which could either be a complete agile method, or a hybrid method with selected agile practices followed. This could be caused mainly by the absence of a PMO, or the PMO not being able to control the projects in following the agile principles.
	32. Lack of customer (user) collaboration	The customers are not consulted or involved frequently enough in the projects, hence not able to solicit their timely feedback.
Technical	33. Lack of complete set of correct agile practices	The organisation either does not follow, or doesn't have proper or matured agile practices. However, being complete will depend on how the organisation adopts the agile practices (completely agile or a stage-gate combined hybrid model).
	34. Inappropriateness of technology and tools	The technology and tools present and available in the organisation are limited or not appropriate for the support of the agile model.
	35. Lack of knowledge on tools	The stakeholders, especially the project team members are not tool savvy, hence not able to utilise the existing tools well. They could also be unaware of the available technology which could be employed to assist them in fostering the agile method more prominently.

Source: Various literature

Table 4.5, continued

Category	Issues and Challenges	Brief Description
Technical	36. Lack of communication support tools	The unavailability or absence of proper communication support tools to be able to offer ease of communication between the stakeholders, especially in a distributed environment where team members are not able to collocate.
	37. Lack of software (tool) to support Agile methods	The unavailability of software to support the agile methods (i.e. collaborative tools, software to detect and automatically track requirements changes and rebuild the design, technical software to provide advisory on changing requirements, tool to assist in capturing and maintaining requirements, and software to guide the PM and team members in their daily tasks)

Source: Various literature

4.8.3 Factors of Success

The combined 37 issues and challenges was then converted to (success) factors which impacts the successful governance and management of APs. The (success) factors have been tabulated in Table 4.6, organised into four categories of “Organisation”, “People”, “Process” and “Technical”.

Table 4.6: Combination of Factors

Area	Code	AP Governance and Management (Success) Factors	Total count
Organi- sation	Org01	Executive sponsorship	53
	Org02	Management commitment/control	46
	Org03	Organisational culture - Traditional Vs Agile	37
	Org04	Organisational culture - Political	11
	Org05	Organisational size	18
	Org06	Agile logistical arrangement	42
	Org07	Understanding of Agile method values (and Principles)	84
	Org08	Support of Investment on Agile method	27
	Org09	Budget to implement Agile methods	9
People	Peo01	Availability of necessary skillset	99
	Peo02	PMgmt competence	108
	Peo03	Teamwork	84
	Peo04	Cooperation from groups or individuals (testers)	76
	Peo05	Customer relationship	35
	Peo06	Communication (for information sharing/decision making)	81
	Peo07	Commitment and dedication (Motivation)	50
	Peo08	Managing stakeholder expectations	28

Source: Various literature

Table 4.6, continued

Area	Code	AP Governance and Management (Success) Factors	Total count
People	Peo09	Stakeholders welcome (embrace) change	61
	Peo10	Managers' participation	26
	Peo11	PMgmt certification	8
	Peo12	Trust and understanding (amongst team members/stakeholders)	19
	Peo13	Creativity and problem solving skills	13
Process	Pro01	Project scope	32
	Pro02	Project requirements	65
	Pro03	Project planning	60
	Pro04	Progress tracking and reporting	45
	Pro05	Customer presence	24
	Pro06	Customer role	44
	Pro07	Timely reporting	14
	Pro08	Complete project visibility	29
	Pro09	Project governance	116
	Pro10	Customers collaboration (agreement/expertise/ability to dictate requirements)	67
Technical	Tec01	Complete set of agile practices	50
	Tec02	Appropriate technology and tools	72
	Tec03	Knowledge on tools (technology)	34
	Tec04	Communication support tools	15
	Tec05	Software (tool) supporting Agile methods	17

Source: Various literature

The researchers discussed the 18 additionally identified factors, over a few rounds of discussion, with the practitioners who participated in the preliminary literature review survey, to categorise the factors into these four broad areas. The Delphi technique was used over several rounds of discussion with the 47 participants, until the group came to an agreement on the groupings. The darker shades in each of the categories denotes the factors derived from the study by Chow and Cao (2008), and the lighter shades denotes the additional factors identified from the literature based on various other studies by other authors as described in Section 4.8.2. The selected 175 studies (described in Appendix Q) were reviewed again if the identified factors were addressed or discussed, and if they were, a count was added each time they were identified to be either addressed or discussed in the respective studies. A table was created with the rows listing each of the 175 studies, with the columns listing each of the 37 factors, forming a matrix which was used as the basis for the evaluation. When reviewing each study, at each instance any of the 37 factors were addressed or discussed, a “yes” was captured in the cells which corresponds to the

respective study and factor, forming a matrix of all the identified factors in all the studies.

A snapshot of the matrix is shown in Table 4.7.

Table 4.7: Sample worksheet matrix for data collection

Article Title Hidden columns (Database, Year, Publication, Category, Author, Citation, Date retrieved, and others)	Executive Sponsorship	Management commitment	Traditional /Agile Organisation culture	Political Organisation culture	Organisation size	Agile logistical arrangement	Understanding of Agile method values (& Principles)
Quintessence of Traditional and Agile Requirement Engineering			Yes			Yes	Yes
Agile approach in the project management of the Czech companies	Yes		Yes		Yes		
PMOs in transition	Yes	Yes	Yes	Yes	Yes		Yes
AP management: steering from the edges		Yes	Yes				
Modified Agile Practices for Outsourced Software Projects					Yes	Yes	
Determinants of Agile Practices- A Gini index approach	Yes	Yes	Yes	Yes	Yes		
Multi-level project governance: Trends and opportunities	Yes	Yes					
A survey study of critical success factors in agile software projects	Yes	Yes	Yes	Yes	Yes	Yes	
Agile Software Development: The People Factor	Yes			Yes			
A Tale of Two Projects	Yes	Yes				Yes	Yes
TOTAL:	7	6	6	4	5	4	3

The snapshot in Table 4.7 only shows the first seven factors (columns) and only 10 randomly selected studies. The details for each category of Organisation, People, Process and Technical are shown in Appendix R, Appendix S, Appendix T and Appendix U respectively. For each column, the total number of times that factor has been addressed or discussed amongst the 175 studies was captured, and shown, as an example based on the matrix of seven factors mapped against 10 studies, in the last column in Table 4.7. The total captured in the actual table is 1,699 counts of reference, based on the total combination of factors. The number of counts for each category of Organisation (9 factors), People (13 factors), Process (10 factors) and Technical (5 factors) against the corresponding studies are shown in Appendix R, Appendix S, Appendix T and Appendix

U respectively. These appendices also show the individual number of counts for all the 37 factors respectively.

4.9 Summary

The research involves a mixed research methodology of an SLR and a GT research. Based on the preliminary literature review on PMgmt, particularly in the area of traditional and APs performed in Chapter 2, an SLR addressing the issues and challenges in APM for IT projects was performed and documented in this chapter. The findings of the SLR fulfil the first part of the purpose of this study as described in Chapter 1 (Section 1.4), which is to identify issues and challenges discussed in literature, producing a list of the issues and challenges of APM identified from the various selected literature. The research method, the search strategy, screening of the initial resulting studies and the extraction of data from the selected studies were described. The first objective (described in Section 1.5, Chapter 1) was partially addressed, by systematically identifying the available literature over the last two decades, and selecting the relevant literature to produce a comprehensive list of issues and challenges in managing agile and traditional projects, including hybrid projects. The search strategy and data extraction criteria was described, along with the results, producing a resulting list of 37 factors on the administration and management of IT projects. As described in Chapter 3 (Methodology), this chapter presented the first phase of the research method, which is the SLR. The second phase of the research method (GT), to identify the issues and challenges from the industry, will be presented in the next chapter (Chapter 5), and a comparison will be made between literature and the industry, to meet the first objective, discussed in Chapter 6. The formulation of the proposed best practice framework is discussed in Chapter 7. The model is evaluated by an expert review team, and the feedback is used to produce an improvised best practice framework in

Chapter 8 (Evaluation of the Framework). A support tool is provided to complement the agile best practice framework, where both are validated by an expert review team, which is described in Chapter 9 (Validation of the Framework). The final chapter (Chapter 10) concludes this thesis by responding to the ROs, the contributions of the thesis derived from the SLR and GT methods, and the overall research contributions, concluding the chapter with the limitations of this research and the proposed future work.

Universiti Malaya

CHAPTER 5: GROUNDED THEORY RESEARCH

5.1 Overview

The previous chapter (Chapter 4) identified and reviewed the issues and challenges faced by APs within existing literature through an SLR study, as part of the purpose of this study defined in Chapter 1 (Section 1.4). This chapter further attempts to identify the issues and challenges faced by AP practitioners within the IT function in various industries by means of a GT research methodology. The reasons for using a GT research method will be described, along with the specific steps and procedures involved, data collection methods, context of the study (participant involvement and demographics) and the method of data analysis employed. The SLR findings from the previous chapter (Chapter 4) will be compared against the GT findings in this chapter, to identify the gaps between discussions in the literature and the real-life issues faced by the practitioners in the industry. The findings will be further analysed and discussed in Chapter 6 (Findings and Discussion), along with the identification of the mitigation methods associated to the issues and challenges in managing APs.

5.2 Background and Related Work

Findings from various literature were reviewed in Chapter 4 to determine the issues and challenges of APM (Chow and Cao, 2008; Farashah et al., 2019; Ebert and Paasivaara, 2017; Lloyd et al., 2017; Yang et al., 2016; Joslin and Müller, 2016; Tilk, 2016; Silvius and Schipper, 2014; Lalsing et al., 2012; Drury et al., 2012; McHugh et al., 2012; Guerra, 2010; Hochmüller and Mittermeir, 2008; Lee et al., 2006b; Nerur et al., 2005), which provided the researchers the foundation in soliciting feedback from the ground. There

could possibly be many more literatures addressing a broader variety of challenges, but due to the intention of obtaining them from the ground, they were not analysed further.

This GT study focuses on APs and is aimed at identifying the issues and challenges faced by agile practitioners in the industry. The study further intends to present a comprehensive list of the prominent issues and challenges with the aim of helping them understand these issues and challenges and to provide them with the ability to mitigate the issues and achieve greater success in managing their projects to achieve greater success. The population for the research is targeted at Practitioners of PMgmt practices with formal academic qualifications or certification in PMgmt or both. The population was selected via the LinkedIn (LinkedIn, 2019) application where they were filtered based on their qualifications and experience, with more than five years of general working experience and a minimum of two years of experience in PMgmt. The participants were also filtered for any number of years of experience in both, traditional and APM method. A questionnaire was formulated to collect demographic and preliminary data on PMgmt, which was distributed to 303 participants, soliciting valid responses from 42 participants, achieving a response rate of 14%. Several rounds of interview sessions were conducted to understand the data and collect subsequent information, in parallel to a detailed literature review, which helped in the categorisation of the data, leading to the formulation of the theory for this study. From an initial total of 111 issues and challenges compiled from both literature and the practitioners, a final list of 55 unique factors were produced and discussed, along with suggestions by the practitioners on mitigation methods.

The output from both, the SLR (37 factors), and GT research (20 factors), producing a total combined list of 55 unique factors, along with the corresponding 55 mitigation methods, was used as the basis to formulate the framework (HAT-PMF Best Practice

Framework v1.0), as summarised in Figure 5.1. The framework will be evaluated, and an improvised version will be formulated (HAT-PMF Best Practice Framework v2.0), along with the support tool (HAT-PMF Toolkit v1.0).

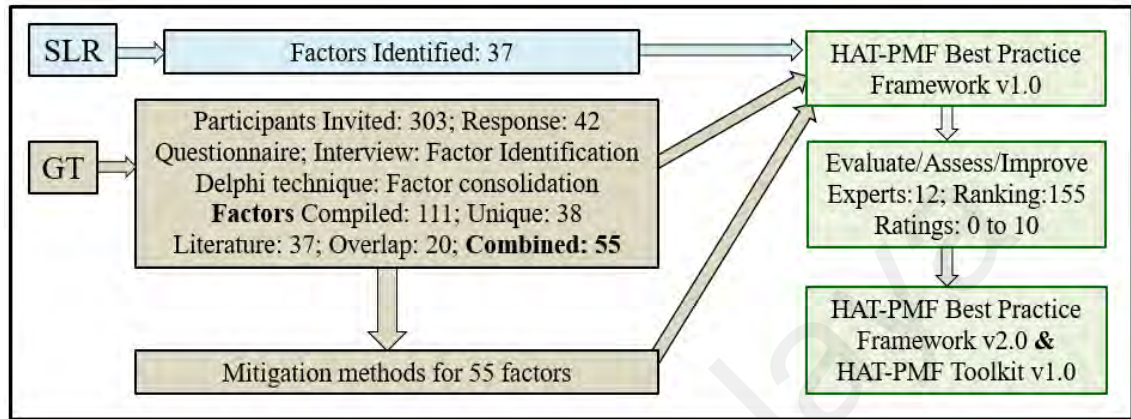


Figure 5.1: SLR and GT process outputs in the formulation of the ITPM Best Practice Framework

5.3 Method

A GT research was conducted as it was found to be the most appropriate research methodology to capture the issues and challenges faced by agile practitioners in the industry, as per the objectives of this study. Two American sociologists’, Glaser and Strauss initially developed GT (Glaser et al., 1967). GT was defined as a systematic approach to discover main concerns of people involved within the context of the study (Glaser, 1978). GT is deemed as the most suitable method to answer questions like “what’s going on in an area?” by generating a formal or substantive theory (Corbin and Strauss, 1990; Corbin and Strauss, 2008). The outcome of a GT study is supposed to produce the outcome of an inductively derived phenomenon (Corbin and Strauss, 1990; Corbin and Strauss, 2008). After obtaining the initial responses from the practitioners, several rounds of interview sessions will be held utilising the Delphi technique to refine the data, while allowing the practitioners to differ their initial comments with more

relevant feedback based on the compiled and summarised feedback from all other practitioners. The main purpose of the Delphi method is to acquire the most reliable consensus of a group of experts' opinion by a series of intensive questionnaires combined with controlled opinion feedback' (p. 458) (Dalkey and Helmer, 1963). By obtaining the consensus of a group of experts in the context of the research, researchers can identify and prioritise the subject under discussion, and develop the results (Greatorex and Dexter, 2000; Okoli and Pawlowski, 2004). The requirements for the use of the Delphi technique are the need for: (1) experts' judgment, (2) group consensus to achieve the results, (3) anonymity in data collection, (4) resolving a complex, multidimensional, and interdisciplinary problem, (5) obtaining consensus to improve and produce perfected knowledge, (6) experienced and capable experts, (7) dispersion of experts, (8) time and schedule flexibility, and (9) a cost-effective method (Habibi et al., 2014). The Delphi technique is a well suited method for compiling feedback from a group of selected contributors, usually a panel of SMEs, by using a series of questions prepared in the form of a questionnaire, while seeking consensus in stages as the data sets are constructed (Dalkey and Helmer, 1963; Dalkey, 1969; Linstone and Turoff, 1975; Lindeman, 1981; Young and Jamieson, 2001; Okoli and Pawlowski, 2004; Habibi et al., 2014). Based upon a comparison amongst 15 Delphi studies, it was concluded that there is no standard form for a Delphi study (Skulmoski et al., 2007). Skulmoski et al. (2007) asserts that the Delphi study should have the following characteristics: (1) participants should be anonymous; (2) should consist of more than one round; (3) the opinions of others in the group should be solicited, while allowing the participants to alter their opinions; and (4) the formulation of data summary and analysis. Habibi et al. (2014) further stated the requirements for the use of Delphi as (1) the need for experts' judgment; (2) unanimous consensus to achieve the results; (3) anonymity in data collection; (4) experienced and capable experts. The Delphi method is normally used when consensus among participants in a relatively

unstructured environment is desirable (Kermanshachi et al., 2016), and can be conducted with a relatively small number of experts (Hatush, and Skitmore, 1997; Skulmoski et al., 2007). For the various reasons described above, the Delphi was selected to compile feedback from a panel of experts in the evaluation of the APM framework, known as the Hybrid-Agile-Traditional Project Management Framework (HAT-PMF). The Delphi method, through the compilation of feedback from a questionnaire, and repeated rounds of verification, was employed as a suitable method to achieve the objectives of the evaluation process.

5.3.1 Reason for using GT

The primary reason for the selection of GT as the research methodology was because GT is best fitted for studying people related issues, as APM is dominantly a people-intensive approach. GT is suitable when researchers have no hypothesis up-front and are looking for a theory grounded in data (Parry, 1998) or would like to investigate and find out the actual phenomenon on the ground, as opposed to what is contained in literature. In the case of this study, although there were many issues and challenges existing in literature, the researchers were attempting to find out if these issues and challenges in literature was really impacting the practitioners on the ground in the governance and management of APs, and if there were other new issues and challenges not stated in literature. It would also be a good opportunity to verify the findings from literature against the actual scenario on the ground. GT research have been prescribed by researchers to produce substantial findings to conclude on substantive theories in the context of Agile over the last decade (Baskerville et al., 2011; Coleman et al., 2007; Hoda et al., 2012). Although the GT method is usually employed in social research studies, it is also deemed useful for a wide range of research studies in the context of software engineering in general, particularly in the context of agile (Gandomani et al., 2013; Hoda et al., 2010).

Instead of the conventional approach of initiating a research through a specific set of RQs, a GT begins with a general area of interest (Parry, 1998). As argued by Glaser (1998) and Moghaddam (2006), formulating and focusing on specific and detailed questions prior to conducting a qualitative study such as a GT research method may lead to preconceived ideas or hypothesis of the phenomenon of research. The method of not deriving specific RQs prior to the study does not denote an absence of a problem in this research, but will provide the opportunity of capturing the main concerns of the target audience of the research at an early stage of the GT research (Glaser, 1992; Glaser, 1998). With the aforementioned reasons in place, this study begins with a general area of interest; the issues and challenges faced by the PMgmt practitioners in general. After obtaining substantial data and verifying that indeed there is a considerable number of factors available in the area of APs, the study was eventually streamed towards the specific issues and challenges associated to the governance and management of APs.

GT has been used in many recent IT, PMgmt, and agile based research work, on the areas of; software process improvement (Coleman and O'Connor, 2007), best practices in PMgmt (Georgieva and Allan, 2008), human aspects of software engineering (Hoda et al., 2010), practices of self-organising agile teams (Hoda et al., 2012), agile transitions in practice (Hoda and Noble, 2017), human related issues and challenges in agile transition (Gandomani and Nafchi, 2015), agile architecture (Waterman et al., 2015), agile transition and adoption framework (Gandomani and Nafchi, 2016), PMgmt in higher education (Porter, 2019), and, project managers' accountability (Mac Donald et al., 2020). Based on the popularity of GT in agile and PMgmt related research, it was used as part of this study to obtain findings from the ground.

5.3.2 GT Steps and Procedures

The GT approach defines the steps involved in developing a GT in a systematic approach. Several steps are defined in the GT process, which forms the GT Life Cycle in this study, as described in Figure 5.2, adapted from Hoda et al. (2011).

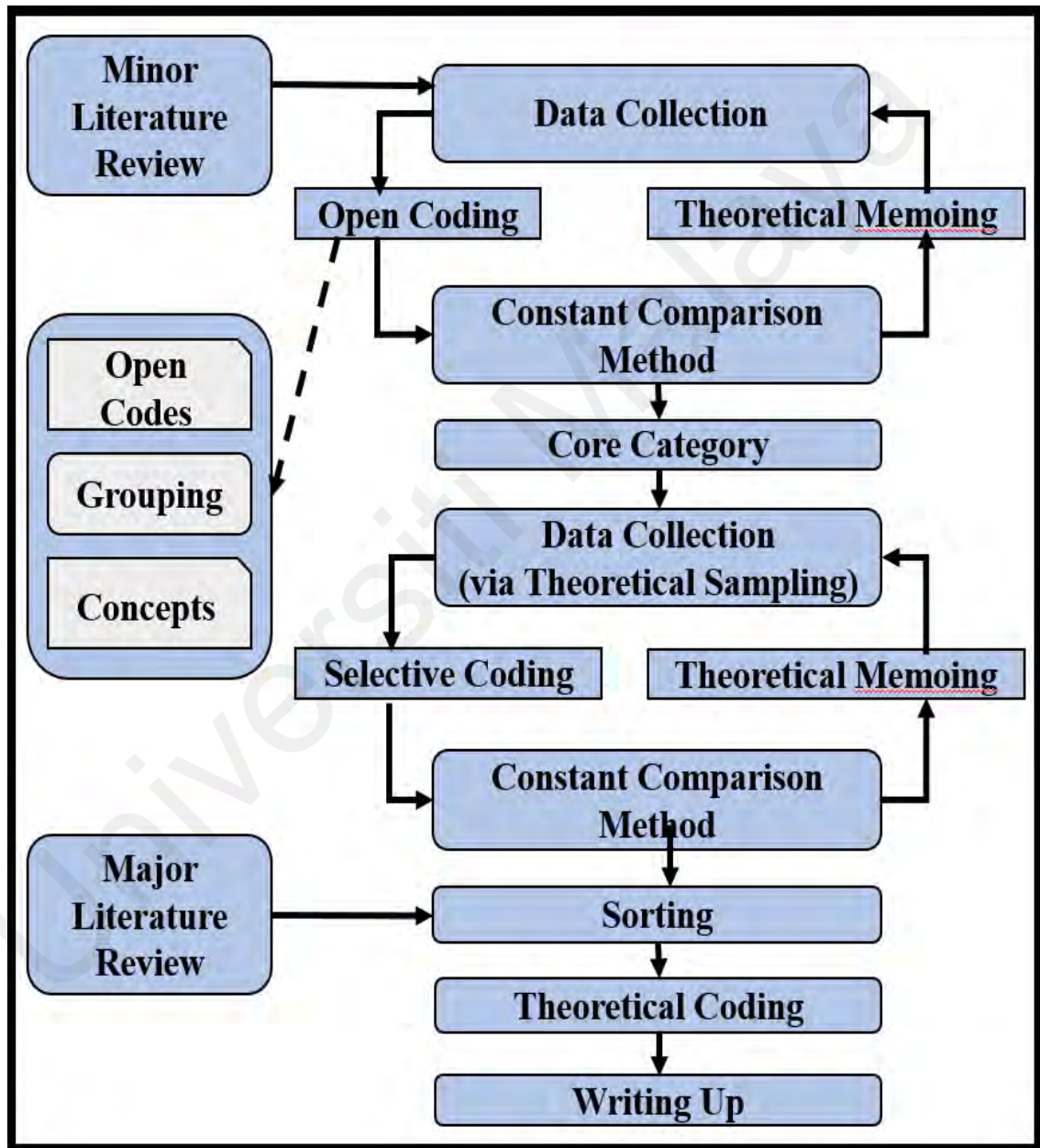


Figure 5.2: Steps and Procedures of the GT Process

Source: adapted from Hoda et al. (2011)

The research methodology utilised in this study is described in Figure 5.3, and explained further in the following section.

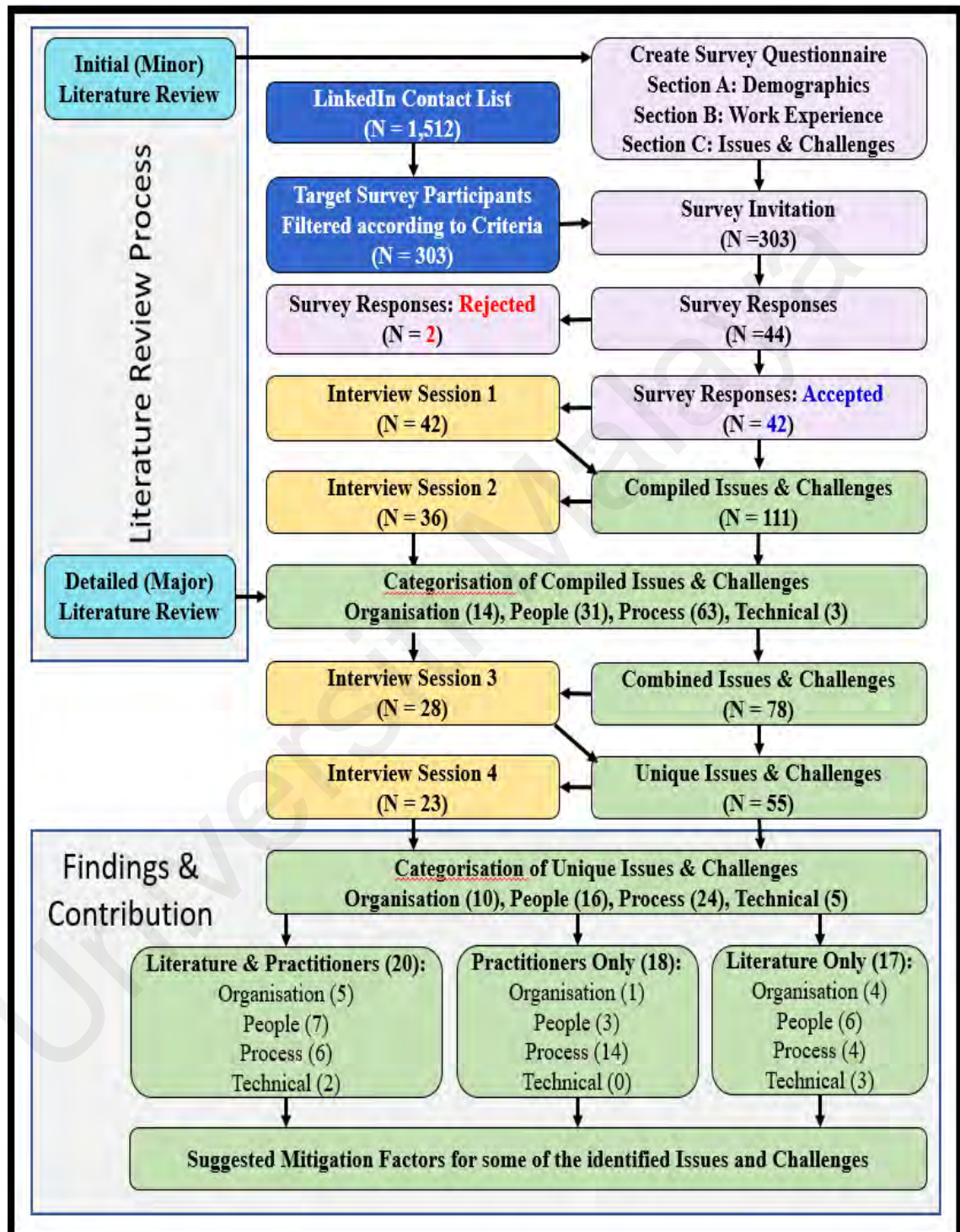


Figure 5.3: Research Methodology employed in this study

5.3.3 Data Collection

GT requires a minimum amount of literature review upfront, allowing the researcher to start with data collection in the early stages, unlike the other methodologies such as an SLR which requires mass amounts of literature review prior to performing an analysis on the findings. GT researchers collect, code, and analyse the data through theoretical sampling, and decide on subsequent data collection along with the source of the data to be able to build a theory as it emerges (Glaser, 1978). This study presents the results of a GT research of issues and challenges in the governance and management of APs. The research commenced with a minor literature review in order to get a feel of the documented issues and challenges of governing and managing IT projects. The outputs of the preliminary literature review in Chapter 3 (Section 3.4) were used. The researchers were curious to find out if the issues and challenges reported in literature are also faced by the practitioners managing various IT projects in the industry. Based on what was found in literature, a preliminary survey instrument was designed to be distributed to the selected target audience, aiming to get a feel of the types of issues and challenges faced by PMgmt practitioners, and the extent these issues and challenges affected the successful delivery of their projects.

The GT process was performed and administered following the method described in Figure 5.3. From the researchers LinkedIn (LinkedIn, 2019) contact list of 1,512 professionals, 303 of them, making out 20% of the contact list, were selected based on the predefined criteria of being in the IT industry, and having the required level of qualifications and working experience. The questionnaire was developed using Google Forms (Appendix V), and distributed to the target audience. Several reminders were sent to solicit response from the selected 303 participants, and after frequent follow-ups, the survey was ended after 3 months with 44 responses recorded. One (1) response was a

duplicate as the same participant filled out the survey questionnaire twice, with the same information. In another response, the participant indicated that he/she will not be able to contribute further due to the lack of experience (which was against the records declared in LinkedIn). With the 2 responses rejected, the number of valid responses were 42 out of 303 invited participants, making out an average response rate of 14%.

The initial questions covered the participants background, role, responsibilities, working experience, PMgmt methods used and level of involvement in the field of PMgmt. The other questions were around the issues and challenges they were faced with in their projects and their respective organisation. These questions are required in order to qualify them as having issues and challenges on APs. Based on the initial responses from the survey, as all 42 respondents indicated that they are faced with issues and challenges on APs, further communication sessions were undertaken with them, namely via LinkedIn In-Mail, Email, Skype, WhatsApp, Viber, Telegram, Signal, Zoom-Meeting, and Google-Meet. An initial interview session was scheduled with all 42 participants of the survey, when it was apparent, through the responses via the questionnaires, that they were indeed confronted with many issues and challenges in the governance and management of their respective projects. After studying the data collected, three subsequent rounds of interviews were held with a gradually declining level of participation, with thirty six (36), 28 and 23 participants in the second, third and fourth rounds of interviews respectively. The reduction in participation was mainly due to the participants' busy work schedule, nevertheless a substantial amount of data was obtained at the end of the interview sessions, which were all recorded in an Excel spreadsheet. Data collection resumed using the theoretical sampling mechanism until a point where the researchers reached a point of theoretical saturation where no further concepts or ideas emerged from the data (Glaser and Strauss, 1967).

The data collection exercise ended, during the last round of interview with the participants, when a point of saturation was reached on the recorded issues and challenges, and at the point when no further new concepts or findings could be derived. A reasonable amount of information were compiled on the issues and challenges faced by the participants in the governance and management of both traditional and APs, as well as hybrid projects. The suggested and proposed mitigation factors were also recorded from the participants, which is a great contribution for this study. In parallel to conducting the multiple rounds of interviews, a detailed literature review was undertaken to identify a comprehensive list of issues and challenges from academia, through a separate SLR study (Chapter 4). The data obtained from the participants were analysed against the existing literature to find a pattern for the purpose of categorisation.

The results from both avenues; literature and practitioners, were tabulated for further analysis. With the involvement and assistance of the participants, by means of a Delphi technique, the issues and challenges were merged, and placed in four (4) broad categories suggested by literature: Organisation, People, Process and Technical. All issues and challenges were combined to produce an initial list of 111 factors, respectively listed by the four identified categories. Similarities were identified between the data obtained from literature against the data collected from the practitioners, and after combining similar data, a combined list of 78 issues and challenges were produced. The list was further scrutinised to come up with a unique list of 55 issues and challenges. When thoroughly analysed, the issues were divided into three broad areas; (1) Issues and Challenges which were both found in literature and also identified by the practitioners, (2) Issues and Challenges which were identified by the practitioners, and not found in literature, and (3)

Issues and Challenges only found in Literature, and not identified by the practitioners.

The results will be discussed in the following section.

5.3.4 Context of the Study

The GT study was carried out by using the opinions of 42 APM practitioners from various industries, who participated in the study upon request by the researchers, by means of an invite to participate (Appendix W). A primary requirement in participating in this study is to be certified in PMgmt and to have more than five years of overall working experience, with a minimum of more than two years of working experience in the field of PMgmt, and with any number of years of experience in both traditional and APM. The participants were selected and filtered from the LinkedIn online portal (LinkedIn, 2019) based on their qualifications and experience, positioned around the industry practitioners from various industries, but within the IT expertise. The qualifications include either a formal degree in the field of PMgmt, or a practitioner certification from a professional and accredited PMgmt body. The target participants are all PMgmt practitioners mainly from the field of software engineering, consisting of PMs, program managers, project directors, agile coaches, trainers and PMgmt consultants, as described in Figure 5.4.

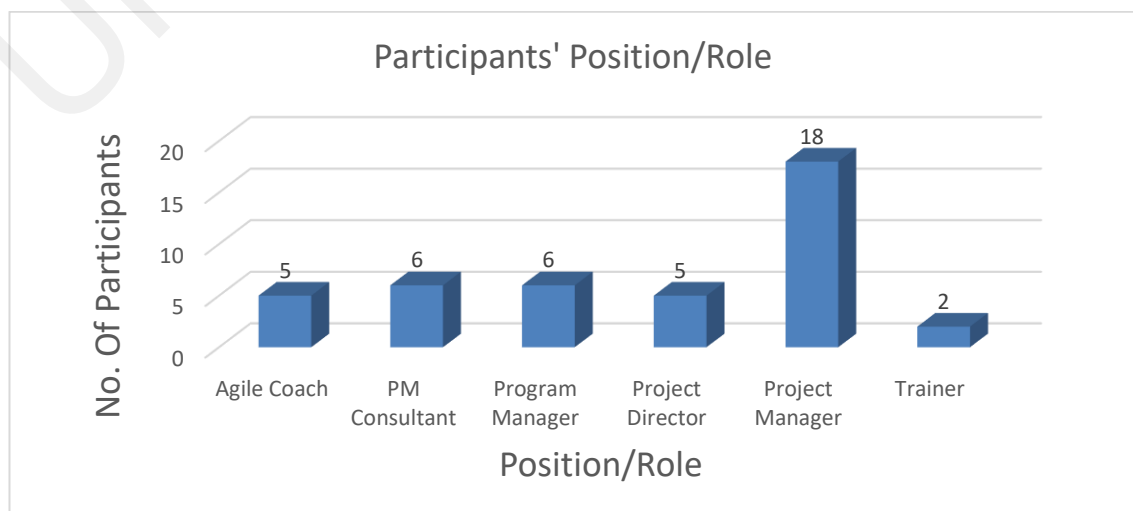


Figure 5.4: Position/Role of the 42 participants

Figure 5.5 and Figure 5.6 describes the continent and country of origin of the participants, who come from the five continents: Asia, Europe, North America, South America, and Africa, and from 20 different countries within these five continents.

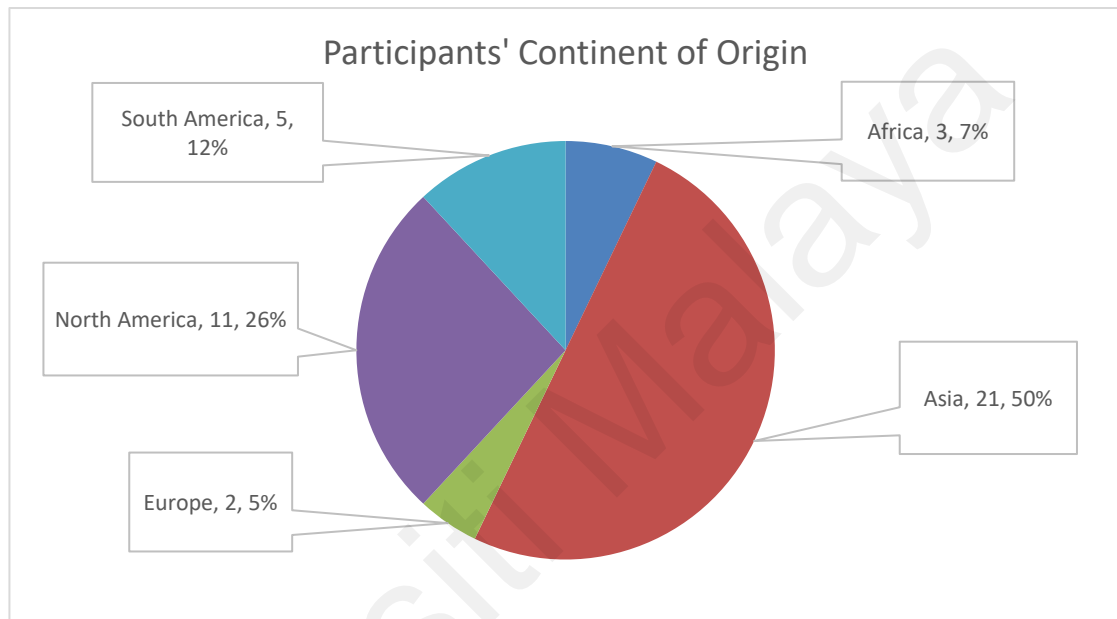


Figure 5.5: Continent of origin of the 42 participants

Most of the participants are from the Asia continent, making out exactly 50% of the total participants. When the country of origin of the participants were analysed, it was discovered that most of the participants are from Malaysia and the USA, contributing to 24% and 21% respectively.

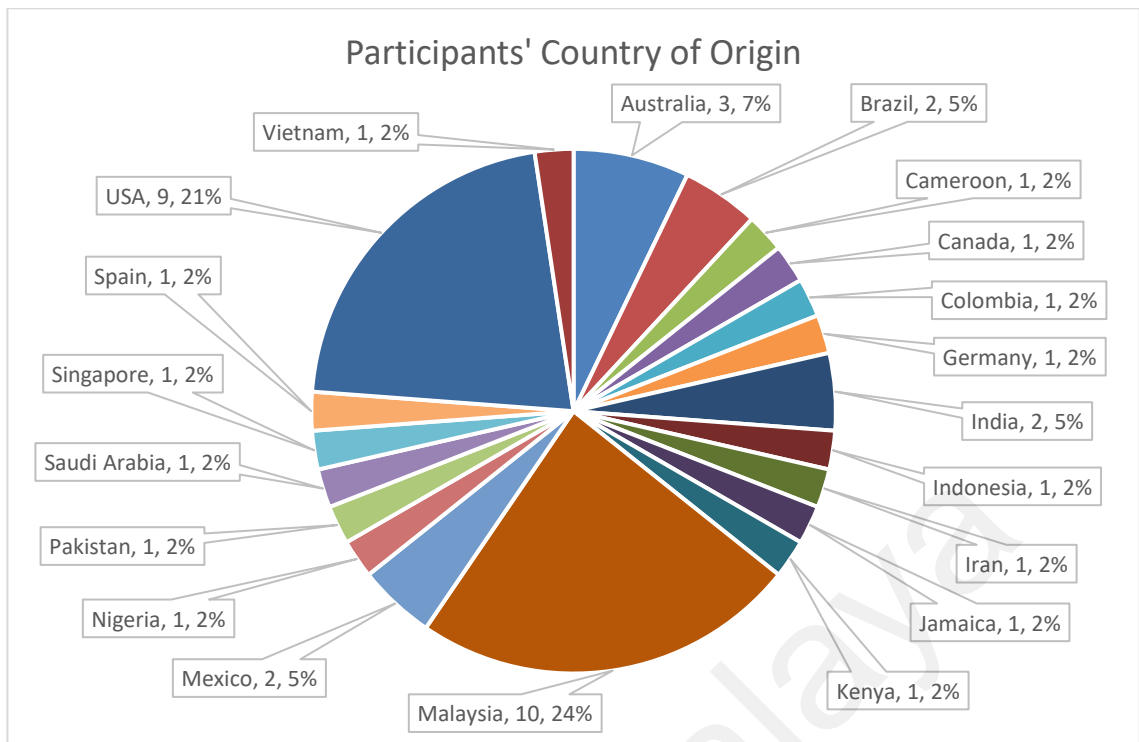


Figure 5.6: Country of origin of the 42 participants

Figure 5.7 and Figure 5.8 describes the number of years of overall working experience and the number of years of experience within the field of PMgmt respectively. Most of the participants (50%) appear to possess more than 20 years of overall working experience. Overall, 95% of the participants possess more than 10 years of overall working experience.

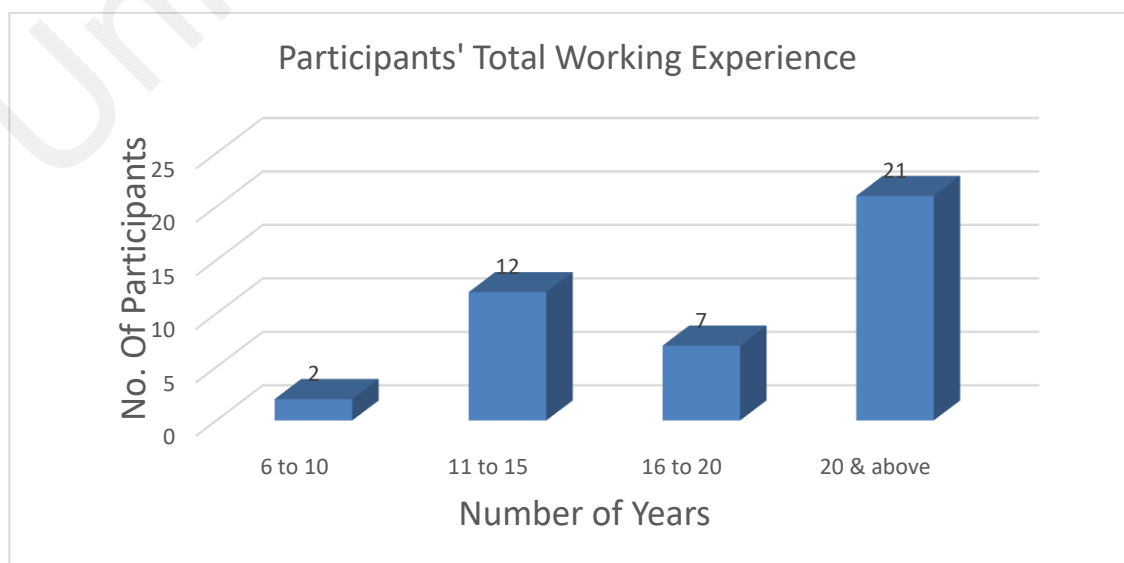


Figure 5.7: Total Working Experience

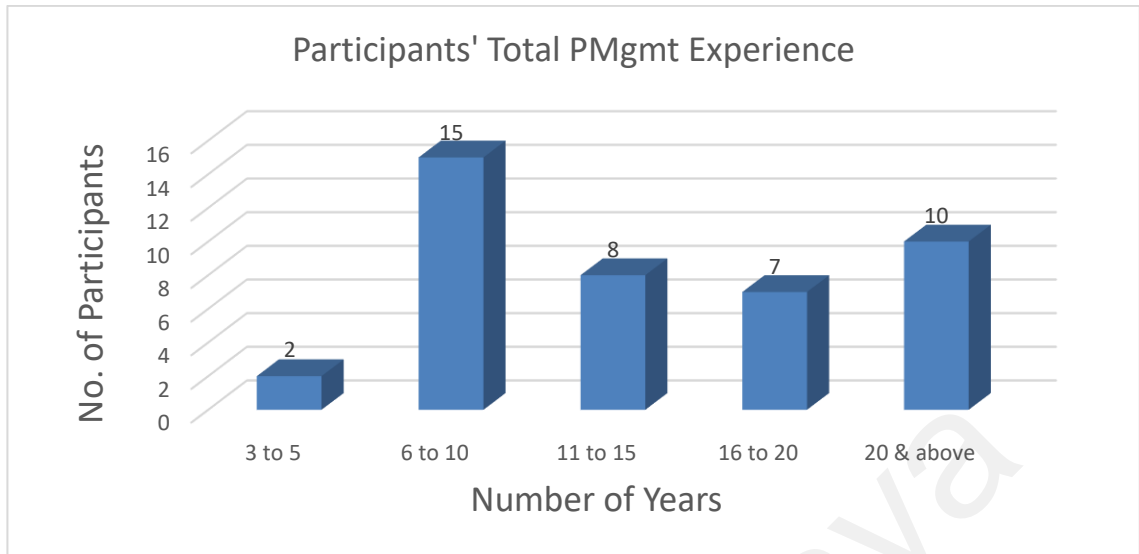


Figure 5.8: Total PMgmt Experience

Figure 5.9 and Figure 5.10 describes the number of years of experience in traditional PMgmt, and the number of years of experience in APM respectively. Most of the participants have more than six years of experience managing Traditional projects, while most of them are new to APM, about 43% having one to two years of experience. Having a good mix of experience between traditional and APM, the participants were able to provide valuable feedback on the issues and challenges of managing APs, and a valuable contribution towards hybrid methods.

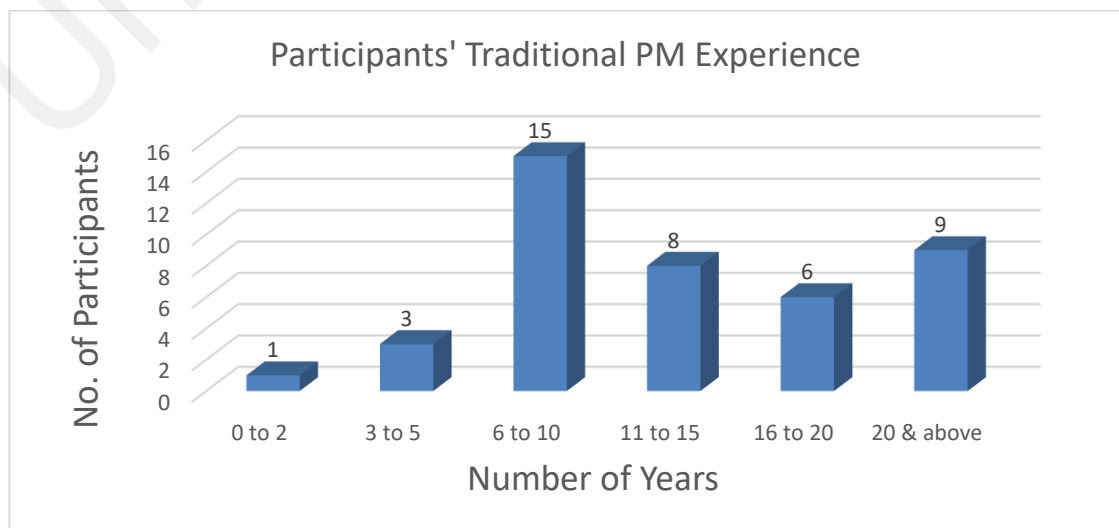


Figure 5.9: Total Traditional PMgmt Experience

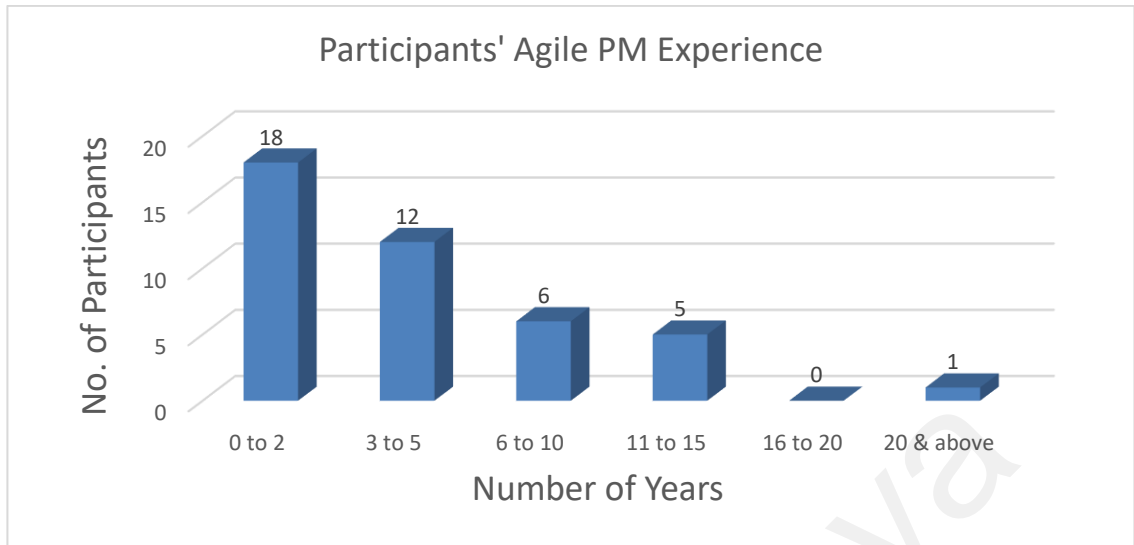


Figure 5.10: Total APM Experience

Figure 5.11 shows the different PMgmt methods, which includes traditional, agile and hybrid methods used by the participants. Most of the participants are using more than a single method within their respective organisations to manage their projects. Scrum appeared to be the mostly used method (30%) within the Agile environment, while PMBOK and Waterfall appeared to be the most widely used amongst the participants managing traditional projects, contributing to 22% and 21% respectively.

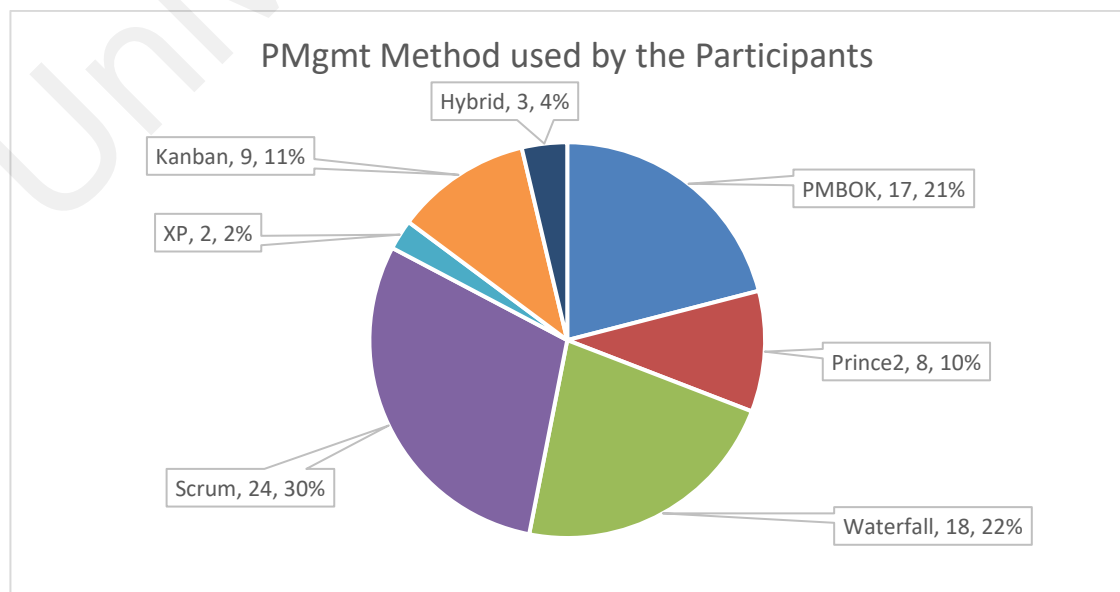


Figure 5.11: PMgmt Methods used by the participants

5.3.5 Data Analysis

The data analysis process, which is referred to in GT as data coding is conducted, where open coding is done initially, gradually moving into selective coding as the data collection approaches a state of saturation. The initial data was collected, and data collection continued up to a stage of emerging theory (Glaser, 1998), where two different approaches of substantive and theoretical coding were used. On one hand, substantive codes allow the emergence of categories and properties which describes the phenomenon under study. On the other hand, the theoretical codes emerges the abstractions of a model representing an interrelated set of hypotheses towards the resolution of the main concern in the study (Glaser, 1978; Glaser 2005). Using the concepts and findings derived from these codes, it enables the researchers to identify the relationship between the concepts and categories towards the modelling of the hypotheses (Glaser, 2005).

Open coding, as the first step of data analysis, was done where each script was analysed sentence by sentence, and line by line, to attain the conceptual understanding of the context under study (Glaser, 1978). The researchers were seeking for key points, and once identified, a code was assigned to the key point (Glaser, 1978). The emergent codes were then compared to the same open codes in the same and previous transcripts, where this process is known as constant comparison, which is recognised as the heart of GT (Glaser et al., 1967). Constant comparison assisted in our progress to achieve a higher level of abstraction, allowing us to identify the concepts and further leading us to identify the categories (Glaser, 1978). Each category is a higher level of abstraction, which encompasses a group of concepts that seem to relate to the same phenomenon (Gandomani and Nafchi, 2015). This is the process that commanded a lot of time and effort, trying to form the relationship between the issues and challenges identified, linking

them with the process of managing APs. The end of open coding is marked by the emergence of a core category (Glaser, 1992). The core category marks the main area of concern for the participants of the GT (Glaser, 1978). Discovering the core category can be a great challenge, being a lengthy and tedious process for the researchers, where due consideration is required on the identification of the core category (Gandomani and Nafchi, 2015). The core category must be central, and related to several other categories and their properties, and it must also re-occur frequently in the data, and relate meaningfully and easily with the other categories, while being able to account for most of the data variations (Glaser, 1978).

This is when the core issues and challenges were distinguished and tabulated to form the fundamental data, to prepare for the interview sessions, and to determine the type of questions directed to the participants, to seek further clarifications on, and to garner a greater understanding of the compiled data sets. Theoretical memoing is the process where memos are formed by collecting more detailed data during the interview process (Glaser, 1998). Memoing is the most significant factor in ensuring quality in GT, where each memo is actually a record of a feeling, idea, thought, and insight of a relation to an emerging concept (Gandomani and Nafchi, 2015). This is the process which allowed the identification of the underlying reasons, and suggestive mitigating factors, for each of the issues and challenges faced by the practitioners in managing APs. Sorting is the following process which formulates the emergent theory and its related categories, and is started at the end of the data collection process, when the all codes reaches a point of saturation. The final step of GT is the theoretical coding, which is a process to identify the connections and relationships between the core category and other emerged categories, which will form the hypotheses that is able to explain the theory (Glaser et al., 1967;

Glaser, 1992). During this stage, the issues and challenges were combined, grouped, and sorted to form the basis of the hypotheses and the resulting theory.

5.4 Findings

This section will discuss the results obtained in the GT research, identifying the factors impacting the successful governance and management of APs, compiled from the PMgmt practitioners. APs come with a set of challenges and problems that are different from those faced by projects following a traditional methodology (Miller, 2013). These challenges and problems can be directly related to issues and challenges, which are comprehended as the issues faced by APs. Chow and Cao (2008) generated 19 issues and challenges which were categorised into four areas: (1) Organisational, (2) People, (3) Process, and (4) Technical.

The findings obtained from the practitioners was categorised into the four categories which were proposed by Chow and Cao (2008). The agile practitioners were consulted on the categorisation of their respective contribution to the issues and challenges, to come up with the list of issues and challenges based on the four categories. The list of 55 issues and challenges were then divided to create three (3) broad areas as follows, and are discussed in the following context:

- (1) Common Issues and Challenges from literature and the practitioners,
- (2) Unique Issues and Challenges from the practitioners, and
- (3) Unique Issues and Challenges from literature.

5.4.1 Common Factors from Literature and the Practitioners

The issues and challenges attained from the practitioners, which were also identified in literature, consist of 20 items, which are separated by the four (4) categories, are listed in Table 5.1 and will be explained in the following context.

Table 5.1: Common Factors (Literature and Practitioners)

Category	Issues/Challenges Reported by Practitioners and identified in Literature
Organisation (5)	Understanding of Agile method values (and Principles)
	Management commitment/control
	Support of Investment on Agile method
	Organisational culture - Traditional Vs Agile
	Organisational culture – Political
People (7)	Stakeholders welcome (embrace) change
	Teamwork
	Managing stakeholder expectations
	PMgmt competence
	Availability of necessary skillset
	Customer relationship
	Communication (for information sharing/decision making)
Process (6)	Project scope (management)
	Project planning
	Progress tracking and reporting
	Project governance
	Project requirements (management)
	Customer role
Technical (2)	Appropriate technology and tools
	Knowledge on tools (technology)

Source: Industry practitioners and various literature

5.4.1.1 Common Factors – Organisation Category

Five items were identified as organisational issues and challenges, discussed as follows.

1. Understanding of Agile method values (and Principles)

The most addressed item was the lack of understanding of Agile method values and principles by the stakeholders in general. The stakeholders who are responsible for the implementation of agile methods in an organisation is not seen to be communicating the values it yields clearly to the key stakeholders. *“They (agile champions) are not communicating the value of Agile to the leadership or the management team. Without this crucial communication, how can we run projects successfully. If they (leadership/management team) are to support us, they first need to understand its (agile) values.”* P09, Agile Coach.

Another common problem is that *“agile is (often) not followed holistically (by the leadership team)”* (P30, Agile Coach), indicating that the leadership team are not completely adhering to the agile methods, even when they have initiated its implementation. The agile principles are also not well understood by the leadership or management team, who are the key stakeholders of projects within the organisation. *“(Lack of) common understanding of agile principles. They (leadership team) implement agile without properly understanding its depth, and they normally don’t admit that they lack knowledge, and are also reluctant to pass on the control to the actual champions of agile.”* P02, PMgmt Consultant.

The executives (leadership team) are often seen to be in a rush to implement agile due to the perceived success it yields, without evaluating the impact of its implementation within the specific organisation. Different organisations may experience different levels of success (or failure), as the industry and the type of projects they manage may, or may not be well suited to the agile methods of development, and management of projects. *“Executives perceiving the hype of success without understanding (the level of) investment required. There are so much in stake to consider, we need to get the right*

people, put in the right process, and most importantly, we need to ensure the method fits into our organisation in the first place.” P24, Program Manager.

There is *“(a lack of) overall organisational exposure to agile.”* (P32, PM). The organisation as a whole must have the correct and required level of exposure to the agile methods, without which, attaining success in managing projects the agile way may be a difficult task to handle.

2. Management commitment/control

There was *“difficulty in getting management to adopt scrum (agile) wholly”* (P26, PMgmt Consultant). Perhaps this could have been caused by the *“Lack of manager commitment”* (P08, Trainer) and the *“(lack of) management support on agile.”* (P27, PM).

3. Support of investment on Agile methods

It is important that the executives of an organisation understand the cost implications of the implementation of agile methods, and commit to support the required level of investment it entails. There is a *“lack of executive support (on investment)”* (P04, Program Manager) and the *“lack of sponsorship and support for Agile methods by the Leadership teams”* (P41, Project Director). A thorough evaluation need to be carried out to ensure the method to be implemented compliments the projects, instead of forcing a method onto projects due to its popularity, when method are not well suited with the projects undertaken by the organisation. *“Applying agile to efforts that are better served with other methods (unwillingness of (the) leadership (team) to invest time, people and money into the effort).”* P24, Program Manager.

4. Organisational culture - Traditional Vs Agile

The “*(organisational) culture change*” (P17, Project Director) need to be accounted for as the implementation of a methodology will impact the way the organisations behave and operate. When moving from a traditional method to an agile method, the mindset changes, hence the culture of the organisation is most likely also set to change.

5. Organisational culture – Political

When an organisation moves into an agile method, for example, if the organisation employs Scrum as the agile method, the teams are required to be self-managed without the frequent interference by the management or leadership team. In some cases, there seem to be “*reluctance (from leaders) to allow self-management by (the) scrum team (political and control)*” (P26, PMgmt Consultant), causing a negative impact in the project teams, and the eventual destruction of the method.

5.4.1.2 Common Factors – People Category

There are seven issues and challenges within the People category, described in this section.

1. Stakeholders welcome (embrace) change

The most common concern discussed by the practitioners in the people category is the topic on change management, and the inability for the stakeholders to handle change properly and effectively. It was mentioned that “*most of the people’s mindset was not ready to (accept or handle) changes*” (P36, PM), as they are “*not open to change or (instil) resistance to change*” (P28, PM). The stakeholders must be “*willing to change, with the ability to adapt to many different scenarios and be able to create multiple values*”

(P05, PM). *“People are afraid of change from what they are most familiar (with). If there's enough dissent with the current methodology, progression will stop and value cease to be created.”* P20, PM.

Switching from a traditional PMgmt method to an agile method requires a *“cultural/mindset change (from traditional) to agile method, (and) not every stakeholder is able to adapt to the method”* (P19, PM). *“Agile focuses on change, (while) people are not good with change”* (P32, PM). It could also be an organisational inflicted problem where the *“organisational/team agile culture (induces) resistance to constant changes”* (P16, PM). As APs are susceptible to continuous changes in requirements, the *“adaption of team member(s) in requirement changes impacts decision making and task dependencies”* (P22, Project Director).

2. Teamwork

Teamwork is a crucial trait in APs as stakeholders at all levels are required to work closely, and be able to communicate regularly and effectively. Sometimes, the *“diversity of ego's in the team”* (P39, Trainer) imposes a heavy impact in the team's ability to work together seamlessly. It could also be due to the *“lack of team member support”* (P04, Program Manager) which induces problems within the team in its ability to work together. *“Team alignment”* (P11, PMgmt Consultant) and *“weak (team) collaboration”* (P06, PM) are alleged to be the reasons hindering good teamwork. A *“weak team (requires) emotional intelligence management”* (P34, PM) which requires the understanding, responding to, and managing ones emotions when dealing with other team members. *“Lack of understanding from client, bad (or unreasonable) expectations from the management, (and the) synergy between teams (are) not good.”* P28, PM. There are huge concerns on the *“poor integration among relevant project stakeholders”* (P10, PMgmt

Consultant). Hence, “*team cooperation, (dictating that) every team member must be a contributor*” (P18, PM) is a crucial trait in ensuring absolute and seamless teamwork in AP teams, to enable the project to attain success.

3. Managing stakeholder expectations

Stakeholder engagement need to be managed well, which has to be held as frequently as deemed necessary in APs. “*Manage expectations*” (P16, PM) seems like a simple term, but can be a very tedious and complex task when confronted with varying expectations, from different levels of stakeholders. “*Methodology alignment and engagement between all parties*” (P34, PM) is crucial, especially in APs. Some organisations are seen to be “*applying agile (methods) to (project) efforts that are better served with other (non-agile) methods*” (P24, Program Manager), by implementing agile methods on projects which are not suitable to be managed in an agile manner, and perhaps better to be managed using traditional methods, or hybrid methods.

4. PMgmt competence

“*Poor PMgmt competency*” (P10, PMgmt Consultant) is also a concern where some team members are not sufficiently trained or equipped with the ability to contribute effectively to their respective projects. “*Team adaptation to cross functional skills*” (P16, PM) is important, as there is greater expectations on AP team members, compared to its traditional counterpart.

5. Availability of necessary skillset

Before moving to agile methods, it is important to take stock of the necessary skillsets within the organisation and amongst all stakeholders who will be involved in the APs.

“One issue I think may be plausible is that agile is useless if the company(s) infrastructure doesn't foster it and/or the employees aren't trained in agile.” P20, PM.

6. Customer relationship

Fostering good customer or client relationship is key to attain *“Client (or customer) support to the project”* (P21, PMgmt Consultant), because when the relationship is good, it will be easier to communicate with the customer, to get their agreement or buy-in, while minimising resistance.

7. Communication (for information sharing/decision making)

The communication strategy within the organisation should be aligned with the agile way of communications. As *“agile is a very informal communication structure”* (P32, PM), there should be flexibility in the methods, frequency, and approach of communication in projects.

5.4.1.3 Common Factors – Process Category

Six items were compiled from the process category, described in the following context.

1. Project scope (management)

Project scope management is a tedious affair in APs as the expectations are, that APs should be flexible and lean, allowing scope changes throughout the development process. *“Scope change”* (P12, PM) and *“scope creep”* (P27, PM) are instrumental in APs, where the *“scope definition”* (P38, PM) must be done properly in the beginning of the project, with a reasonable amount of allowance and flexibility, for changes to take place.

However, there is a risk in *“uncontrolled scope creep as the client feels it’s their right to increase (or alter the) scope under the sun without (the) reprioritisation of backlogs.”* (P18, PM). *“Cost management in agile can be tricky. Expanding/changing scope can lead to uncontrolled scope creep.”* P19, PM.

When scope changes, it is imperative that the tasks be reviewed and reprioritised, which will most likely impact to the project schedule and cost. *“Resourcing and scoping”* (P37, PM), may have a great impact on project costs as changing scope may also require resources to be changed, new resources to be obtained, or existing resources to be made redundant. The *“(lack of) understanding of delivery requirements (end deliverables not properly defined)”* (P21, PMgmt Consultant) can cause a considerable amount of impact on project success. When the scope and requirements are not clearly documented, and deliverables not clearly agreed with the customers, it leaves the project team in a very vulnerable position on the final delivery of the project.

2. Project planning

Irrespective of the type of project, planning is a crucial activity, which should be done upfront. Even for APs, which does not encourage comprehensive planning at the beginning stage of the project, *“bits and pieces approach should be avoided”* (P30, Agile Coach), as it is still advisable to plan as much ahead as possible for all the predictable elements of the project, which includes risk management. *“Practitioners of agile methodologies often times think that risk identification and management is a waste of effort, and end up getting hit by a risk that could have been foreseen, and (otherwise) mitigated.”* P24, Program Manager.

With proper planning, changing project scope should be aligned with the project schedule and budget requirements. Scope change may either stretch the existing resources, or require additional resources to be added to the project, which in turn will demand additional cost, or time, or both. *“Lack of resource planning”* (P28, PM) may also cause this deficiency in projects. *“Due to increase of scope, the team works longer hours to complete the backlogs - longer hours requires more compensation (overtime, time-off, day-off), (and) these are not covered in the project budget. Again, it becomes the PMs headache (and responsibility).”* P18, PM.

3. Progress tracking and reporting

Insufficient project tracking and reporting may impose a great impact in the team members' ability to deliver projects successfully. For example, in the Scrum method, not *“maintaining (the) scrum schedule (of the project delivery cycles or) Sprints”* (P16, PM) may place the project in great risks of not being able to deliver on schedule. Often, the APs are so intense that *“no (or insufficient) project control time (is) scheduled”* (P08, Trainer), and the task of progress tracking and reporting is done outside of normal work hours, or sometimes not done at all. *“Too many Tickets open, no clear picture of the whole project, teams are not aligned, too little (or insufficient) test environment for all the Sprints, (and) releases.”* P31, PM.

4. Project governance

“Quality assurance” (P38, PM) and *“quality control”* (P38, PM) are important in APs, to ensure the projects are managed with proper governance. Projects should ensure the proper use of methods and employ the best-fit method for the respective types of projects, and not force a standard method onto all types of project within an organisation. When a full agile method is deployed, problems occur when there are *“people who want to*

implement "Agile Lite" (P07, Project Director), or reduce the intensity of the method to align it with a milder version of the method for full blown APs. This could be done for many reasons, such as not being familiar with the method, lack of skills, or simply not willing to change.

5. Project requirements (management)

Managing requirements is fundamental and the *"failure to clarify objectives/requirements"* (P07, Project Director) upfront may result in a fuzzy implementation process. At times, and in many cases, the *"customer(s) understanding of (the) requirements (is insufficient)"* (P14, PM), making it very difficult to clarify them with the customers, as the customers are not willing to discuss them further.

6. Customer role

"Clarifying roles and responsibilities" (P09, Agile Coach) of the customer is important and should be done upfront, while being able to *"catch (the) customer(s) interest (identify key users and capitalise)"* (P38, PM) at early stages of the project.

5.4.1.4 Common Factors – Technical Category

From the technical category, there were only two (2) items highlighted by the participants, which are discussed in the following context.

1. Appropriate technology and tools

Having the right and appropriate technology and tool is important, as APs have aggressive timelines, while requirements may keep changing. Not having the right *"architecture software"* (P01, Agile Coach) may impose on the project in losing its ability to keep track

of, and controlling changes, while losing the opportunity to automatically align them with the required level of changes in the schedule, resourcing requirements and cost implications.

2. Knowledge on tools (technology)

Not having the right skills and knowledge on the available tools can cause a “*misuse of agile software tools*” (P34, PM). A “*technical debt*” (P38, PM) scenario happens when a complex bug is found in the codes (of software development projects), but there are either no proper tools to identify and correct the codes, or there is insufficient knowledge in the utilisation of the available tools to reconstruct the code in a fast and efficient manner. The team members are often seen resorting to old ways of debugging, spending a considerable amount of time, figuring out the problem and performing re-coding manually, which may introduce (more) human errors.

5.4.2 Unique Factors from the Practitioners

Table 5.2 lists the issues and challenges obtained from the practitioners, but were not identified in literature, hence they are classified as unique in this study.

Table 5.2: Unique Issues and Challenges (Practitioners only)

Category	Issues/Challenges reported by Practitioners, not found in Literature
Organisation (1)	Mismatch of Organisational objectives and Agile principles
People (3)	Adopting the agile mindset
	Lack of knowledge/understanding of Agile method
	Lack of team empowerment
Process (14)	Mismatch of method - Agile Vs Traditional
	Hybrid method
	Proper implementation of Agile method
	Prioritisation and Scheduling
	Cost management
	Project Team role definition not clearly defined and understood
	Improper Vendor Management
	PM Role not clearly defined and understood
	Flexible process to align with project scope
	Proper change management and control
	Quality Management
	Insufficient Resource planning
	Manageable units of deliverables to provide value
	Project closure activities neglected/downplayed

Source: Industry practitioners

5.4.2.1 Unique Factors – Organisation Category

Only one unique issue was obtained from the practitioners in this category, described as follows.

1. Mismatch of Organisational objectives and Agile principles

The organisational objectives is seen to be misaligned with the agile principles, and this could be accorded to “*poor business vision*” (P01, Agile Coach) as one of the main reasons. The business objectives are either not amended to reflect the agile vision, or the agile method is implemented without consulting the organisational objectives, goals, mission, and vision.

5.4.2.2 Unique Factors – People Category

Under the people category, the participants highlighted three prominent issues and challenges impacting their respective organisations and the projects they are working in, as per the following.

1. Adopting the agile mindset

Having an “*agile mindset*” (P27, PM), is important when organisations practice APM. Due to the “*lack of understanding on (the) agile approach*” (P06, PM) by the stakeholders, or having a “*misunderstanding of what Agile is*” (P44, PM), the organisation may be imposed with a prominent handicap, causing projects to be mis-managed, thus reducing the project success rate. Some managers appear to be adamant on their own ways of management, and find it very difficult to adapt to new ways of working with the agile method. “*Agile management can be difficult with the wrong manager; they need to let go.*” P32, PM.

Often, the staff of an organisation are not consulted prior to the implementation of a new method or system within the organisation, which impacts the way they work. It is important to get “*buy in from staff*” (P33, Project Director), as they are considered very important stakeholders of an organisation, and projects.

2. Lack of knowledge/understanding of Agile method

It is imperative that the stakeholders who will be utilising the method are knowledgeable in it, and possess a good understanding of its principles. A crucial issue is that the people who are directly involved find it uncomfortable in using the agile method, due to not being familiar with it, resulting in them, either reverting to the more familiar traditional

methods, or causing the organisation to fall back on the previous method used due to resentment by the staff. *“For example, at CPA (Chartered Professional Accountants) Ontario, we initially worked with agile, but backtracked to waterfall, because people weren't used to the methodology.”* P20, PM.

3. Lack of team empowerment

The agile teams do not get the level of empowerment required and as dictated by the agile principles of PMgmt. At times the team leaders, using their organisational rankings, impose an overpowering role, causing the effectiveness of the agile team(s) to diminish. *“We have a team leader who overrides the Scrum Master, making him ineffective, and not allowing team members to collaborate. He directs instead.”* P23, Agile Coach.

5.4.2.3 Unique Factors – Process Category

Within the process category, the participants raised the highest number of issues and challenges, totalling to 14 items, which are discussed in the following context.

1. Mismatch of method - Agile Vs Traditional

Having a mismatch of methods in managing agile and traditional projects appeared to be the most raised concern amongst the participants. The concern was more towards the *“misuse of (the) agile”* (P44, PM) method in managing traditional projects, where organisations are *“applying agile (methods) to efforts (projects) that are better served with other methods (requirements mismatch)”* (P24, Program Manager).

A key factor to keep in mind is that the *“agile method is not applicable to every type of project e.g. infrastructure”* (P19, PM), as the method is *“quite challenging to follow for*

Infrastructure projects” (P40, Program Manager). In general, “agile implementation (is not suitable) in IT infrastructure projects” (P29, Program Manager). It is important to ensure the agile method is not mistakenly turned into a traditional waterfall model. “Avoiding “waterfalling” of the sprint, more like “WAgile”.” P09, Agile Coach.

2. Hybrid method

In a scenario where the *“product delivery is compromised at the expense of sticking to a particular PMgmt methodology” (P19, PM), it would be wise to use a combined (or hybrid) method instead. “Agile methods most likely cannot be used on its own, especially for IT projects. There has to be a balance between agile and its predecessors. A hybrid model is more practical and realistic.” (P41, Project Director).*

When an agile method is used for a project more suited to be managed by a traditional method, the traditional principles interfere with the agile principles, causing the project to be *“mixed with traditional management” (P23, Agile Coach). In cases like this, it would be more suitable to implement a hybrid model instead.*

“Even within agile methods, using solely a single method may not give you the flexibility of achieving project objectives. Managing projects using (a) purely Agile method is very challenging, without the mix of traditional methods. Agile lacks the level of structure, which traditional methods command” (P42, Program Manager) Nevertheless, organisations should practise caution when moving from a traditional method to an agile method as “some rules are not very clear. When you use waterfall methodology and start to apply agile, there are a lot of details you don’t know how to solve or how to use.” (P25, PMgmt Consultant).

3. Proper implementation of Agile method

Implementing agile methods properly appears to be another big concern, as organisations are seen to be rushing into the implementation of agile methods, without first studying its impact on the organisation and its people. It is often misunderstood that agile methods can handle all types of projects. It must be kept in mind that “*Complex Multiple projects Management*” (P40, Program Manager) may not be well suited with a standard method of management. It is also crucial that the organisation performs “*methodology alignment and engagement between all parties*” (P34, PM) prior to implementing the method. “*Agile is great concept, I am all for it. I like its flexibility. But, the implementation of it is bad. Every company wants to do Agile because it’s the in-thing, without providing proper training to the ones who are working on it . We are all doing 'patch work' and hybrid style of agile management.*” (P18, PM)

Organisations need to “*(ensure the proper) use of agile methods*” (P17, Project Director) in the post implementation stage. Organisations are seen to be “*attempting to implement agile all at once. There is a learning curve to changing to an agile method of thinking, as well as PMgmt.*” (P24, Program Manager). The implementation of the agile method is sometimes rushed and done all at once, without considering a possible phased approach.

4. Prioritisation and Scheduling

Due to activity “*backlog*” (P30, Agile Coach) and “*weak prioritisation (on activities and tasks for delivery)*” (P06, PM), the projects fall out of schedule. By either not keeping track of the daily activities, or losing sight of the activities completed against the ones not completed and in-progress, the project “*team compromise(s) with the backlog activities*” (P21, PMgmt Consultant), resulting in schedule overruns. There needs to be an understanding established with the customer on the changes in scope and requirements,

to ensure they consider delays in schedule, and are willing to reprioritise tasks whenever the scope changes. *“Uncontrolled scope creep. Client feels it’s their right to increase scope under the sun without reprioritisation of backlogs”* (P18, PM). It was also highlighted by the participants that when teams are involved in *“multi-tasking, errors in task impacts (the) following activity(s)”* (P22, Project Director). The *“timeline (firm milestone for (the) deliverables)”* (P13, Program Manager) on all activities must be clearly drawn up, and monitored with frequent reprioritisation.

5. Cost management

Managing cost in APs is important; careful attention needs to be given to this area. In a typical project, *“(project) backlogs (and the delays in backlog resolution increases project cost)”* (P13, Program Manager). There should be a separate element added to the *“(project) budget”* (P27, PM) to cater for the cost of additional resources for project delays, due to the increase in scope, change in requirements, and other general project backlogs, including the *“Managing and monitoring (of) cost”* (P16, PM). *“Due to increase of scope, the team works longer hours to complete the backlogs; longer hours requires more compensation (overtime payment, time-off, day-off), these are not covered in the project budget. Again, it becomes the PMs headache (responsibility).”* P18, PM.

6. Project Team role definition not clearly defined and understood

Due to the *“misunderstanding of roles and responsibilities”* (P34, PM) by the project teams, there appears to be a lot of confusion on what needs to be done, when it needs to be done, and who is responsible in performing the tasks. As the agile method imposes a very matured and independent way of working, *“clarifying roles and responsibilities”* (P09, Agile Coach) is very crucial for the smooth and seamless delivery of projects.

7. Improper Vendor Management

When it comes to the involvement vendors in the project, the delivery of the vendors will have to be tracked and monitored closely. There is no proper control over the deliverables by the appointed vendors, as organisations overlook associating or tying-up the deliverables to the corresponding payments to the vendors. *“Backlogs (delays in backlog resolution by vendors). No end game iteration (for vendor).”* P13, Program Manager. There seems to be gaps in the management and control of vendors, in that *“Vendor payment by phases (should be tied to work completion and non-compliance penalties)”* (P43, Agile Coach), which are important elements in ensuring responsible and accountable delivery by the vendors.

8. PM Role not clearly defined and understood

There seems to be unreasonable approaches and demands by organisations on appointing an AP lead (i.e. scrum master), with the expectations of non-agile deliverables, which is a clear mismatch of the PM's role. *“No clear definition of the PM's role when transitioning between waterfall to Agile. During my previous assignments, the PMs were automatically appointed as scrum master(s), and (they) are expected to lead the project during stand-ups, and other tasks. That is already time consuming, but the management and business expect the same level of dedicated PM attention for APs, they do for a waterfall project - detailed planning and reporting . The dual role is an overload for the PM. The PM is now expected to be a; (1) superwoman/man and know the daily tasks and details (scrum master), and (2) also perform delivery as per the conventional PMgmt approach. I learnt later in PMI seminars that both are different roles and should not be confused (or mixed).”* P18, PM.

9. Flexible process to align with project scope

The processes employed sometimes overlaps and interferes with one another, causing unreasonable delays in the delivery of projects. *“Systems and processes has to (be) inline (or aligned), overlapping process for concurrent activity(s) impacts project timeline.”*

P22, Project Director.

10. Proper change management and control

In the context of agile methods, allowing the flexibility of frequently changing scope and requirements, can cause the *“agile development model (to) go on forever”* (P32, PM). Being cautious, as to not allow unreasonable number of changes, and to control the amount of changes to a manageable level is important.

11. Quality Management

In ensuring proper quality management is practised in the organisation, they should be focused on *“delivering value consistently at the end of each iteration, and delivering working software (in the case of software development projects) at the end of each iteration”* (P09, Agile Coach), as failing to manage quality, and delivery on quality, will definitely impact the success factor of the project.

12. Insufficient Resource planning

Organisations tend to under-estimate their staff turnover rate, or sometimes choose to be ignorant about the attrition rates within the industry, country, or field of expertise, downplaying their resource planning activities. *“Resources Leaving”* (P03, PM) the project or the organisation is a problem which cannot be avoided, and organisations must perform the relevant level of resource planning to be in a position to replace resources quickly and effectively when the need arises.

13. Manageable units of deliverables to provide value

“Organisation need quality, not (necessarily) smaller releases, (the focus should be on substantial size of deliverables)” (P43, Agile Coach). While Agile methods focus on smaller units of deliverables, it is not always practical to split units of deliverables into smaller chunks to abide by the agile principles, they need to be kept at an optimal and meaningful size. Reducing the size of the deliverable does not necessarily improve the quality of deliverables.

14. Project closure activities neglected/downplayed

In APs, it is often noted that the project closure activities are either neglected or minimised, in consideration of tight datelines. The *“poor capturing of lesson(s) learnt, especially mistakes and failures”* (P10, PMgmt Consultant) hinders organisations from acquiring learnings from past projects, thus wasting valuable information, which could otherwise be stored as reference materials.

5.4.3 Unique Factors from Literature

Table 5.3 lists the issues and challenges identified in literature, but were not obtained from the practitioners, or discussed by them. It cannot be concluded that these issues and challenges are not faced by the practitioners, but they were not raised as concern areas as they were neither provided in the survey feedback form nor discussed during the many rounds of interviews held with the corresponding practitioners. These issues may have not been considered important, or the practitioners may have simply overlooked discussing them.

Table 5.3: Unique Issues and Challenges (Literature only)

Category	Issues/Challenges identified in Literature, but not reported by Practitioners
Organisation (4)	Executive sponsorship
	Organisational size
	Agile logistical arrangement
	Budget to implement Agile methods
People (6)	Cooperation from groups or individuals (testers)
	Commitment and dedication (Motivation)
	Managers' participation
	PMgmt certification
	Trust and understanding (amongst team members/stakeholders)
	Creativity and problem solving skills
Process (4)	Customer presence
	Customers collaboration (agreement/expertise/ability to dictate requirements)
	Timely reporting
	Complete project visibility
Technical (3)	Complete set of agile practices
	Communication support tools
	Software (tool) supporting Agile methods

Source: Various Literature

As they were not identified by the practitioners as areas of concern, and as they have been described earlier in this study (Section 4.8.2), they will not be discussed in this section.

5.5 Summary

The previous chapter (Chapter 4) identified and reviewed the issues and challenges faced by APs within existing literature through an SLR study, as part of the purpose of this study defined in Chapter 1 (Section 1.4). This chapter had further identified the issues and challenges faced by AP practitioners, within the IT function in various industries, by means of a GT research methodology. The GT research method was described in detail, including the steps, processes, findings, along with the search strategy, screening of the initial resulting studies and the extraction of data from the selected studies.

The findings from both, the SLR (Chapter 4) and GT (this chapter), will be compared, and analysed. The gaps between the issues and challenges of managing APs discussed in literature and the real-life issues faced by the practitioners in the industry are identified. The analysis of the findings will be further discussed in Chapter 6 (Findings and Discussion). These will be used as input towards the formulation of the best practice framework (described in Chapter 7). The evaluation of the of the framework will be described in Chapter 8, to produce an improvised framework, along with the development of a support tool. The improvised framework, along with the support tool, will be validated by an expert review team (described in Chapter 9). The final chapter (Chapter 10) concludes this thesis by responding to the ROs, the contributions of the thesis, derived from the SLR and GT methods, and the overall research contributions, concluding the chapter with the limitations of this research and proposed future work.

CHAPTER 6: FINDINGS AND DISCUSSION

6.1 Overview

The previous chapters addressed the purpose of this study, as defined in Chapter 1 (Section 1.4), to identify the issues and challenges of APs in literature as described in Chapter 4 (SLR), and to further identify the issues and challenges faced by the industry practitioners, described in Chapter 5 (Grounded Theory Research). In this chapter, the findings obtained from both the research methodologies (SLR and GT) employed in this research, will be described, analysed, and discussed.

The RQs specifically designed and related to the SLR are discussed and answered, and the general observations are recorded. The discrepancies and open issues are also discussed. On the GT research, an analysis is conducted on the findings, along with the suggested mitigation methods. The gaps between the findings in literature (SLR) and the findings from the industry practitioners (GT) will be identified, in terms of the issues faced by the industry practitioners which were not discussed in literature, and the issues found in literature which were not raised by the industry practitioners. With the identification of gaps between the SLR and GT findings, the first objective will be fulfilled. Further to that, a part of the second objective will also be fulfilled in this chapter, by identifying the mitigation methods for the identified factors (issues and challenges) from the industry practitioners, for the successful management of IT projects within the agile (and hybrid) environment. The mitigation methods suggested by the practitioners will be compiled and verified with the selected panel of agile practitioners and the existing literature, which will be documented in this chapter. The RQs identified in Chapter 1 (Section 1.6) based on the objectives of this research (Section 1.5) will be explained and answered in Chapter 10.

To conclude the research findings, and to complete the second and third objectives, the formulation of a best practice framework will be described in Chapter 7, with the evaluation of the framework discussed in Chapter 8, to produce an improvised framework, along with the development of a support tool. The fourth objective will be fulfilled with a validation of the framework, described in Chapter 9.

6.2 SLR Findings

As findings for the SLR research method, the specific RQs related to the SLR will first be answered, followed by the discussion on the general observations. After which the open issues and discrepancies in the literature are identified.

6.2.1 Answers to the SLR RQs

Four specific RQs were defined for the SLR, as described in Section 4.4, denoted with SLR-RQ respectively (SLR-RQ1, SLR-RQ2, SLR-RQ3, and SLR-RQ4). This section will attempt to answer the four specific SLR RQs.

As an answer to **SLR-RQ1**, “What are the reported issues and challenges associated to the governance and management of APs?”, a total of 19 issues and challenges were initially identified in managing APs based on the study presented by Chow and Cao (2008), as described Chapter 4.14.1 (Chapter 4), with the summary of these 19 factors listed in Table 4.3 within the same section. On reviewing more literature, a total of 18 additional issues and challenges in managing APs were identified from various other literature (Ambler, 2009; Drury et al., 2012; Ebert and Paasivaara, 2017; Farashah et al., 2019; Guerra, 2010; Hochmüller and Mittermeir, 2008; Joslin and Müller, 2015; Lalsing

et al., 2012; Lee et al., 2006b; Lloyd et al., 2017; McHugh et al., 2012; Nerur et al., 2005; Silvius and Schipper, 2014; Tilk, 2016; Yang et.al., 2016) shown in Table 4.4 (Chapter 4). The original 19 issues and challenges presented by Chow and Cao (2008) were further simplified, as the basic factors for the successful governance of management of APs, which are classified as the original factors. The additional 18 issues and challenges identified from various other literature, which were also simplified as factors, were merged to create a combined list of 37 factors, which have been listed and briefly described in Table 4.5 (Chapter 4).

As an answer to **SLR-RQ2**, “What AP (success) factors are addressed or discussed in literature?”, The 37 issues and challenges addressed in literature were simplified as (success) factors, listed in Table 4.5, which are elaborately discussed in Section 4.8.

As an answer to **SLR-RQ3**, “How frequently are these (success) factors addressed in literature over the last two decades?”, the factors and methods of reviewing the literature were discussed, with the findings summarised in Table 4.6, showing the frequency of each of these factors addressed or discussed in literature, consisting of the 175 selected studies. An analysis on the results was performed against the findings of the literature review, summarised in Figure 6.1. The factor most addressed in the 175 selected studies is “Project Governance” (categorised under the Process area), which was addressed in 116 out of the 175 studies. This indicates that project governance is an important aspect and careful consideration and attention should be given to this factor. This next (second) most addressed factor is “PMgmt Competence” (categorised under the “People” area), which was discussed in 108 studies, followed by “Availability of necessary skillset” as the third most addressed factor, with a count of 99 studies. Both of these factors are from the “People” category. The fourth and fifth most addressed factors both scored 84 counts

each, which are “Understanding of Agile Method Values (and Principles)” , from the “Organisation” category, and “Teamwork” , from the “People” category. On analysing the top five factors referenced in the selected studies, three of them are from the “People” category, indicating importance on people, or the stakeholders of APs, mainly the team members (skillset, teamwork, PMgmt competence). Various studies discuss the crucial role of people in the success of APs as these factors are seen to be critical elements when managing projects in an agile manner.

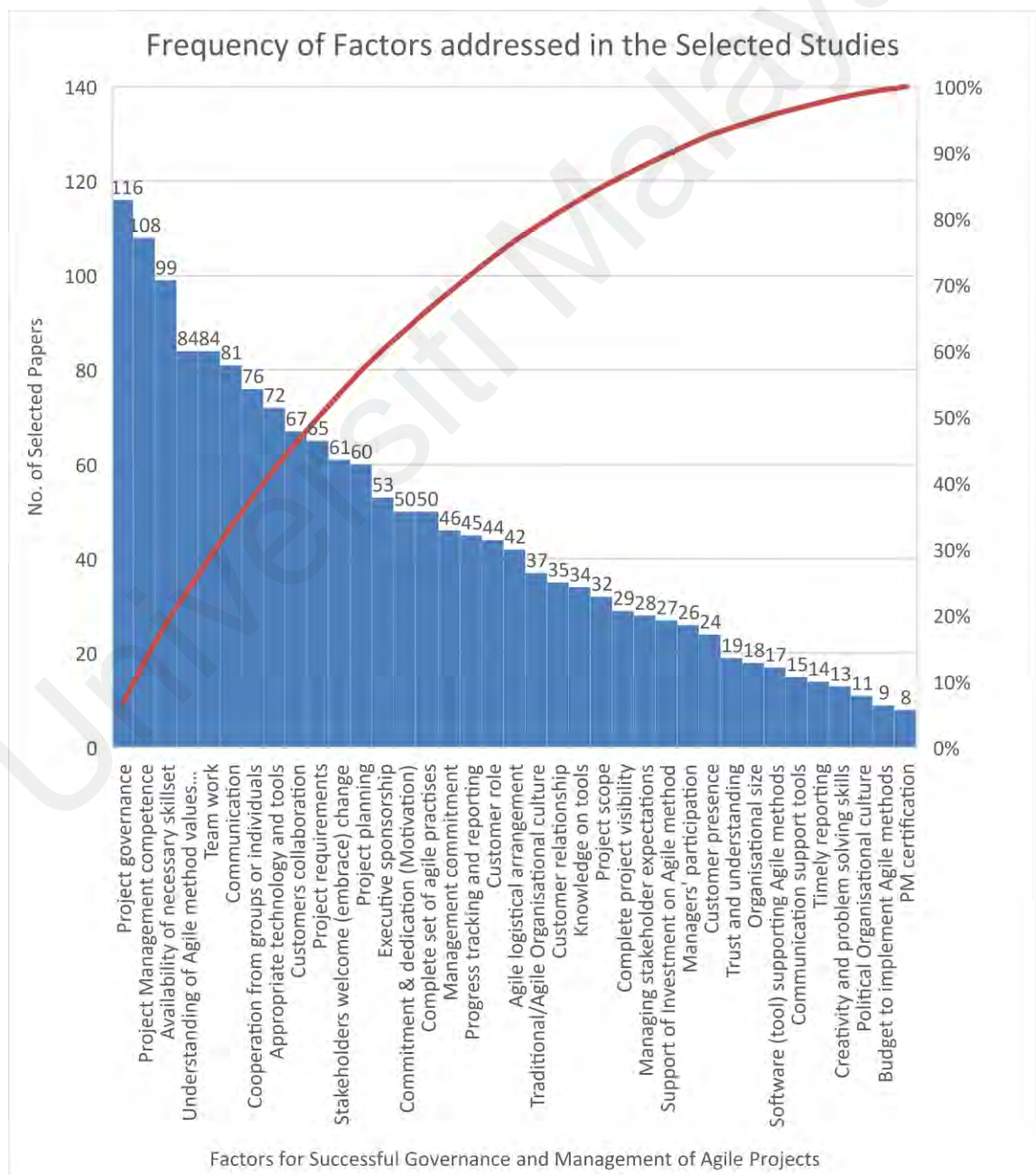


Figure 6.1: Factors for (Successful) Governance and Management of APs

Ranking in the 6th and 7th position with a respective count of 81 and 76 studies are both from the “People” category, which are “Communication (for information sharing/decision making)” and “Cooperation from groups or individuals (testers)”. Although the former (communication) has been regarded as a crucial element in attaining success in APs, as proclaimed in various literature, they were not the mostly addressed, as many authors believe that communication skills, and the ability to strategise the communication protocol, is a given trait for APs. Without frequent communication, APs are at risk of not obtaining the required level of success. For the latter (Cooperation from groups or individuals), it is also seen as an important element in AP success, as the willingness to cooperate is key to a matured manner of PMgmt in the agile environment. For this factor, most studies have addressed the cooperation from testers, viewed as an important stakeholder, to ensure the aggressive way of development and producing smaller chunks of deliverables for the customer is tested as quickly as possible (in the case of software development projects).

Skillset and PMgmt competence has been viewed as highly discussed factors, but on the contrary, “PMgmt certification” from the “People” category scored the lowest (eight studies), indicating the least addressed factor. The researcher concluded that PMs knowledge and experience are very important, which may not necessarily be substantiated with a formal certification. Formal certification may be a mandatory requirement in some organisations, but according to the analysis, it may not guarantee project success. “Budget to implement Agile methods” from the “Organisation” category is positioned as the second least discussed factor (9 studies). The researcher feel that this factor is closely related to two other factors, which are “Executive Sponsorship” and “Support of Investment on Agile Method”. In securing sponsorship and support from the leadership

team, a budget would have probably been allocated upfront, probably contributing to the reason they were not discussed exclusively in literature. The upfront investment in implementing and adopting the methodology may consume minimal cost, pointing to the understanding that agile methods are supposed to reduce cost in the long run.

From the “Technical” area, only one factor, “Appropriate technology and tools”, stands out from the rest, in the 8th position. It is believed that this factor is crucial, as agile development mostly depend on the technology and tools available, for collaborative purposes, and to assist in speeding up the process of development and delivery of the end products, and the ability to keep up with changing trends, as the requirements are expected to evolve in an aggressive manner, as pointed out by most of the selected studies. Ranking in the 9th and 10th position, are “Customer Collaboration (agreement/expertise/ability to dictate requirements)”, discussed in 67 studies, and “Project Requirements”, addressed in 65 studies. Both of these factors are from the “Process” category. These factors are key to ensuring that the “Customers” participate in the process of gathering “Project Requirements”, as requirements are expected to change according to the various demands, caused by changes within the organisation or the environment, market sentiments, user demand, changing needs, scope change, political influence, budgetary conditions, and many other possible causes. Working in close collaboration with the customers ensures that these changes are captured swiftly, and factored into the development process, via changing requirements. The score for the rest of the 30 factors can be seen in Figure 6.1, which can be referenced against Table 4.6.

As an answer to **SLR-RQ4**, “What is the yearly trending of these factors over the last two decades?”, first the number of selected studies within each year, from 2001 to 2019 were counted, and the results of the count against each year were tabulated. The factors

identified from the selected studies within each year of publication were then combined, and the trending of the factors from 2001 to 2019 (the last two decades) were identified. In analysing the findings, the numbers of studies selected from years 2001 to 2007 was low, and only contributed to about 14% of the total selected number of studies. In year 2008, there was a spike in the number of relevant studies, where the agile topic discussions were observed to be gaining traction. The majority of the selected studies were obtained between the publication year of 2014 to 2016 (total of 33% over these three years, or an average of 11% per year), and are considered as the period in which the discussions on APM was very popular and regular. The number of selected studies, and its percentage against the respective years from 2001 to 2019 (up to March) is tabulated in Table 6.1, and further graphically presented in Figure 6.2. An uptrend can be seen from year 2001 onwards, until year 2015, after which the number of selected studies, classified as relevant to the topic of this study, went on a downtrend up to March 2019.

Table 6.1: Number of studies obtained against the year of publication

Year of Publication	No. of Studies (of 175 Studies)	Percentage (of 100%)	Year of Publication	No. of Studies (of 175 Studies)	Percentage (of 100%)
2001	1	0.6	2011	13	7.4
2002	2	1.1	2012	14	8.0
2003	2	1.1	2013	10	5.7
2004	2	1.1	2014	16	9.1
2005	6	3.4	2015	25	14.3
2006	5	2.9	2016	17	9.7
2007	6	3.4	2017	10	5.7
2008	11	6.3	2018	10	5.7
2009	8	4.6	2019 (up to March)	7	4.0
2010	10	5.7			

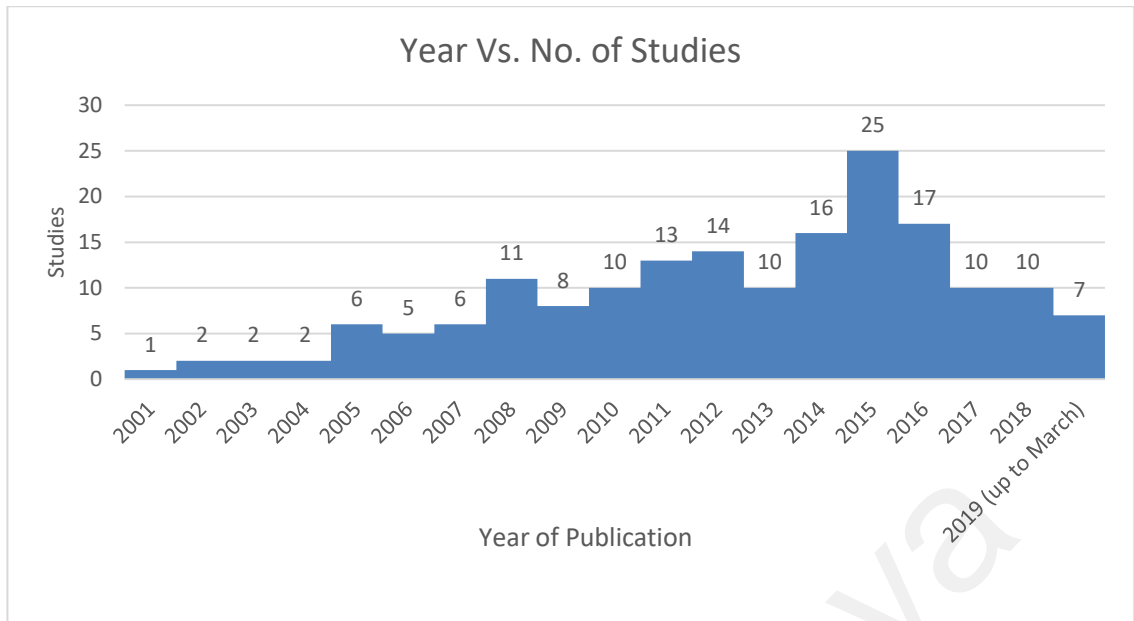


Figure 6.2: Number of studies obtained against the year of publication

A further analysis was done to identify the trending of factors obtained from the selected studies by the published year (Figure 6.3). It was observed that the highest number of factors were identified between years 2008 and 2018 (total of 1,439 counts), with a spike in year 2015 (282 counts). Although this is an interesting find, it could be directly related to the number of selected studies identified during the respective periods.

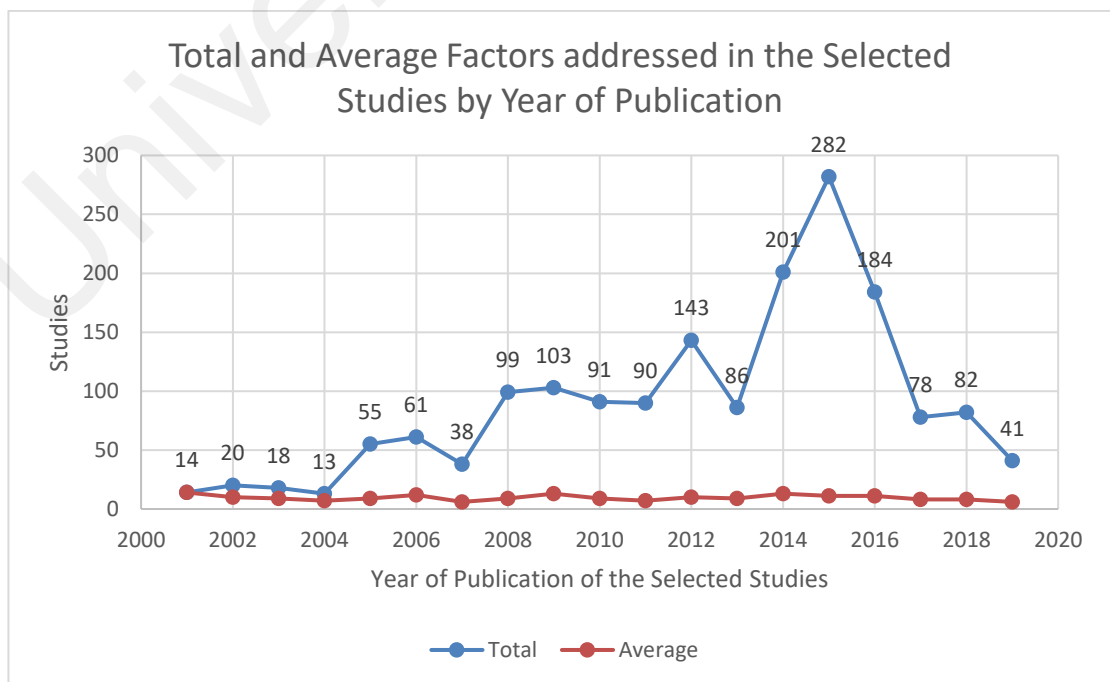


Figure 6.3: Total number of Factors addressed by Year of Publication of the Selected Studies for the Governance and Management of APs

6.2.2 General Observations

The median of the highest score (116) and the lowest score (eight) is calculated as 62, resulting in 10 factors falling under the upper median category, while the remaining 27 factors falling under the lower median category. The researcher chose to discuss only the 10 factors which were classified under the upper median category (Table 6.2).

Table 6.2: Ranking of the top 10 factors mostly addressed/discussed within the 175 selected studies

Rank	Area	Category	AP Governance and Management (Success) Factors	Factor score
1	Process	Pro09	Project governance	116
2	People	Peo02	PMgmt competence	108
3	People	Peo01	Availability of necessary skillset	99
4	Organisation	Org07	Understanding of Agile method values (and Principles)	84
5	People	Peo03	Teamwork	84
6	People	Peo06	Communication (for information sharing/decision making)	81
7	People	Peo04	Cooperation from groups or individuals (testers)	76
8	Technical	Tec02	Appropriate technology and tools	72
9	Process	Pro10	Customers collaboration (agreement/expertise/ability to dictate requirements)	67
10	Process	Pro02	Project requirements	65

The comparison between the number of selected studies and the number of factors discussed in these studies is graphically shown in Figure 6.4. Years 2005, 2006, and 2007 saw a spike in the number of factors discussed, with 201, 282, and 184 factors respectively, even when the number of studies were quite consistent. A consistent increase in both studies and factors were seen between years 2008 and 2013, with the exception of year 2012, which recorded a spike in the number of factors, but not directly proportionate to the increase in the number of selected studies.

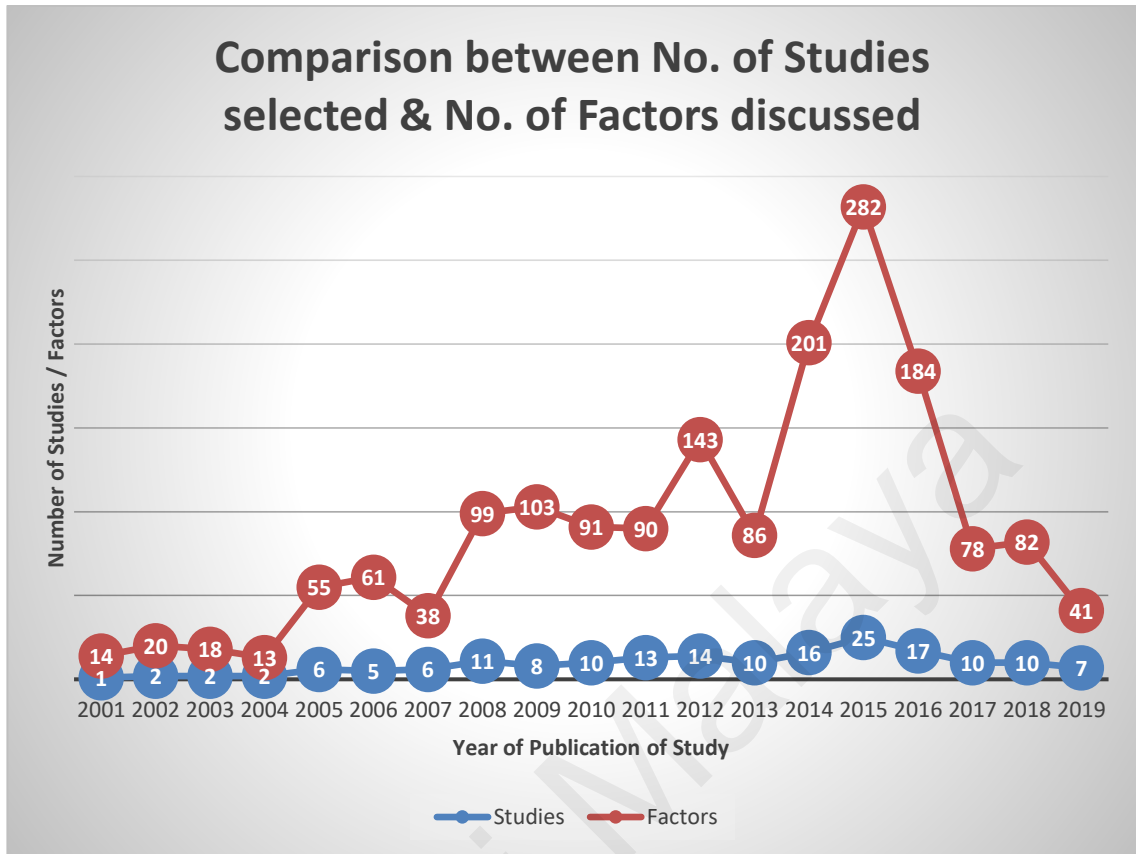


Figure 6.4: Trending Analysis of the number of selected Studies against the number of Factors addressed by Year of Publication of the Selected Studies

The years 2017 and 2018 also saw a similar trend (with years 2008 to 2013) of studies and factors. However, there was a large increase for years 2014, 2015 and 2016, on both the number of selected studies, and the number of factors addressed in the studies. It should be noted that since the definition and publication of the agile manifesto in 2001, the popularity of agile discussions was seen to be increasing gradually year on year, with two notable spikes in years 2012 and 2015. There has been a gradual increase of the usage of agile methods by organisations globally, which could have resulted in the increase in academic writing on this topic. Seen in another angle, the increase in the presence of the agile topic in literature could have also triggered the need for organisations to use the method. There were a few notable spikes in the discussion of factors in literature, in years

2005, 2008, 2012, 2014, and 2015, but this analysis does not really dictate any conclusive reasons for the trend. As of late, there have been many discussions around the outsourcing of the IT and Software Development, with sub-discussions around Offshore development. There has also been a growing trend of distributed systems and environments which have found the agile methods to be contradictory to the logistical ability to completely follow the method. The discussions around hybrid methods (a combination of agile and traditional models) have also picked up as of late, resulting in organisations trying to mix and match the methods (agile and traditional), to arrive at implementing a method with the right balance, while being able to cater to the changing demands of the organisation structure, and the way the industry operates, along the growing geographical boundaries of organisations.

6.2.3 Discrepancies and Open Issues

The researcher had initially identified the 19 issues and challenges in the study by Chow and Cao (2008), simplified them, and classified them as 19 factors, and further combined other factors found in the other studies amongst the remaining 174 studies (Ambler, 2009; Drury et al., 2012; Ebert and Paasivaara, 2017; Farashah et al., 2019; Guerra, 2010; Hochmüller and Mittermeir, 2008; Joslin and Müller, 2015; Lalsing et al., 2012; Lee et al., 2006b; Lloyd et al., 2017; McHugh et al., 2012; Nerur et al., 2005; Silvius and Schipper, 2014; Tilk, 2016; Yang et.al., 2016), to come up with a list of 37 factors. These factors were then used as the basis of identifying whether the factors were discussed or addressed in the 175 selected studies, from which the researcher identified additional factors (in addition to the 37 factors). These factors were not added on, otherwise there would have been too many factors to be mapped against the selected studies. Furthermore, depending on how the factors are analysed, there may also be duplication within the factors, on the basis of how they are analysed. Care was taken as not to keep adding

factors as they were identified in literature, as it would then be necessary to conduct multiple rounds of review, until the attainment of satisfaction and conclusion on the review work, which is not easily achievable in the context of analysing literature. Hence, it was decided to restrict the factors to the 37 factors concluded from the first round of literature review.

6.3 GT Findings

In this section, the findings of the GT research will first be analysed and discussed, followed by an analysis on the mitigation methods suggested by the participants.

6.3.1 Analysis of the Findings

The findings obtained from the participants via the GT method will be analysed from the perspectives of the four categories of: Organisation, People, Process, and Technical. The “Process” area appears to yield the highest number of factors, totalling to 20, followed by the People category with 10 factors, then the Organisation category having six factors, and finally the Technical category with the smallest number, with only two factors addressed as concerns by the participants. The analysis will be done based on the respective categories, in the following context, concentrating only on the issues and challenges raised by the participants, allowing us to analyse the findings from the perspectives of the industry practitioners, as per the basis of this GT research.

Process Category

Firstly, concerns are based on the implementation of the agile method, where organisations rush to jump into the band wagon to implement the agile method without first analysing its fit in the organisation, and not considering the type of projects

undertaken by the organisation, often causing a mismatch of methods between the traditional and agile environments. The demand for the careful consideration of a hybrid method is high, and well sought after by the practitioners. While implementing the correct method, the roles of all stakeholders, especially the PM, customer and the project team members, need to be properly established, and clearly communicated, to avoid a misunderstanding of the individual roles, while preventing conflicts between them.

The processes within the implemented methods are also not clearly defined, lacking flexibility, and the proper management of change, quality, vendor, cost, schedule, and the prioritisation of project tasks. The projects scope and requirements appear misaligned, causing the tasks of change management and change control very difficult to administer. The overall planning activity is seen as insufficient, with a lack of resource planning and insufficient project tracking and reporting. The deliverables are also not properly scaled to produce manageable units of implementation or release, with a lack of learnings captured during the project closure activities, due to time constraints. In general, there is poor project governance within the organisations in which project are managed.

People Category

Within the people category, the participating practitioners raised many concerns, on the ability of the stakeholders in adopting the agile mindset, lacking the knowledge and understanding of agile methods. This contributed to the key stakeholders' inability in managing the expectations of the stakeholders, possibly resulting from incompetence in PMgmt and not possessing the correct and expected skillset, to handle the demands of the agile principles. The core characteristic of an AP is its ability to manage and track changes, which was seen to be a very difficult activity for the stakeholders to handle. This could have been due to their ignorance and unwillingness in accepting changes. The

project team members were seen to be unable to work together harmoniously, and in a seamless manner, not being able to communicate properly, and maintain good relationships with the customers. The core of the problems could be due to not administering proper empowerment to the team members, to independently perform their roles, as dictated by the agile principles. This causes them to be labelled as incapable of delivering successful projects, and to the expectations of the organisation.

Organisation Category

From the perspectives of the organisation, there seems to be a lack in understanding of the agile method and its values and principles by the executives, leaders, and senior management teams in the organisation. Without this understanding, and without the required level of commitment and support, they are not able to support the investments towards the implementation of the agile method. It was highlighted by the participants that, the cause of this issue could be the mismatch between the objectives of the organisation, and the principles of the agile method. In some cases, the organisational culture was not in support of the agile method, due to a conflict between the traditional culture and the agile culture, and also due to the unforeseen or unexpected political agendas within the organisation.

Technical Category

Concerns in the technical area was mainly the unavailability of proper technology and tools, to help the project team members in the management of APs. Even if some tools were readily available within the organisation, there was concerns on not possessing the appropriate knowledge to use them effectively, causing them to lose out on the technological arena.

6.3.2 Proposed Mitigation Methods

The steps to be taken, as suggested by the practitioners, to mitigate the issues and challenges highlighted in the previous sections, is summarised in the following context. There are no significance or preference in the order they are listed, not to be mistaken for the first item to be the most prominent and the last item to be the least prominent.

1. Executives and leaders must first understand the agile concept and be able to map it into the organisational objectives, mission, and vision. The organisational culture must be aligned to support the implementation, while the executives and leaders need to ensure all political agendas are neutralised, so as not to affect the possible implementation of the proposed agile method.
2. A separate and independent team that is both, influential and knowledgeable, can be established to drive the implementation of the agile method. This team should be responsible to ensure the executives and leaders understand the agile values and support its principles, and also ensures the organisation objectives are aligned while the organisational culture complements the implementation.
3. Apply staggered implementation if necessary, stage by stage. The main components, or the backbone concepts can be implemented first, and the rest can be added over time after having the luxury of testing the workability of the method in stages, while avoiding undue risks by doing a full-fledged implementation at one go. This method should be accompanied by validation stages, which determines the level of success of the preceding stage, prior to implementing the next stage.
4. A business case should be created, which captures the complete scope, corresponding requirements, implementation plan, and areas of concern, with all risks identified, along with the appropriate prevention, management or mitigation plans. This should

be done prior to the implementation of the agile method, with agreement from all parties, confirming their commitment and support with a sign-off.

5. After gaining proper understanding on the agile values and principles, the organisation should undertake a study on the projects, to ensure proper fit into the agile way of management. The organisation should also indulge in customising the method according to the types of projects to be managed, within the capabilities of the organisation.
6. A communication plan should be established to ensure continuous engagement is undertaken, before, during, and even after the implementation stage. A proper feedback channel should be established, equipped with a capable team to administer, and respond to all feedback received on a timely manner, with a goal to resolve all disparities.
7. Once a decision is made to implement the selected method (i.e. agile or hybrid), the complete process need to be established, along with the roles and responsibilities of all stakeholders. The organisation need to ensure both the process, and the respective roles and responsibilities are well understood by all stakeholders, including the customer. It is crucial that the customer understands the agile principles, and is prepared to invest the expected level of involvement, as per the demand and expectations of the APs.
8. Identification of the correct resources with the required skillset, or a plan to upskill the existing resources with the necessary skillset, with the establishment of the right set of programs to train the stakeholders, need to be established and carried out prior to and/or in parallel to the implementation process. Critical roles should be assigned to capable people.
9. A continuous learning environment need to be established which fosters the appropriate levels of motivation and coaching, to reflect a culture that sufficiently

empowers and supports the team members. If possible, relevant task forces need to be established and administered, to assist and advise the project stakeholders in every stages of the project, positioned to keep abreast on the technology and tools. The established task force need to possess the required level of expertise, to adopt the right technology, and to implement the right tool(s) , at the appropriate time.

10. Team synergy need to be established and managed to ensure all stakeholders are able to communicate and work together harmoniously, including a good working relationship with the customers.
11. Establish a proper method to track and prioritise projects and its tasks, to prevent overwork, and to maintain a proper work-life balance for all stakeholders, while ensuring the proper compensation package is in place, with the allocation of additional budget to cover cost overruns.
12. Establish backup resources with senior members for all critical roles, and shadow roles with junior members for all other roles, or based on the appropriate configuration, to ensure seamless PMgmt, as a contingency measure to deal with human resource attrition.
13. Focus on small and manageable units of deliverables, which are realistic and achievable, while ensuring scope changes are managed effectively with re-prioritisation of tasks, on any changes in requirements.
14. Maintain a weekly project status update and a risk register, with frequent updates to be made on daily basis, or as frequently as deemed necessary, to capture and reported progress as frequently as required, based on project demands. The risk register must be constantly reviewed to update the status of the risks and to include newly identified risks.
15. Where applicable, establish a product owner role, to take the lead, and own the project budget and schedule, with close liaison with the PM and the key stakeholders.

Conduct daily meetings wherever possible and whenever required, based on project type, size, and its corresponding demands.

16. For projects outsourced or handled by appointed vendors, a proper vendor management process need to be established, which controls the vendors' activities and deliverables, with penalties and staggered payments tied to the corresponding deliverables. The terms and conditions should be agreed upfront and administered continuously, to ensure smooth delivery of the individual units of deliverables, based on the agreed timelines. The payments to vendors should be broken down to smaller units, to enable a better control on the deliverables.
17. Allocate time for project closure activities by including them in the schedule, to capture lessons learned in a centralised database, and to disseminate them to all stakeholders as required. This information will be an organisational asset to ensure learnings are captured, while failures of older projects are not repeated in new projects.

The mitigation methods are summarised as general PMgmt advisory in Table 6.3.

Table 6.3: Proposed mitigation methods

Area	Summary of Proposed Mitigation Methods
Organisational culture with executive and leadership support and business case with stakeholder agreement.	The organisational culture must be aligned to support the implementation, while the executives and leaders need to ensure all political agendas are neutralised so as not to affect the implementation of the proposed agile method. Executives and leaders must first understand the agile concept and be able to map it into the organisational objectives, mission, and vision. A business case should be created to capture the complete scope, corresponding requirements, implementation plan, and areas of concern. All risks should be identified along with the appropriate prevention, management, or mitigation plans prior to the implementation of the agile method. Agreement should be sought from all parties, confirming their commitment and support with a sign-off.
Independent and experienced agile team with staged implementation.	A separate and independent team that is both influential and knowledgeable can be established to drive the implementation of the agile method. This team should be responsible to ensure the executives and leaders understand the agile values and support its principles. This team also ensures the organisational objectives are aligned, while the organisational culture complements the implementation of the agile methods. Staggered implementation on a stage by stage basis should be implemented. The main components, or the backbone concepts can be implemented first. The rest can be added over time after having the luxury of testing the workability of the method in stages. Organisations should avoid the risk of doing a full-blown, one-time implementation. This method should be accompanied by validation stages to determine the level of success of the preceding stage, prior to implementing the next stage.

Source: Industry practitioners

Table 6.3, continued

Area	Summary of Proposed Mitigation Methods
Customised fit-for-purpose method and established process understood by all stakeholders.	After gaining proper understanding on the agile values and principles, the organisation should undertake to study the projects. This is to ensure they will fit into the agile way of management. The organisation should indulge in customising the method according to the types of projects to be executed and the capabilities of the organisation. Once a decision is made to implement the selected method (such as agile or hybrid), the complete process need to be established, along with the roles and responsibilities of all stakeholders. The organisation need to ensure both the process and the respective roles and responsibilities are well understood by all stakeholders, including the customer. It is crucial that the customer understands the agile principles and is prepared to invest the expected level of involvement in the projects as per the demand and expectations of the hybrid or APs.
Harmonious teamwork, continuous engagement, and communication, with proper project closure activities.	Team synergy need to be established and managed to ensure all stakeholders are able to communicate and work together harmoniously. This includes a good working relationship with the customers. A communication plan should be established to ensure continuous engagement is undertaken before, during and even after the implementation stage. A proper feedback channel and a capable team should administer and respond to all feedback received on a timely manner, with a goal to resolve all disparities. The sufficient amount of time should be allocated for project closure activities, by including them in the project schedule. The lessons learned should be captured in a centralised database and disseminated to all stakeholders as required. This information will be an organisational asset to ensure learnings are captured and failures of older projects are not repeated.
Human Resource planning, skillset development and continuous learning environment.	The organisation should identify the appropriate resources with the necessary skillset, or upskill the existing resources with the required skillset accordingly. The right set of programs need to be established to train the stakeholders prior to and/or in parallel to the implementation process. Critical roles should be allocated to capable people. A continuous learning environment need to be established, fostering the appropriate levels of motivation and coaching. This should be done to reflect a culture that sufficiently empowers and supports the team members. The organisation should establish the relevant task forces to assist and advice the project stakeholders in every stages of the project lifecycle. The respective task forces should keep abreast on technology and tools and possess the expertise to adopt the right technology and implement the right tool at the right time.
Project tracking and prioritisation with project status update and risk management.	A proper method to track and prioritise projects along with its tasks should be established to prevent overwork and to maintain a proper work-life balance for all stakeholders. The proper compensation package with additional budget allocation (as buffers) should be in place to cover cost overruns. A weekly project status update and a risk register should be maintained. Frequent updates are to be made on daily basis or as frequently as deemed necessary so that the progress is captured and reported as frequently as required based on project demands. The risk register must be constantly visited to update the status of the risks, to include newly identified risks, and to remove risks which are no longer applicable.
Manageable units of deliverables with a proper vendor management process.	The focus should be on small and manageable units of deliverables, which are realistic and achievable. Organisations should ensure that the scope changes are managed effectively with re-prioritisation of tasks on any changes in requirements. For projects outsourced or handled by appointed vendors, a proper vendor management process need to be established. This process is expected to control the vendors with penalties tied to non-performance and staggered payments tie to deliverables. The terms should be agreed to upfront and administered continuously to ensure the smooth delivery of the individual units of deliverables based on the agreed timelines. The payments to vendors should be broken down to smaller units for a better control on the deliverables.
Establish product ownership role with sufficient mirroring and backup for critical roles.	Where applicable, a product owner role should be established. This person should take the lead and own the project budget and schedule, with close liaison with the PM and the key stakeholders. Daily meetings should be conducted wherever possible and whenever required, based on the project type and its corresponding demands. The organisation should establish backup roles with senior members for all critical roles and shadow roles with junior members for all other roles. This is to ensure a seamless PMgmt process is in place as a contingency measure to cater for resource attrition.

Source: Industry practitioners

6.4 Factor Mitigation Methods

The detailed mitigation methods associated to the 55 factors are addressed in the following context, within the categories of Organisation (10 factors), People (16 factors), Process (24 factors), and Technical (5 factors).

Organisation category

1. Org01 (Executive Sponsorship): Obtain executive sponsorship for every project, without which, a project should rightfully not be executed. This is normally done during the project initiation phase, and usually through the means of a project charter, seeking necessary approvals from the project sponsor, and the executive team, or leadership team. The seniority level of the executive will depend on the size and scope of the project, the level of impact against the stakeholders, and the amount of budget it requires. Obtaining sign-off is crucial as it can be used as a fall-back, and evidence of support, in case of challenges (i.e. financial, resourcing, contracting, legislative or regulatory changes) in the future, during the implementation or deployment stages of the project. The method to be used should be agreed to, and supported by the executives. It will be ideal for the executives to sponsor the PMgmt methodology used, to induce a sense of ownership, garnering the required level of support towards the use of the method throughout the organisation. When the senior executive directs the use of the method, usually the entire organisation will strive to follow the process in a dedicated way.
2. Org02 (Management Commitment/Control): The management team should adopt the agile method completely, and committed in adhering to its principles, tapering them down to their respective teams. The leadership team, probably through a task force, should continuously engage the management team to ensure compliance and understanding. They (the leadership team or the appointed task force) should provide

support and act as advisors to the management team, while ensuring the managers are capable of delivering along the agile method and principles.

3. Org03 (Organisational Culture - Traditional Vs Agile): Culture varies from one organisation to another. Implementing agile in a traditional environment will be challenging, hence it needs to be adopted top down, with the leadership team driving its implementation, and the management team supporting the notion.
4. Org04 (Organisational Culture - Political): The organisations may also have a political culture, affecting the way APs are managed and delivered. The agile teams should be allowed to independently deliver on their tasks, without exerting undue control over them. The AP team should be isolated from any political agenda of the organisation, and the management team should not be reluctant to allow self-management of the project teams.
5. Org05 (Organisation Size): The size of the organisation and the size of the project teams will have a direct impact on the success of the project. Agile normally works in smaller teams and smaller organisations, advertently with less bureaucracy. When implemented in a large organisation or within large project teams, it should be closely monitored in terms of team empowerment, non-interference by the management team, non-control by the PM, and many other areas. The most important factor is to allow the team to fulfil their responsibilities without imposing controls over them. All identified issues should be translated into risks, and possibly mitigated or managed properly.
6. Org06 (Agile Logistics arrangements): Project logistics need to be planned at the beginning of the project. Due to the nature of APs, which anticipates changes and requires fast action, all logistics need to be managed efficiently.
7. Org07 (Understanding of Agile method values (& principles)): The project stakeholders should be well versed with the principles of agile methods, while

acquiring a good understanding on the values it is envisaged to bring to the project, and to the organisation in general. The leadership team, through a task force, should ensure this understanding is achieved, by providing support and guidance to all levels of the AP stakeholders, so that the agile method will be understood, adhered to, and followed holistically. There should be a common understanding of the agile values throughout the organisation, and amongst all the project stakeholders. The business challenges of the organisation should be mapped to the values of agile, and communicated clearly to the executives, for buy-in and support. Agile promotes the delivery of project success in a faster pace, but not without the active engagement and participation of a product owner, who is both, an expert in the business needs being resolved, and empowered to make decisions to drive the project.

8. Org08 (Support of Investment on Agile method): Executives should clearly understand the investment needs, prior to anticipating and expecting the hypes of success. The leadership team, through a task force, should ensure this understanding is achieved, and should further provide support and guidance to all levels of the AP stakeholders so that the cost of running an AP is anticipated, and accepted by them. A business case would clearly spell out the benefits and encourage support from the executives.
9. Org09 (Budget to Implement Agile methods): The leadership team and the project sponsor should clearly understand the investment needs of the agile methodology, prior to making decisions to implement the method. The necessary budget should be allocated so that the agile method can be executed within the organisation, with its intended strength and support, avoiding a cashflow situation during the project execution phase. Additional budget should be anticipated for logistical arrangements (i.e. face to face meetings, collocation of team members and customers, tools to support a higher frequency of communication). Leaders must first see the benefits that

the agile method yields, driving agile methods in a manner in which they will be motivated to sponsor willingly and objectively. These should be documented in a business case, and shared with the executives for understanding and support, prior to its execution.

10. Org10 (Business Vision): There should be a clear business vision, supporting the scope of the project, and the changing nature of APs. These should be documented in the business case. If the organisational vision supports the implementation of an agile method, to support its core and/or business objectives, it will be easier to implement the agile methodology.

People category

11. Peo01 (Availability of Skillset): The PM and the project team managers should first be trained in, or should at least be familiar with the Agile method of PMgmt. All the other required and crucial skillset need to be evaluated prior to recruiting the project team.
12. Peo02 (PMgmt Competence): It is an expectation for the project team members, especially the PM, to possess PMgmt skills, with an expected level of competency in the crucial areas of PMgmt (i.e. planning, scheduling, budgeting, cost tracking, reporting, and other PMgmt competencies). The team should be able to adapt to cross functional skills. The competency gap should be identified at the beginning (prior to the start of the project), with the establishment of a training needs analysis (TNA) and training needs identification (TNI) process, carried out as deemed necessary. Motivation and coaching need to be appropriately arranged, as required.
13. Peo03 (Teamwork): The ability of the entire project team to work together is crucial towards the success of the project and its deliverables. There must be a good level of integration amongst the project stakeholders, with a good level of understanding

established with the customers/clients. Synergy, collaboration, alignment, and cooperation is expected amongst the project team members. The emotional intelligence level, of the team members, need to be assessed for alignment, while identifying and managing the diversity of egos amongst them. Establish clear roles and communicate clearly to all stakeholders, with multiple and enhanced communication channels. Training, education, coaching and mentoring should apply where required, with possible team-building related sessions held, to garner a better working relationship amongst the stakeholders, especially the project team members.

14. Peo04 (Cooperation from groups or individuals (testers)): The cooperation from the individual stakeholders are expected, especially the testers, in support of the activities executed in the project, towards the achievement of project success.
15. Peo05 (Customer relationship): There should be a good relationship established with the 'customers' of the project, who are important stakeholders. Customers may consist of some of the main stakeholders (i.e. budget holder, approvers, clients, project sponsor). Having a good relationship will foster better support for the project, especially during the execution of crucial project activities (i.e. budget re-allocation, approval processes, critical path traversal, resource variance and backfilling, cost and schedule overruns, scope changes, testing and acceptance).
16. Peo06 (Communication): Communication is an important activity in APs, and the project team need to be well attained in the skills of communication, including the utilisation of communication tools (i.e. email, messaging, daily meetings, weekly reporting, periodic updates to the leadership team, and other modes of communication).
17. Peo07 (Commitment and Dedication): APs will demand a higher level of dedication, due to the nature of the projects, which are executed using the agile method.

18. Peo08 (Managing Stakeholder expectations): The expectations of the stakeholders need to be managed carefully, having sufficient engagement with all levels of the stakeholders. There should be constant communication with the stakeholders, especially the key stakeholders who are capable of influencing the project, both positively and negatively. A reasonable amount of time and effort need to be allocated, in identifying the project attributes that work for the organisation, to determine a best-fit methodology. For APs, there should be a dedicated stakeholder (i.e. product owner) to ensure agile success. The methodology used need to be validated, with proper communication and training programs conducted at the early stages, to ensure all relevant stakeholders become familiar with the methodology.
19. Peo09 (Embrace Change): All project stakeholders should be attuned to having a change mindset, with the ability to anticipate, accept and deal with frequent changes, with minimum, or no resistance. People should not be afraid of change, and the expectations need to be set at the beginning of the project. Foster the necessary coaching and motivation elements, and perhaps an additional element of compensation, tied to the stakeholders' ability to accept and handle changes.
20. Peo10 (Managers' participation): The absolute participation of departmental and functional managers are important, at all stages of an AP, to garner project success. Hence, it is important that the agile method and its expectations are well understood by them (managers). Ensure the managers are trained in agile methods, driving it top down from the leadership team. The agile method should be supported by the leadership team. It will be most ideal if the leaders sponsor the implementation of agile methods in the organisation, as managers at all levels will be committed to understand, accept, and manage them without much issues.
21. Peo11 (PMgmt certification): It is indeed ideal for the PMs, and possibly the project team members, to possess a formal certification in PMgmt (i.e. Prince2, CAPM, PMP,

PgMP, PfMP, PMI-ACP, CSM). However, it is not an absolute necessity to possess a formal qualification, as skill and experience will matter most in the industry. It is regarded as a good-to-have element in the academic arena, creating more job matches as organisations use it to screen prospective employees, in cases where the competition is steep. However, the requirements for PMgmt certification has become a norm in the current, highly competitive, and volatile environment.

22. Peo12 (Trust and Understanding): As APs require a very close working relationship between the various stakeholders, especially between the project team members, trusting and understanding each other will enable a better working relationship between them.
23. Peo13 (Creativity and Problem solving skills): Due to the nature of APs which requires the team members to be able to solve problems quickly and produce relevant solutions, the team members, or the key and relevant stakeholders, at the least, should be creative and possess problem solving skills.
24. Peo14 (Agile Mindset): The organisational culture need to adapt the agile way of thinking, and foster its principles top down.
25. Peo15 (Understanding of Agile Method): The stakeholders need the proper understanding on the agile methods, prior to proceeding with the utilisation of the method, to manage and administer projects. There should be an acceptable level of confidence by the stakeholders, especially by the project team members, before moving into the agile way of PMgmt. The demands and expectations should be well scrutinised, and accepted by the key stakeholders. Situations of backtracking to traditional methods, due to the lack of understanding on agile methods, should be avoided. It involves enabling an infrastructure, acquiring senior management team support, and aligning the organisational culture to foster APM.

26. Peo16 (Team Empowerment): The team should be empowered to perform their respective tasks, without any undue interference from their superiors. In the scrum method, the scrum master may not necessarily be the PM or project lead, and should be given the empowerment to lead and direct the project. In this example, the team leaders should understand the agile concept clearly and not interfere with the scrum master unnecessarily. Leadership team support is necessary, in ensuring the agile principles are adhered to, at all times.

Process category

27. Pro01 (Project Scope): Scope is captured at the initial stage of the project and is used as input, in formulating the requirements. Scope change is inevitable in an agile environment, necessitating the project stakeholders, especially the project team members, to adopt the flexibility to accept and embrace changes in scope at various stages of the project. However, scope creep need to be controlled, as there is a tendency for the customers to feel that an AP should accept changes consistently. Due consideration need to be accorded to the schedule and cost of the project, with possibilities of variations in the demand for project resources. Upfront engagement with the customer is required, to set and balance the expectations of scope creep, against increasing costs and timelines. It is important that the scope definition be established, and the initial scope clearly documented, with subsequent changes documented, in alignment with the schedule and cost, to be agreed by the customer. Checkpoints can be created at different stages of the project, describing the impact of scope change at different stages.

28. Pro02 (Project Requirements): The requirements need to be carefully derived from the project scope, to ensure it meets all angles of the customers' requirements, and well documented to be able to track changes properly and completely. All changes

need to be tied to the associated impact on the project, documented and presented to the customer for agreement. Scope creep is a very important element in the risk register, which should be given high importance, and handled with utmost care.

29. Pro03 (Project Planning): Planning involves all areas of the project, and should be affected against all knowledge areas (integration, scope, schedule, cost, quality, resource, communication, risk, procurement, and stakeholder) The respective areas should be carefully planned against the scope and requirements, as well as the anticipated changing requirements.
30. Pro04 (Progress tracking and reporting): Maintenance of a proper and complete project schedule, incorporating all project elements, with the necessary buffer, is required from the beginning through completion of the project. The schedule should be communicated to all relevant stakeholders, and their understanding need to be secured, to ensure their expectations are controlled. The specific requirements demanded by the agile method (i.e. sprints for the Scrum method) need to be incorporated into the schedule, allocating time for daily meetings, communication sessions, anticipated scope creep and changing requirements. The project team need to be briefed, coached, and guided on the traits of maintaining and controlling a proper project schedule. The project lead should track all schedule changes against its impact on resources, investment decisions and variances on expenditure.
31. Pro05 (Customer Presence): In an AP, customer presence throughout the development stages of the project is crucial, especially during the testing phases. It is important to establish this expectation, and ensure the customers are committed in participating in crucial activities in the project, which demands their presence. Secure customer agreement on their anticipated commitment upfront, and ensure they allocate the necessary and required time in their schedule, for these activities.

32. Pro06 (Customer Role): The roles and responsibilities of the customer need to be identified and clearly documented. The customer need to understand his or her role, and carry out his or her responsibilities accordingly. Any vague role or responsibility need to be carefully scrutinised and clarified, with the expectations clearly spelled out and agreed by all relevant parties.
33. Pro07 (Timely Reporting): Reporting in an AP environment should be more frequent, less formal, brief, and concise. Alarms and disparities should be raised at the soonest possible time, to the attention of the key stakeholders, for a quick turnaround of decisions.
34. Pro08 (Complete Project Visibility): The key stakeholders must have complete visibility with consistent updates on the project, via frequent and multiple communication methods, so that all parties will be kept abreast with the current project status at all times. All deviations to the plan must be reported at the soonest possible, with the necessary mediation in place.
35. Pro09 (Project Governance): It is crucial to ensure proper project governance is adhered to at the planning stage itself, and throughout the project, while progressing the project.
36. Pro10 (Customer Collaboration): The customer or client should be well understood, their role well defined and the relationship should be well maintained. Due to the requirements of customer collaboration in APs, frequent and constant communication with the customer is expected, for the success of APs.
37. Pro11 (Proper Implementation of Agile Method): Whichever agile method chosen (i.e. Scrum, Kanban, XP, FDD, ASD, LSD, and Crystal Methodology), or a hybrid method incorporating traditional methods (i.e. waterfall, PMBOK), need to be implemented properly, and followed systematically.

38. Pro12 (Cost Management): The cost of the project need to be consistently tracked against the allocated budget. There are high chances that the changes in project scope will attract additional cost, which should have been budgeted for.
39. Pro13 (Process Flexibility): The processes contained and dictated by the selected methodology should be flexible enough (to be managed easily, and in a flexible manner) to allow changes in the various areas (scope, requirements, cost, schedule, resourcing, and procurement).
40. Pro14 (Hybrid Method): For projects that doesn't really work well, in either a complete conventional or agile environment, a customised hybrid method would be well suited. Once implemented, the correct processes dictated in the customised hybrid method need to be followed on all aspects of the projects (integration, scope, schedule, cost, quality, resourcing, communication, risk, procurement, and stakeholder management).
41. Pro15 (Method Match - Agile Vs Traditional): The projects should be evaluated based on the type, their size, scope, and other parameters, to determine the most appropriate method to be implemented. The selected method could either be a pure conventional method or an agile method, or a sensible combination of both to produce a customised hybrid method, which should be aligned with the respective areas of the project.
42. Pro16 (Clearly Defined PM Role): The role of the PM should be clearly defined. The necessary training and coaching need to be rendered to the PM to equip them with the correct understanding, along with the assistance of a dedicated support group (i.e. PMO, agile or hybrid implementation team, agile or hybrid task force).
43. Pro17 (Prioritisation and Scheduling): The project activities need to be broken down to manageable components of tasks, which should be monitored for progress status towards completion, reprioritising as per the prevailing project, business, industry, and organisational demands.

44. Pro18 (Project Closure Activities): Project closure activities may include capturing lessons learnt, identifying the mistakes suffered by the project, along with suggestive improved methods, generally capturing what can be done better through the experience gained, while documenting them to make them available as reference material for future projects.
45. Pro19 (Project Team Role Definition): The role of project team members should be clearly defined, especially in APs. The necessary training and coaching need to be rendered to the project team members, to equip them with the correct understanding, along with the assistance of a dedicated support group (i.e. PMO, coach, agile or hybrid implementation team, agile or hybrid task force).
46. Pro20 (Proper Change Management and Control): As APs are expected to change frequently, a proper set of controls need to be in place to track changes against the cost, timelines, resourcing needs, quality of deliverables, and other components. This needs to be included as an element of risk, and managed accordingly, and carefully.
47. Pro21 (Quality Management): The management of quality of the project, in terms of delivering against the scope and requirements, on time and budget, and producing the expected deliverables, to be monitored closely throughout the project.
48. Pro22 (Resource Planning): The planning of resources is a crucial activity, to identify all required resources for the project. The planning for resources would include the type of resources (i.e. people, material, equipment, tools, software, application, and other resources), when and for how long they will be required, and when they can be disbanded. Resource planning will also be included in the budget planning and scheduling exercise, based on the scope and requirements of the project.
49. Pro23 (Manageable Units of Deliverables): The deliverables must be of the right size, which should be measurable. The unit of deliverables need to be managed effectively and efficiently within all areas of the project.

50. Pro24 (Vendor Management): The vendors and contractors need to be aligned, and managed properly, according to the established method and principles dictated by the implemented methodology, with payments tied to the deliverables, and incorporating the necessary penalty clauses, to prevent losses to the project, while ensuring a greater level of project success.

Technical category

51. Tec01 (Complete set of Agile Practices): The appropriate and complete set of agile practices should be followed, as dictated by the selected methodology. In the case of a hybrid method, the employed agile principles should be used accordingly.

52. Tec02 (Appropriate Technology and Tools): Employing the use of appropriate technology and tools will enable better capabilities of managing a project, especially an AP, or its hybrid counterpart.

53. Tec03 (Knowledge on Tools (& Technology)): The project stakeholders, especially the PM and the team members, should be kept abreast with new tools in the market and the emerging technology in the industry.

54. Tec04 (Communication Support Tools): The appropriate tools should be obtained and used to support communication, especially within the administration of APs, due to the natural need of frequent and constant communication. The project plan and budget should make provisions for these tools due to the critical role of communication. Some tools are even available without cost, as provided in the social media (email, conferencing, and messaging portals), but may impose a risk on privacy and security. For high profile and confidential projects, it is best to secure the explicit use of tools, with a valid license, for its utilisation. These are normally organised and provided at the organisational level.

55. Tec05 (Software supporting Agile methods): Due to the nature of APs, which are fast phased and change oriented, software support will likely enhance the administration and management of APs.

The identified suggestive mitigation methods by the industry practitioners will definitely assist PMgmt professionals in the governance and management of APs. It will provide them with a synopsis of the kind of issues and challenges they will be faced with, giving them the choice of either avoiding them upfront, or mitigating them as they surface. The practitioners will also be able to prepare in advance to handle the possible issues and challenges which would otherwise be unforeseen and introduce surprises.

6.5 Summary

The purpose of this study, as defined in Chapter 1 (Section 1.4), has been partially addressed in the previous chapters. The issues and challenges of APs discussed in literature (Chapter 4) and identified within the industry practitioners (Chapter 5), have been described. This chapter presented a comprehensive discussion on the findings, identifying the gaps between the findings in literature (SLR) and the findings from the industry practitioners (GT), fulfilling the first objective of this study. A part of the second objective was also fulfilled with the identification of the mitigation methods for the identified factors for the successful management of IT projects within the agile, and hybrid environments. The mitigation suggested by the practitioners were compiled and verified with the selected panel of agile practitioners, via the Delphi method, and documented.

The specific RQs related to the SLR study identified in Section 4.4 (Chapter 4), based on the first objective of this research (section 1.5), was explained and answered. As a conclusion on the research findings, and to complete the second objective, the formulation of the framework will be described in Chapter 7, with the evaluation of the framework described in Chapter 8. The third and fourth objectives will be fulfilled, with the validation the framework by an expert review team, to produce an improvised framework, along with the support tool, as described in Chapter 9. The final chapter (Chapter 10) concludes this thesis by responding to the ROs, answering the RQs, describing the contributions of the thesis, the limitations of this research and proposed future work.

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CHAPTER 7: FORMULATION OF THE FRAMEWORK (HAT-PMFv1.0)

7.1 Overview

As one part of the purpose of this study, defined in Chapter 1 (Section 1.4) was to identify the issues and challenges of APs discussed in literature, an SLR was conducted as described in Chapter 4. As the other part of the purpose of the study, to obtain and compile the issues and challenges in ITPM from the industry practitioners, a GT research was carried out as described in Chapter 5. The findings from both of these research methods have been described and analysed in Chapter 6, along with the suggestive mitigation methods compiled from, and verified with the practitioners.

This chapter presents the formulation of the proposed framework, carefully examining the prominent agile methods discussed in Chapter 2 (Literature Review), considering a possible hybrid model, by incorporating some features of the popular traditional methods, tied with the features of popular agile methods. By presenting this model, this chapter intends to fulfil the second objective proposed in Chapter 1 (section 1.5) of identifying mitigation methods from the industry practitioners, and verifying them with a selected panel of agile practitioners, to develop them into an agile best practice framework, which can be used as a guideline for the successful management of IT projects. The produced framework will be assessed by an expert review team, subscribing proven assessment methods, to produce an improvised framework in the following chapter (Chapter 8).

7.2 Consideration of Methodologies

Based on the results obtained from the participants of the GT study (Chapter 6), they are seen to be involved in both Traditional and Agile methods simultaneously. During the

various discussions held with the participants, it was learned that the project stakeholders are usually involved in more than one project simultaneously at any one point in time, and the projects are not all managed using an agile method. There are scenarios where the same PM manages multiple projects in a combined project environment.

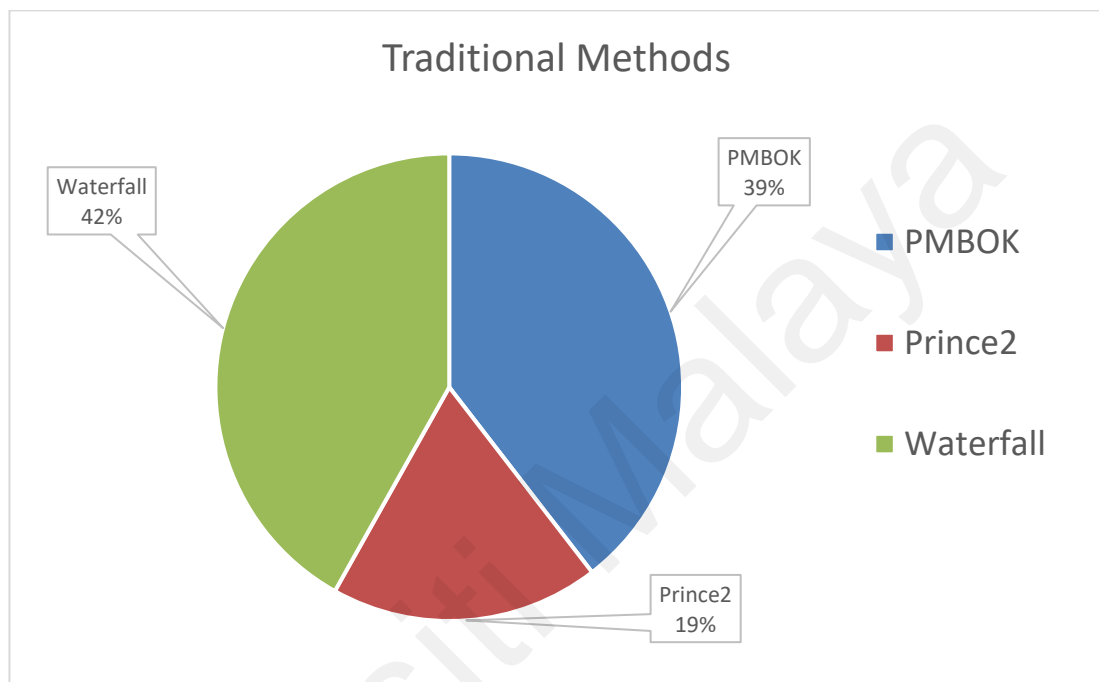


Figure 7.1: Popularity of Traditional Method used by practitioners (GT participants)

As described in Figure 7.1, it appears that 42% of the population are involved in the Waterfall model, while 39% of them are involved in the PMBOK process, which is viewed by the practitioners as a traditional method, even when it is considered a standard by a wide audience. Although the PMBOK is regarded as a standard for PMgmt, the project phases of initiating, planning, executing, monitoring, and closing is very much skewed towards a traditional method of managing projects. As discussed during the multiple rounds of interviews and meetings with the participants, they appear very comfortable with both these methods, as such, the basis of the framework will be on a

combination of the Waterfall model, consulting the PMBOK as advisory, in instilling standards within the framework.

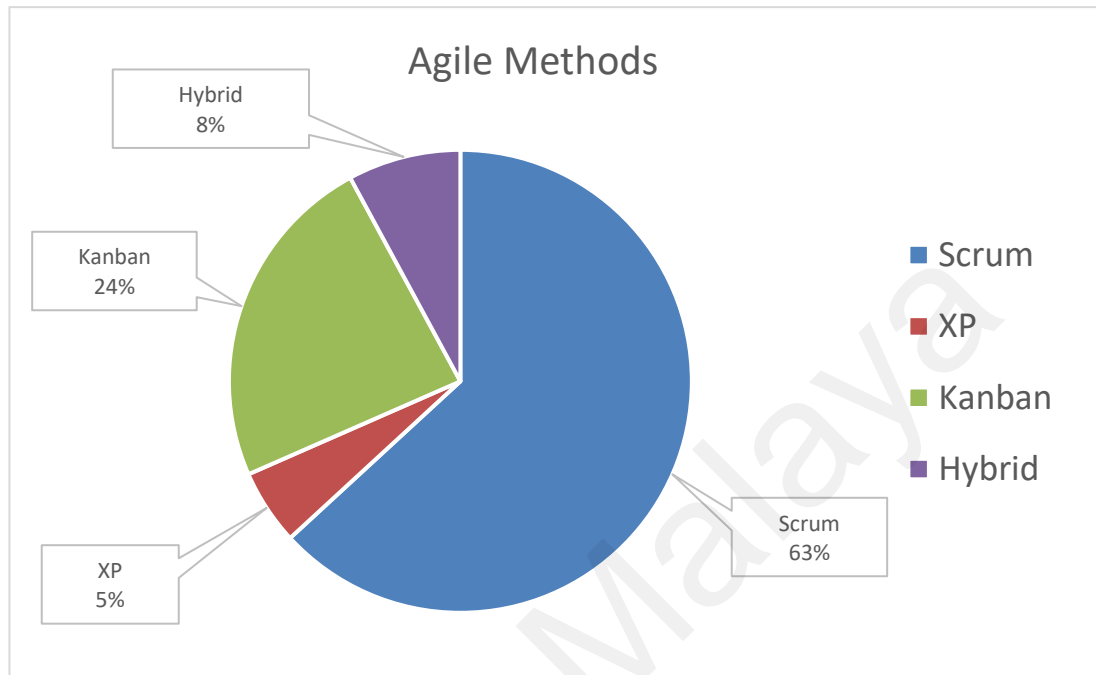


Figure 7.2: Popularity of Agile Methods used by practitioners (GT participants)

As shown in Figure 7.2, Scrum appears to be the most utilised method, having 63% of the population who participated in the GT study utilising this method. Kanban appears to be the second most popular method used by 24% of the population. With this level of popularity of both Scrum and Kanban within the community of practitioners who participated in the GT research, the framework will incorporate these two methods, on specific Agile advisory. Papadakis and Tsironis (2018), ranked Scrum as the most widely used agile method (72%), followed by XP (65%), DSDM, Lean, Hybrid, and Crystal. Most of the practitioners who participated in the GT study were users of the Scrum and Kanban method, hence the XP method was downplayed in the design and development of the framework. As the hybrid method was positioned at accepting fluidity and regarded as a more nimble approach to ITPM (Papadakis and Tsironis, 2018), the overall framework will position itself as a Hybrid model, giving the prospective users the liberty

to choose the method they intend to use, based on the project type and the methods they respectively demands.

7.3 Foundation of Framework

The developed framework is based on the two most popular agile methods (Scrum and Kanban) and the two most popular traditional methods (Waterfall and PMBOK). The developed framework is 4-dimensional, of which the first dimension contains the four methods as mentioned above. The second dimension represents the specific knowledge areas of the PMBOK, the third dimension segregates the four categories of the factors, derived from the 37 issues and challenges identified via the GT study (chapter 6), and the fourth dimension charts the 55 consolidated factors against the previous three dimensions.

The four methods (Scrum, Kanban, Waterfall and PMBOK) have been discussed sufficiently in Chapter 2 (Literature Review), and a summary is described in the following context, which will be used to form the first dimension of the framework.

The Scrum method and process (Schwaber and Sutherland, 2011) is summarised into the following areas, contributing to the first dimension of the framework, contained in the first row, as follows:

1. Sprint planning meeting:
 - a. Product Owner solicits input from End-users, Customers, Team and other Stakeholders
 - b. Product Backlog review
 - c. Sprint backlog update
2. Daily Sprint meeting:

- a. Review changes
 - b. Perform changes (if/where required)
 - c. Issue incremental updates
 - d. Deliver incremental product
3. Retrospective:
- a. Review delivered products
 - b. Refine product backlog
 - c. Update Sprint backlog

The Kanban method (Anderson, 2010) is summarised as follows, which also forms the first dimension of the framework, appearing on the second row, as follows:

- 1. Pool of Ideas (to be developed into a project):
 - a. Prepare Features (composed of all ideas)
 - b. Select Features (based on a subset of the prepared features)
- 2. Track Requirements/Task/Incidents (items):
 - a. Backlog (all pending requirements, tasks in hand, or incidents to fix)
 - b. Planned (items already planned)
 - c. In-Progress (items currently in “work-in-progress” state)
 - d. Developed (items already developed)
 - e. Tested (items developed and tested)
 - f. Completed (items completed, after a successful testing event)

As a popular traditional PMgmt method, the waterfall model, developed by Winston W. Royce in 1970 (Van Casteren, 2017), is summarised as follows, which forms the subsequent row within the first dimension of the framework, appearing on the third row, as follows:

1. Requirements Analysis Stage
2. Implementation or Build Stage
3. Testing Stage
4. Deployment Stage
5. Maintenance Stage

The Process Groups within the PMBOK (PMI Standard, 2017) method is summarised as follows, which forms the final row within the first dimension of the framework, appearing on the fourth row, as follows:

1. Initiating
2. Planning
3. Executing
4. Monitoring
5. Closing

The Knowledge Areas of the PMBOK (PMI Standard, 2017) method is summarised as follows, which forms the second dimension of the framework, appearing on the first (left-most) column, as follows:

1. Project Integration Management
2. Project Scope Management
3. Project Schedule Management
4. Project Cost Management
5. Project Quality Management
6. Project Resource Management
7. Project Communications Management
8. Project Risk Management

9. Project Procurement Management

10. Project Stakeholder Management

The third dimension of the framework is represented by the four categories of the identified issues and challenges, shown as factors within the framework, appearing on the last (right-most) column, as follows:

1. Organisation (abbreviated as “Org”)
2. People (abbreviated as “Peo”)
3. Process (abbreviated as “Pro”)
4. Technical (abbreviated as “Tec”)

The fourth and final dimension are the 55 consolidated factors which are mapped against the previous three dimensions according to relevance and applicability. The 55 factors (combination of Appendix Z and Appendix AC), classified within the respective categories as per the abbreviations (Org, Peo, Pro and Tec) have been tabulated into the framework as discussed and agreed with the expert review team of agile practitioners. The factors have been tabulated in all applicable knowledge areas, with a high likelihood of the same factor appearing multiple times within the framework. For example, Pro18 (Project Closure Activities) appears in every knowledge area, as the closure activities will involve every knowledge area of the project, so there will be 10 instances of the factor within the framework. The full version of the framework is shown in Appendix AD (HAT-PMFv1.0). A simplified version for easy reference, with factor code only (description of factors removed), is shown as a summary in Appendix AE. The 55 factors appear in all applicable cells in the framework, and are seen as duplicates within the various columns (phases/stages of the project) as it shows that these factors need to be considered throughout the highlighted phases/stages of the project. The mitigation

methods for each of the 55 factors contained in the framework are shown in Appendix AE, as a point of reference. In summary, when a project traverses through the framework as it progresses, the factors need to be noted, and referenced accordingly in the mitigation plan to achieve project success.

7.4 Formulation of the Framework

For the purpose of discussions, the framework has been be segregated into the 10 respective PMBOK Knowledge Areas, and elaborated in the following sub-sections, in addition to the general mitigation methods, for the 55 factors, described in Chapter 6 (Section 6.3.3).

7.4.1 Project Integration Management Factors

A total of 12 factors have been mapped into the Integration Management area, out of which, nine factors are within the Process category and three factors are within the Technical category, as shown in Table 7.1.

Table 7.1: Factors tabulated against the “Integration Management” Knowledge area

Agile	Scrum	Sprint Planning meeting (Product Owner): 1) Stakeholder Input 2) Product Backlog review 3) Sprint backlog update	Daily Sprint meeting (Scrum Master): 1) Review changes 2) Perform changes (if/where required) 3) Issue incremental updates 4) Deliver incremental product				Retrospective: 1) Review delivered products 2) Refine product backlog 3) Update Sprint backlog		Factor Category
	Kanban	Pool of Ideas --> Prepare and Select Features	Track Requirements/ Task/Incidents: Backlog, Planned, In-Progress, Developed, Tested, Completed.						
Traditional	Waterfall	Lifecycle Phases							
		Requirements Analysis	Implementation	Testing	Deployment	Maintenance			
PMBOK	PMBOK	Process Groups							
		Initiating	Planning	Executing			Monitoring	Closing	
PMBOK® Knowledge Area: Project Integration Management			Pro03						Process
			Pro09						
			Pro11						
			Pro13						
			Pro14						
			Pro15						
			Pro23					Pro18	
			Pro24						
Technical			Tec01						
			Tec02						
			Tec05						

The description and suggested mitigation methods are as follows:

1. Pro03 (Project Planning): The integration of the project needs to be planned properly for all areas of the project (i.e. scope, schedule, cost, quality, resource, communication, risk, procurement, and stakeholder), as much as possible at the early stages of the project. Identify corresponding risks for all the areas which applies to avoid surprises at later stages of the project. Involve the relevant project stakeholders (i.e. budget holder, product owner, PM, project team, and other persons who has an interest in, or benefits, from the project). Identify and interact with SMEs and keep the product owner abreast of the crucial elements of the project.
2. Pro09 (Project Governance): Governance should be adhered to at every stage of integration of the project.
3. Pro11 (Proper Implementation of Agile Method): The integration of project elements should adhere to the implemented method and agreed processes.

4. Pro13 (Process Flexibility): There should be flexibility in performing project integration work (combining elements of project deliverables as they are produced, completed, tested, and implemented in stages).
5. Pro14 (Hybrid Method): In the case of the implementation of a hybrid method, the agreed process and principles should be followed through on all project integration efforts.
6. Pro15 (Method Match - Agile Vs Traditional): The implemented method should be aligned with the project integration requirements.
7. Pro18 (Project Closure Activities): As per the project integration activities, the necessary time and resources need to be anticipated, allocated, and budgeted for, at the beginning of the project.
8. Pro23 (Manageable Units of Deliverables): The unit of deliverables need to be managed effectively and efficiently within all areas of the integration activities of the project.
9. Pro24 (Vendor Management): During the crucial stages of project integration, the vendors and contractors need to be aligned, and managed properly, according to the established method and principles dictated by the implemented methodology.
10. Tec01 (Complete set of Agile Practices): The implemented agile practices need to be closely followed during every stage of project integration to attain a maximum level of project success.
11. Tec02 (Appropriate Technology and Tools): Appropriate tools will help in the integration of the various components of the project deliverables, in enabling the process to be more effective and efficient.
12. Tec05 (Software supporting Agile methods): The appropriate software should be made available to support the integration of project deliverables.

7.4.2 Project Scope Management Factors

A total of 17 factors have been mapped into the Scope Management area, with one factor each within the Organisation and People categories, and with 12 and three factors respectively within the Process and Technical categories, as shown in Table 7.2.

Table 7.2: Factors tabulated against the “Scope Management” Knowledge area

Agile	Scrum	Sprint Planning meeting (Product Owner): 1) Stakeholder Input 2) Product Backlog review 3) Sprint backlog update	Daily Sprint meeting (Scrum Master): 1) Review changes 2) Perform changes (if/where required) 3) Issue incremental updates 4) Deliver incremental product				Retrospective: 1) Review delivered products 2) Refine product backlog 3) Update Sprint backlog		Factor Category
	Kanban	Pool of Ideas --> Prepare and Select Features	Track Requirements/ Task/Incidents: Backlog, Planned, In-Progress, Developed, Tested, Completed.						
Traditional	Waterfall	Lifecycle Phases							
		Requirements Analysis	Implementation	Testing	Deployment	Maintenance			
PMBOK	PMBOK	Process Groups							
		Initiating	Planning	Executing			Monitoring	Closing	
PMBOK® Knowledge Area: Project Scope Management	Org10							Organisation	
			Peo09					People	
			Pro01					Process	
			Pro02						
			Pro03						
				Pro08					
			Pro09						
			Pro11						
				Pro13					
				Pro14					
				Pro15					
							Pro18		
				Pro20					
				Pro23					
			Tec01					Technical	
				Tec02					
				Tec05					

The description and suggested mitigation methods are as follows:

1. Org10 (Business Vision): The method to be implemented and the scope of the project should be closely aligned with the organisational vision. This alignment should be ascertained at the project initiation phase.
2. Peo09 (Embrace Change): The project team should be open to new ideas, concepts, tools, and technology. They should be open to accepting manageable change, having

the ability to align the project accordingly (i.e. schedule, budget, scope, and requirements). There should be cultural alignment and an open mindset to embrace change enthusiastically. As the agile method facilitates frequent change, the team need to be cultivated on the characteristics of APs, invoking their willingness to accept change without resentment. All relevant stakeholders involved in managing scope change should have a similar understanding, and should have hand in hand to agree on scope changes, and align the requirements and project deliverables accordingly.

3. Pro01 (Project Scope): Typically, there will be minimum impact on scope change during the initiation and planning stages, and to the contrary, a maximum impact during the testing and implementation stages. The customer or client need to be educated on the repercussions and consequences of scope changes, most likely impacting the project cost and schedule. All scope changes should be documented clearly, with sign-off from the customers or clients agreeing to the impact it may cause the project. The agile team can be flexible to determine and accept minor changes which doesn't have an adverse impact on the team's performance, budget, resources, and milestone of the project. Scope changes should be tied to a contractual agreement and managed very carefully.
4. Pro02 (Project Requirements): The requirements should be captured at the beginning stage of the project, with a sign-off. An agreement should be made, on the manner in which, requirements changes will be handled, which will impact other elements of the project (i.e. cost, timelines).
5. Pro03 (Project Planning): Capture the project scope, and plan the elements carefully, leading towards the creation of accurate requirements. Resources need to be planned based on the scope of the project. Prepare for scope-change situations and include them as a risk item in the risk register, tracking it frequently to ensure all other

elements associated to scope changes are captured (i.e. scope, requirements, budget, and schedule). Involve the product owner, especially on owning the budget and schedule, being responsible for budget and schedule overruns, whenever the project scope changes.

6. Pro08 (Complete Project Visibility): Complete project visibility is required during the implementation (development) stage of the project, making it easier to manage the scope, along with and any subsequent scope changes. Any changes to the scope must be reported immediately, to the relevant stakeholders.
7. Pro09 (Project Governance): Project scoping is done at the beginning of the project, and scope changes need to be tracked throughout its lifecycle, in accordance with the methodology used, to manage and administer the project.
8. Pro11 (Proper Implementation of Agile Method): The initial project scope, and subsequent changes should be administered according to the processes dictated by the implemented methodology.
9. Pro13 (Process Flexibility): There should be to allow scope changes to be managed easily, and in a flexible manner.
10. Pro14 (Hybrid Method): In the case of the implementation of a hybrid method, the agreed processes and principles need to be followed, on capturing scope changes, tracking them against cost, resource, and schedule changes.
11. Pro15 (Method Match - Agile Vs Traditional): The implemented method should be aligned with the project scoping and re-scoping (for scope change) requirements.
12. Pro18 (Project Closure Activities): Lessons learnt, in managing and tracking the changing scope, should be captured, and documented.
13. Pro20 (Proper Change Management and Control): A proper set of controls need to be in place to track changes to the project scope and requirements.

14. Pro23 (Manageable Units of Deliverables): The project deliverables need to be broken down into manageable units from the scope of the project, progressing into the requirements of the project, turning them into manageable units of work, entailing manageable and measurable tasks and activities.
15. Tec01 (Complete set of Agile Practices): The implemented agile practices need to be closely followed when capturing the initial project scope, and throughout the project, especially when there are scope changes in subsequent phases of the project.
16. Tec02 (Appropriate Technology and Tools): Appropriate tools may help in the task of managing scope creep and the changing requirements more effectively and efficiently.
17. Tec05 (Software supporting Agile methods): The appropriate software should be made available to support the changing nature of the scope and requirements.

7.4.3 Project Schedule Management Factors

14 factors were mapped into the Schedule Management area, with 11 factors within the Process category, and three factors within the Technical category, as shown in Table 7.3.

5. Pro09 (Project Governance): Project timelines need to be tracked as frequently as required, by the method used, more often for APs, and reported on a timely basis to the various stakeholders.
6. Pro11 (Proper Implementation of Agile Method): The baseline schedule, and all changes to the schedule, due to scope or other changes, should be administered according to the processes dictated by the implemented methodology, along with the suggested tools.
7. Pro13 (Process Flexibility): There should be flexibility to allow a project schedule which can be altered easily, with appropriate buffers, to be able to adjust the timelines, while still being focused on the quality of the deliverables, and the cost of the project.
8. Pro14 (Hybrid Method): In the case of the implementation of a hybrid method, the agreed processes and principles need to be followed on capturing changes on the timelines, and tracking them against the scope, cost, and resource deviations.
9. Pro15 (Method Match - Agile Vs Traditional): The implemented method should be aligned with the project scheduling requirements.
10. Pro17 (Prioritisation and Scheduling): The conventional approach of a work breakdown structure (WBS), or similar approaches, can be used to break down bigger tasks into smaller chunks. Each task need to be prioritised and charted against the project schedule.
11. Pro18 (Project Closure Activities): Lessons learnt, in managing and tracking the schedule, along with the shortcomings, should be captured, and documented.
12. Tec01 (Complete set of Agile Practices): The implemented agile practices need to be closely followed during the initial setup of the project schedule, and when making schedule changes in subsequent phases of the project.
13. Tec02 (Appropriate Technology and Tools): A proper scheduling tool will help track schedule changes. Performing a critical path analysis in an automated manner (using

a tool) will automatically align the schedule according to the critical path(s), providing capabilities on performing independent tasks in parallel and sequential tasks in the most effective order, and maintaining the schedule in real time. Different types of reports can also be generated automatically and timely, for different stakeholders, as deemed necessary.

14. Tec05 (Software supporting Agile methods): The appropriate software should be made available to support variations in the project schedule, to track changes automatically.

7.4.4 Project Cost Management Factors

A total of 13 factors were mapped into the Cost Management area, with one factor within the Organisation category, nine factors within the Process category, and three factors within the Technical category, as illustrated in Table 7.4.

Table 7.4: Factors tabulated against the “Cost Management” Knowledge area

Agile	Scrum	Sprint Planning meeting (Product Owner): 1) Stakeholder Input 2) Product Backlog review 3) Sprint backlog update		Daily Sprint meeting (Scrum Master): 1) Review changes 2) Perform changes (if/where required) 3) Issue incremental updates 4) Deliver incremental product		Retrospective: 1) Review delivered products 2) Refine product backlog 3) Update Sprint backlog		Factor Category	
	Kanban	Pool of Ideas --> Prepare and Select Features		Track Requirements/ Task/Incidents: Backlog, Planned, In-Progress, Developed, Tested, Completed.					
Traditional	Waterfall	Lifecycle Phases							Factor Category
		Requirements Analysis	Implementation	Testing	Deployment	Maintenance			
PMBOK		Process Groups							Factor Category
		Initiating	Planning	Executing			Monitoring	Closing	
PMBOK® Knowledge Area: Project Cost Management		Org06							Organisation
			Pro03						Process
				Pro08					
				Pro09					
				Pro11					
			Pro12						
				Pro13					
				Pro14					
				Pro15					
								Pro18	
				Tec01					Technical
					Tec02				
				Tec05					

The description and suggested mitigation methods are as follows:

1. Org06 (Agile Logistics arrangements): As it is a given that APs will go through more change than a traditionally managed project, expecting to attract additional expenses in the arrangements of logistics for the projects, the necessary costs should be included in the project budgetary process. It should also include additional costs, which needs to be borne by the project, for the requirements of a faster logistics turnaround time. Sudden and temporary arrangements may need to be made, to acquire logistical items, which may attract a higher cost.
2. Pro03 (Project Planning): Identify all project cost elements and include them in the project budget. Incorporate the necessary buffer for cost overruns, especially on the acceptance or mitigation of risk elements (i.e. policy changes, legislative changes, business direction, varying customer demands). Include 'cost overrun' as a risk item and track it closely, involving the product owner, so that he/she will be aware of the consequences of scope changes during the project execution stage. Reflect all cost changes in the budget, and keep the management and product owner abreast at the very instance there is a change in budget (especially when there is an increase, while decreases should also be reported). Involve the product owner on critical budgetary changes.
3. Pro08 (Complete Project Visibility): Changes to the project parameters, scope, or deliverables may attract additional costs, which need to be tracked, and key stakeholders updated as regularly as required.
4. Pro09 (Project Governance): Project cost need to be tracked diligently, with budgetary changes monitored closely, at all stages of the project.

5. Pro11 (Proper Implementation of Agile Method): The cost should be closely monitored as per the organisational standards, combined with the specific processes, commanded by the implemented methodology.
6. Pro12 (Cost Management): Costing and expenditure (project spend) reports should be generated and shared with the key stakeholders, especially the project sponsor.
7. Pro13 (Process Flexibility): There should be flexibility to allow the project budget to be altered, based on prevailing and changing project costs, triggered by changes in scope and project deliverables.
8. Pro14 (Hybrid Method): In the case of the implementation of a hybrid method, the agreed processes and principles need to be followed, on capturing changes to the cost of the project against the allocated budget, and tracking it against the scope, resource, and schedule changes.
9. Pro15 (Method Match - Agile Vs Traditional): The implemented method should be aligned with the project costing and budgetary requirements.
10. Pro18 (Project Closure Activities): Lessons learnt, in managing and tracking the cost, and the corresponding changes in the budget, should be captured, and documented.
11. Tec01 (Complete set of Agile Practices): The implemented agile practices need to be closely followed, from the initial budget preparation, until the end of the project, particularly at every instance of a change in project costing, due to scope or resource changes.
12. Tec02 (Appropriate Technology and Tools): The proper financial management tools may assist in aligning the planned budget with the actual cost, while providing hints on all cost elements in terms of its spending capacity, cost savings opportunity, and the options for scrutinising the cost according to organisational and project requirements.

13. Tec05 (Software supporting Agile methods): The appropriate software should be made available to support variations in the project cost, and the alignment of cost against the planned budget.

7.4.5 Project Quality Management Factors

Within the Quality Management area, the mapping was done for 12 factors, with nine factors within the Process category, and three factors within the Technical category, as depicted in Table 7.5.

Table 7.5: Factors tabulated against the “Quality Management” Knowledge area

Agile	Scrum	Sprint Planning meeting (Product Owner): 1) Stakeholder Input 2) Product Backlog review 3) Sprint backlog update	Daily Sprint meeting (Scrum Master): 1) Review changes 2) Perform changes (if/where required) 3) Issue incremental updates 4) Deliver incremental product				Retrospective: 1) Review delivered products 2) Refine product backlog 3) Update Sprint backlog		Factor Category
	Kanban	Pool of Ideas --> Prepare and Select Features	Track Requirements/ Task/Incidents: Backlog, Planned, In-Progress, Developed, Tested, Completed.						
Traditional	Waterfall	Lifecycle Phases							
	PMBOK	Process Groups							
		Requirements Analysis	Implementation	Testing	Deployment	Maintenance			
		Initiating	Planning	Executing			Monitoring	Closing	
PMBOK® Knowledge Area: Project Quality Management			Pro03						Process
			Pro09						
			Pro11						
				Pro13					
				Pro14					
				Pro15					
								Pro18	
				Pro21					
				Pro23					Technical
				Tec01					
			Tec02						
			Tec05						

The description and suggested mitigation methods are as follows:

1. Pro03 (Project Planning): The quality of the project will be impacted by all other elements of the project, especially in delivering the outcome and deliverables of the project as per the expectations of the key stakeholders, especially the customers.

Ensure the product owner and customers are aware of the importance of the delivery of project outcomes, on acceptable quality, tied to the scope, cost and schedule.

2. Pro09 (Project Governance): Project quality can be maintained with proper governance.
3. Pro11 (Proper Implementation of Agile Method): The proper implementation of the method will determine the quality of the project and its deliverables.
4. Pro13 (Process Flexibility): There should be flexibility to allow changes in scope, schedule, and cost, while being able to maintain an acceptable level of quality.
5. Pro14 (Hybrid Method): In the case of the implementation of a hybrid method, the agreed processes and principles need to be followed, on delivering the projects, on the expected quality, and tracking them against the scope, cost, resource, and schedule changes.
6. Pro15 (Method Match - Agile Vs Traditional): The implemented method should be aligned with the expected quality of the project deliverables.
7. Pro18 (Project Closure Activities): Lessons learnt, in producing the expected quality of the deliverables, should be captured, and documented.
8. Pro21 (Quality Management): Quality management is an on-going activity which needs to be carried out throughout the project, from the initiation phase, through the closing phase.
9. Pro23 (Manageable Units of Deliverables): The unit of deliverables need to be managed effectively and efficiently, not affecting the quality of the deliverables, in terms of timely delivery, within budget, as per the scope and requirements, and as expected by the customers/clients.
10. Tec01 (Complete set of Agile Practices): The implemented agile practices need to be closely followed to maintain the quality of deliverables, dictated as, on schedule,

within the allocated budget, as per the scope and requirements, and with user/client/customer acceptance.

11. Tec02 (Appropriate Technology and Tools): The proper tools may help in maintaining the quality of project deliverables, by enabling the processes to be executed in an effective and efficient manner.
12. Tec05 (Software supporting Agile methods): The appropriate software should be made available to support variations in scope, requirements, resources, cost, timelines, and other elements of the project, that are likely to affect the quality of the project.

7.4.6 Project Resource Management Factors

A total of 24 factors were mapped into the Resource Management area, with one factor within the Organisation category, nine factors within the People category, 10 factors within the Process category, and four factors within the Technical category, as described in Table 7.6.

Table 7.6: Factors tabulated against the “Resource Management” Knowledge area

Agile	Scrum	Sprint Planning meeting (Product Owner): 1) Stakeholder Input 2) Product Backlog review 3) Sprint backlog update	Daily Sprint meeting (Scrum Master): 1) Review changes 2) Perform changes (if/where required) 3) Issue incremental updates 4) Deliver incremental product			Retrospective: 1) Review delivered products 2) Refine product backlog 3) Update Sprint backlog	Factor Category
	Kanban	Pool of Ideas --> Prepare and Select Features	Track Requirements/ Task/Incidents: Backlog, Planned, In-Progress, Developed, Tested, Completed.				
Traditional	Waterfall	Lifecycle Phases					
		Requirements Analysis	Implementation	Testing	Deployment	Maintenance	
PMBOK	PMBOK	Process Groups					
		Initiating	Planning	Executing		Monitoring	Closing
PMBOK® Knowledge Area: Project Resource Management	Org06						Organisation
	Peo01						People
	Peo02						
	Peo03						
	Peo07						
	Peo11						
	Peo12						
	Peo13						
	Peo14						
	Pro03						Process
	Pro09						
	Pro11						
	Pro13						
	Pro14						
	Pro15						
	Pro16						
	Pro19						
	Pro22						Technical
	Tec01						
	Tec02						
Tec03							
Tec05							

The description and suggested mitigation methods are as follows:

1. Org06 (Agile Logistics arrangements): APs require an efficient logistical management process. When acquiring project resources for APs, the task should anticipate the changing needs of the scope of the projects, allowing the flexibility of changes in resource types, and the duration in which they are required, by the respective projects.

2. Peo01 (Availability of Skillset): The required skillsets should be made available throughout the duration of the project, to be made available especially during the planning and execution stages.
3. Peo02 (PMgmt Competence): The project team members (including the PM) should be competent in their respective roles, while performing the relevant PMgmt tasks.
4. Peo03 (Teamwork): A continuous effort need to be in place to ensure the team works in complete harmony during the execution phase.
5. Peo06 (Communication): The resources need to be trained in communication, and they need to know when to communicate, the amount of information to communicate at various stages of the project, and who to communicate with.
6. Peo07 (Commitment and Dedication): The resources recruited into the project teams need to be of high calibre, with high levels of commitment and dedication to the project, to effectively carry out the tasks demanded by the project.
7. Peo11 (PMgmt certification): This should be affirmed during the planning stages, prior to recruiting members into the project. Acquiring PMgmt certification may be time-consuming, and should be a pre-requisite for recruitment.
8. Peo12 (Trust and Understanding): This is usually a part of the organisational culture, and most likely embedded into the characteristics of the individual contributors. This trait is an important element during the execution of the project.
9. Peo13 (Creativity and Problem solving skills): The recruitment of team members should include this requirement. Training programs can help bridge any gap.
10. Peo14 (Agile Mindset): The team members should be properly trained, in the agile principles and its expectations. People who are used to managing projects, using traditional methods, need to be willing to “let-go”, willing to adopt the agile culture. A continuous learning environment and the required awareness sessions need to be

made available, with coaching and mentoring on the agile principles, facilitated by a dedicated support team.

11. Pro03 (Project Planning): Resource planning is a very crucial element of a project, especially on resource identification and allocation, based on the availability of the necessary budget, for payments towards expected regular project work and unexpected additional work anticipated (i.e. overtime, recruiting additional resources, replacing resources on absence or medical situations). Prepare for situations of varying requirements, increase in scope, and changes to policies which affects the project requirements, or any other situations demanding for additional budget in managing resources.
12. Pro09 (Project Governance): Project resources (i.e. people, equipment, machinery, tools, application, software, and other resources) will inherently change, due to the changing nature of APs, which needs to be anticipated (with experience), planned as much ahead as possible, closely monitored, especially for APs, that will impact the project timelines and budget.
13. Pro11 (Proper Implementation of Agile Method): The hiring or acquiring, and management of resources should follow the processes dictated by the implemented methodology.
14. Pro13 (Process Flexibility): There should be flexibility to allow changes in resources (i.e. to be managed easily, and in a flexible manner).
15. Pro14 (Hybrid Method): In the case of the implementation of a hybrid method, the agreed processes and principles need to be followed, on managing the resources, while tracking it against the scope, cost, and schedule changes.
16. Pro15 (Method Match - Agile Vs Traditional): The implemented method should be aligned with the project resourcing requirements.

17. Pro16 (Clearly Defined PM Role): The PM role should be clearly aligned with the methodology used, the environment in which the project is executed, and the culture of the organisation.
18. Pro18 (Project Closure Activities): Lessons learnt, in managing and tracking the resources, including the recruitment, training, performance, compensation, and tardiness (if any) elements, should be captured, and documented.
19. Pro19 (Project Team Role Definition): The Project team roles should be clearly aligned with the methodology used, the environment in which the project is executed, and the culture of the organisation.
20. Pro22 (Resource Planning): The planning of resources is administered during the planning phase. As the recruitment process can be tedious and time consuming, it should be in the project initiation phase, or even earlier, when the projects are envisaged by the organisation.
21. Tec01 (Complete set of Agile Practices): The implemented agile practices need to be closely followed for all resourcing needs, and when there are changing needs of resources during the project execution phase.
22. Tec02 (Appropriate Technology and Tools): Appropriate tools will help in managing resources effectively and efficiently, enabling the integration of resource management efforts with scope, schedule, and cost management. Any changes in resourcing needs, due to changing requirements, can be quickly analysed, and acted upon by the project team.
23. Tec03 (Knowledge on Tools (& Technology)): The appropriate training on tools, and exposure on technology, should be provided to the relevant project stakeholders, with continuous learning opportunities on new and improvised tools, and knowledge on the latest emerging technology. Support on tools should be provided throughout all phases of the project, preferably administered by the PMO or a dedicated team.

24. Tec05 (Software supporting Agile methods): The appropriate software should be made available to support the administration and scheduling of resources.

7.4.7 Project Communication Management Factors

Within the Communication Management area, the mapping was done for 15 factors, with one, two, eight and four factors each, within the Organisation, People, Process, and Technical categories respectively, as shown in Table 7.7.

Table 7.7: Factors tabulated against the “Communication Management” Knowledge area

Agile	Scrum	Sprint Planning meeting (Product Owner): 1) Stakeholder Input 2) Product Backlog review 3) Sprint backlog update	Daily Sprint meeting (Scrum Master): 1) Review changes 2) Perform changes (if/where required) 3) Issue incremental updates 4) Deliver incremental product				Retrospective: 1) Review delivered products 2) Refine product backlog 3) Update Sprint backlog		Factor Category
	Kanban	Pool of Ideas --> Prepare and Select Features	Track Requirements/ Task/Incidents: Backlog, Planned, In-Progress, Developed, Tested, Completed.						
Traditional	Waterfall	Lifecycle Phases							PMBOK® Knowledge Area: Project Communication Management
		Requirements Analysis	Implementation	Testing	Deployment	Maintenance			
PMBOK	Process Groups								
	Initiating	Planning	Executing			Monitoring	Closing		
	Org10							Organisation	
			Peo05					People	
			Peo06						
		Pro03						Process	
			Pro08						
		Pro09							
		Pro11							
			Pro13						
			Pro14						
			Pro15						
							Pro18		
		Tec01						Technical	
			Tec02						
			Tec04						
			Tec05						

The description and suggested mitigation methods are as follows:

1. Org10 (Business Vision): The business vision, envisaged to support the changing nature of APs, should be documented clearly in a business case. The business case

should be well communicated to the executives of the organisation, tapered down appropriately to all levels of management and their respective teams.

2. Peo05 (Customer relationship): Fostering a good relationship with the stakeholders via a good communication protocol, planned at the early stages of the project. The communication should be managed well, at all levels of the project. Each project phase will demand different levels and frequency of communication, with varying details. High level summaries at the start of the project, with detailed technical information during the design stage, and overall summary during the closing stage, are some examples of varying details and density of the information, to be communicated to the stakeholders, at different stages of the project.
3. Peo06 (Communication): The standard and formal communication methods are dictated in the traditional methods (i.e. PMBOK), which should be scrutinised to include elements of informality for APs. The communication need to be managed properly in terms of when to communicate, amount of information to communicate, and the relevant stakeholders to be included in the communication.
4. Pro03 (Project Planning): Plan the communication in terms of who to communicate with, when to communicate with them and what methods to use as deemed appropriate. Understand and acknowledge that, as the project progresses, the level of communication may get technical and detailed, which may gradually reduce towards the end of the project. The product manager and the customer should be given importance in communicating the correct information, at the right time.
5. Pro08 (Complete Project Visibility): Project visibility is obtained through frequent and multiple communication methods, throughout the duration of the project.
6. Pro09 (Project Governance): Proper communication need to be administered as per the established process. APs, apart from the required frequent level of

communication, would also attract informal and irregular communication, due to its nature and characteristics.

7. Pro11 (Proper Implementation of Agile Method): Agile methods demand a high level of communication, which would be frequent and informal, in addition to formal methods.
8. Pro13 (Process Flexibility): There should be flexibility to allow the free flow of information between the stakeholders, to encourage frequent and constant communication.
9. Pro14 (Hybrid Method): In the case of the implementation of a hybrid method, the correct communication process and principles need to be followed, on delivering the project against the scope, cost, resource, and schedule changes.
10. Pro15 (Method Match - Agile Vs Traditional): The implemented method should be aligned with the project communications requirements.
11. Pro18 (Project Closure Activities): Lessons learnt, in managing and tracking the internal and external communications, should be captured, and documented.
12. Tec01 (Complete set of Agile Practices): The implemented agile practices need to be closely followed during all stages and levels of communication.
13. Tec02 (Appropriate Technology and Tools): Appropriate communication tools will help in enabling effective and efficient communication between the project team members, and the timely dissemination of information and project updates to the stakeholders.
14. Tec04 (Communication Support Tools): Sufficient communication tools should be available to the stakeholders, throughout the duration of the project. If possible, the various medium (email messages, text messages, documents, spreadsheets, slides) should have the capabilities to be merged and unified.

15. Tec05 (Software supporting Agile methods): The appropriate software should be made available to support the varying communication needs within the project and the organisation. Different software may be used for different projects, based on the nature of the projects and its environment.

7.4.8 Project Risk Management Factors

12 factors were mapped into the Risk Management area, with two factors within the Organisation category, seven factors within the Process category, and three factors within the Technical category, as depicted in Table 7.8.

Table 7.8: Factors tabulated against the “Risk Management” Knowledge area

Agile	Scrum	Sprint Planning meeting (Product Owner): 1) Stakeholder Input 2) Product Backlog review 3) Sprint backlog update	Daily Sprint meeting (Scrum Master): 1) Review changes 2) Perform changes (if/where required) 3) Issue incremental updates 4) Deliver incremental product			Retrospective: 1) Review delivered products 2) Refine product backlog 3) Update Sprint backlog	Factor Category	
	Kanban	Pool of Ideas --> Prepare and Select Features	Track Requirements/ Task/Incidents: Backlog, Planned, In-Progress, Developed, Tested, Completed.					
Traditional	Waterfall	Lifecycle Phases						
		Requirements Analysis	Implementation	Testing	Deployment	Maintenance		
	PMBOK	Process Groups						
		Initiating	Planning	Executing			Monitoring	Closing
PMBOK® Knowledge Area: Project Risk Management		Org05						Organisation
		Org09						
			Pro03					Process
			Pro09					
			Pro11					
				Pro13				
				Pro14				
				Pro15				
							Pro18	Technical
			Tec01					
			Tec02					
			Tec05					

The description and suggested mitigation methods are as follows:

1. Org05 (Organisation Size): The size of the organisation and the size of the project teams should be carefully analysed at the beginning stages of the project (initiation

phase), which will influence the manner in which the projects are executed, and the match with the methodology employed.

2. Org09 (Budget to Implement Agile methods): The necessary budget to run the project need to be acquired prior to the execution of the projects, and is mostly done during the project initiation phase.
3. Pro03 (Project Planning): Risk planning should start at the project infancy stage, and continuously monitored for the inclusion of newly identified risks, changes in risk categories and the associated impact, and closing of items not imposing a risk to the project any longer. Perform risk identification and management at an early stage, to avoid surprises at a later stage in the project. Identify and interact with SMEs within all relevant areas, in the identification of risks, and keep the product owner abreast of the risks, and the management or mitigation protocol employed.
4. Pro09 (Project Governance): Proper risk management and tracking need to be carried out, especially when there is a change in scope, with the necessary risk mitigation methods in place.
5. Pro11 (Proper Implementation of Agile Method): Risk management should be performed in accordance to the frequency and requirements of the implemented methodology.
6. Pro13 (Process Flexibility): There should be flexibility in the various areas of the project. This flexibility should be factored in as an element of risk, monitored and managed accordingly.
7. Pro14 (Hybrid Method): In the case of the implementation of a hybrid method, the proper risk identification and management process and principles need to be followed, on delivering the project against the scope, cost, resource, and schedule changes.
8. Pro15 (Method Match - Agile Vs Traditional): The implemented method should be aligned with risk management activities and outcomes.

9. Pro18 (Project Closure Activities): Lessons learnt, in managing and tracking the risk elements, and its avoidance or mitigation methods, should be captured, and documented.
10. Tec01 (Complete set of Agile Practices): The implemented agile practices need to be closely followed when performing the risk management tasks, as the agile method may have new, or different types of associated risks.
11. Tec02 (Appropriate Technology and Tools): Appropriate tools will help in the identification of risks, and the effective management, and timely mitigation of the identified risks.
12. Tec05 (Software supporting Agile methods): The appropriate software should be made available to support the project risk management activities, including the mitigation (or acceptance) of the identified risks. The software should also provide the projects with the ability to quickly add newly identified risks into the risk management portfolio, which may impact the schedule, cost, and quality of the project deliverables.

7.4.9 Project Procurement Management Factors

Within the Procurement Management area, the mapping was done for 12 factors, with one factor within the Organisation category, eight factors within the Process category and three factors within the Technical category, as depicted in Table 7.9.

Table 7.9: Factors tabulated against the “Procurement Management” Knowledge area

Agile	Scrum	Sprint Planning meeting (Product Owner): 1) Stakeholder Input 2) Product Backlog review 3) Sprint backlog update	Daily Sprint meeting (Scrum Master): 1) Review changes 2) Perform changes (if/where required) 3) Issue incremental updates 4) Deliver incremental product		Retrospective: 1) Review delivered products 2) Refine product backlog 3) Update Sprint backlog		Factor Category	
	Kanban	Pool of Ideas --> Prepare and Select Features	Track Requirements/ Task/Incidents: Backlog, Planned, In-Progress, Developed, Tested, Completed.					
Traditional	Waterfall	Lifecycle Phases						
		Requirements Analysis	Implementation	Testing	Deployment	Maintenance		
	PMBOK	Process Groups						
		Initiating	Planning	Executing			Monitoring	Closing
PMBOK® Knowledge Area: Project Procurement Management		Org06						Organisation
			Pro03					Process
			Pro09					
			Pro11					
				Pro13				
				Pro14				
				Pro15				
							Pro18	
				Pro24				
				Tec01				
				Tec02				
			Tec05					

The description and suggested mitigation methods are as follows:

1. Org06 (Agile Logistics arrangements): When procuring project resources, equipment, tools, material, or any other items required for use by the project, either internally within the organisation, or externally through a third party (i.e. vendor, supplier), an effective procurement process should be in place. The process should complement the anticipated changing needs of the scope of the APs, leading to the appropriate amendments in the type and quantity of the procured items.
2. Pro03 (Project Planning): Based on the scope of the project, the procurement of items need to be planned properly (i.e. human resources, contractors, equipment, devices, and services). Include any procurement related item which may impose a risk to the overall project, and add them to the risk register, while keeping the product owner abreast on any impact, which may be introduced by the procured elements.

3. Pro09 (Project Governance): Procurement for the projects need to adhere to the established processes and regulations to ensure it will be able to cope with the anticipated fast pace of APs.
4. Pro11 (Proper Implementation of Agile Method): A properly organised procurement process need to be undertaken, as agile methods are expected to demand a faster mode of procurement (i.e. securing material, resources from third party vendors).
5. Pro13 (Process Flexibility): There should be flexibility to allow an easy and efficient procurement process, along with a flexible delivery and payment process.
6. Pro14 (Hybrid Method): In the case of the implementation of a hybrid method, the correct procurement process and contracting principles need to be followed, on delivering the project against the scope, cost, resource, and schedule changes.
7. Pro15 (Method Match - Agile Vs Traditional): The implemented method should be aligned with contracting and procurement requirements.
8. Pro18 (Project Closure Activities): Lessons learnt, in managing the procurement activities, should be captured, and documented.
9. Pro24 (Vendor Management): The process for managing the vendors should be aligned with the employed methodology (i.e. conventional, agile or hybrid). Procurement (contracting and legal department) experts should be consulted.
10. Tec01 (Complete set of Agile Practices): The implemented agile practices need to be closely followed for all procurement needs, as the nature of procurement and contracting may be different, due to a different level of demand by the agile method of PMgmt.
11. Tec02 (Appropriate Technology and Tools): The utilisation of proper tools may assist in performing and fulfilling the procurement needs of the projects efficiently.
12. Tec05 (Software supporting Agile methods): The appropriate software should be made available to support effective and efficient procurement needs of the project.

The description and suggested mitigation methods are as follows:

1. Org01 (Executive Sponsorship): The executives are very important stakeholders of the project, and their support (and sponsorship) is normally sought for at the beginning stages of the project (i.e. initiation phase), presented in a project charter, for their agreement and subsequent approval.
2. Org02 (Management Commitment/Control): The necessary commitment from the management team should be acquired during the initiation phase. They should remain committed during the planning and execution phases of the project.
3. Org03 (Organisational Culture - Traditional Vs Agile): When projects are initiated, they should reflect the organisational culture. In cases of conflicts, in terms of the organisational culture and the principles of PMgmt, an alignment must be done prior to moving into the other phases of the project.
4. Org04 (Organisational Culture - Political): Organisational politics should not interfere with the PMgmt principles. In case the political influences are unavoidable, they should be included as risk elements at the initiation stage of the projects, and carefully managed.
5. Org07 (Understanding of Agile method values (& principles)): Proper understanding on the values and principles of the implemented method should be acquired at the project initiation phase, prior to running the projects.
6. Org08 (Support of Investment on Agile method): The necessary and required level of support should be acquired prior to the execution of the APs, usually acquired at the beginning of the initiation phase.
7. Peo04 (Cooperation from groups or individuals (testers)): Absolute cooperation should be acquired from all stakeholders, especially during the execution phase.

8. Peo05 (Customer relationship): There should be a good relationship established with all the identified customers and clients of the project. Additional efforts should be placed in maintaining a good relationship, which could be via the means of informal and casual meetings, to create a comfortable environment to build the relationship.
9. Peo06 (Communication): Upon identifying the various stakeholders and their roles, the necessary communication plan need to be drawn out, which includes the level of communication to administer, amount to communicate, frequency, and method of communication. Communication is normally informal in APs, however, having a firm communication plan adds value to the process.
10. Peo08 (Managing Stakeholder expectations): This task need to be planned and executed throughout the duration of the project. 'Unreasonable' expectations (if any), should be carefully tackled and managed.
11. Peo09 (Embrace Change): Ensure the stakeholders are aware of the changing nature of APs, and support the principle. Attain support at the beginning stage of the project, and ensure continuous support throughout the planning and execution phases.
12. Peo10 (Managers' participation): Ensure that the managers' understand the principles of the APs, and render their participation and support, during the execution stages of the project.
13. Peo14 (Agile Mindset): Project stakeholders need to understand the agile principles, and be willing to adapt to its methods seamlessly, with an open mind.
14. Peo15 (Understanding of Agile Method): Ensure that the stakeholders understand the method. Training programs can help bridge any gaps, which should be done at the early stages of the project, or even before the project is initiated.
15. Peo16 (Team Empowerment): Team empowerment may be tied to the organisational culture, and politics. Attain an agreement for the required level of authority prior to executing the project.

16. Pro03 (Project Planning): Identify the stakeholders (i.e. customer, product owner, investors, public, peers, superiors, subordinates, PM, project team members, contractors, vendors, clients, government, and other relevant stakeholders) and chart them against an impact matrix, identifying the level of influence each of these stakeholders may have, against the different phases and deliverables of the project. Perform risk identification related to all the identified stakeholders.
17. Pro05 (Customer Presence): Customer presence is very important during the planning and execution phases. Their time and commitment need to be ascertained prior to these stages, ensuring their commitment does not change during the execution stages (i.e. due to workload, unavailability).
18. Pro06 (Customer Role): The customer role should be defined and communicated well in advance, ensuring the role is assumed by the customer throughout the planning and execution phases.
19. Pro09 (Project Governance): The stakeholders of the project, especially the PM and team members, need to be trained in the established processes demanded by the PMgmt methodology, and should be aware of the importance of project governance, working together to consistently deliver with conformance.
20. Pro10 (Customer Collaboration): The necessary collaboration with the customer is required during project planning and execution, where an agreement needs to be acquired upfront, prior to the execution of the project.
21. Pro11 (Proper Implementation of Agile Method): All stakeholders must be trained in the implemented method, and an expert team (i.e. central agile implementation and support team, PMO, special task force, project advisory committee) need to be available, to provide support and guidance to the stakeholders.

22. Pro13 (Process Flexibility): There should be flexibility practised by the stakeholders at every stage of the project, effected at the beginning stages of the project, and practiced throughout the project.
23. Pro14 (Hybrid Method): In the case of the implementation of a hybrid method, the agreed processes, and principles to liaise with, and handle the stakeholders need to be followed on delivering the project against the scope, cost, resource, and schedule changes.
24. Pro15 (Method Match - Agile Vs Traditional): The implemented method should be aligned with the anticipated expectations of the stakeholders, especially the key stakeholders who may adversely impact the project should they be unsatisfied with the processes. The implemented method should be well understood by all project stakeholders, and accepted by them to a reasonable extend via the means of training, coaching, briefing, support groups and other through informal sessions.
25. Pro18 (Project Closure Activities): Lessons learnt, in managing all levels of the stakeholders, including internal and external stakeholders, should be captured, and documented.
26. Tec01 (Complete set of Agile Practices): The implemented agile practices need to be closely followed by all project stakeholders to ensure cooperation is rendered at all levels of the project. A task force consisting of either SME's of the methodology or a governing PMO should ensure all stakeholders understand the common practices in the organisation and specific process variations within the respective projects.
27. Tec02 (Appropriate Technology and Tools): The enablement of tools will help in providing the stakeholders with the ability to monitor the project effectively. All relevant stakeholders need to be trained or be familiar with the tools and technology employed, preferably with the necessary support from a dedicated technology support team.

28. Tec05 (Software supporting Agile methods): The appropriate software should be made available to support the effective management of the various stakeholders, to fulfil their various needs and demands in an efficient manner.

7.5 Mapping of Factors into the Framework

The mapping of the factors into the framework was done in consultation with the industry practitioners (participants of the GT), to form the ‘Expert Review Team’. The 55 combined, unique factors obtained from the SLR study and GT research were reviewed, one by one, with the Expert Review Team, to seek for an agreement to place them in the cells within the framework. After formulating the complete framework with all 55 factors tabulated in all applicable cells, the framework was reviewed by the expert review team again, where the factors were: (1) re-assigned to a different cell, (2) assigned to additional cells, (3) or removed from previously assigned cells.

This cycle was repeated a few times until all the members of the expert review team were satisfied with the placement of the factors into the cells, and arrived at an agreement. The finalised framework (HAT-PMFv1.0) was then distributed to get a final agreement, before locking in the changes, after which, the framework was prepared for the evaluation phase (described in Chapter 8). The process of mapping the factors into the framework is described in Figure 7.3. As the final version of the framework

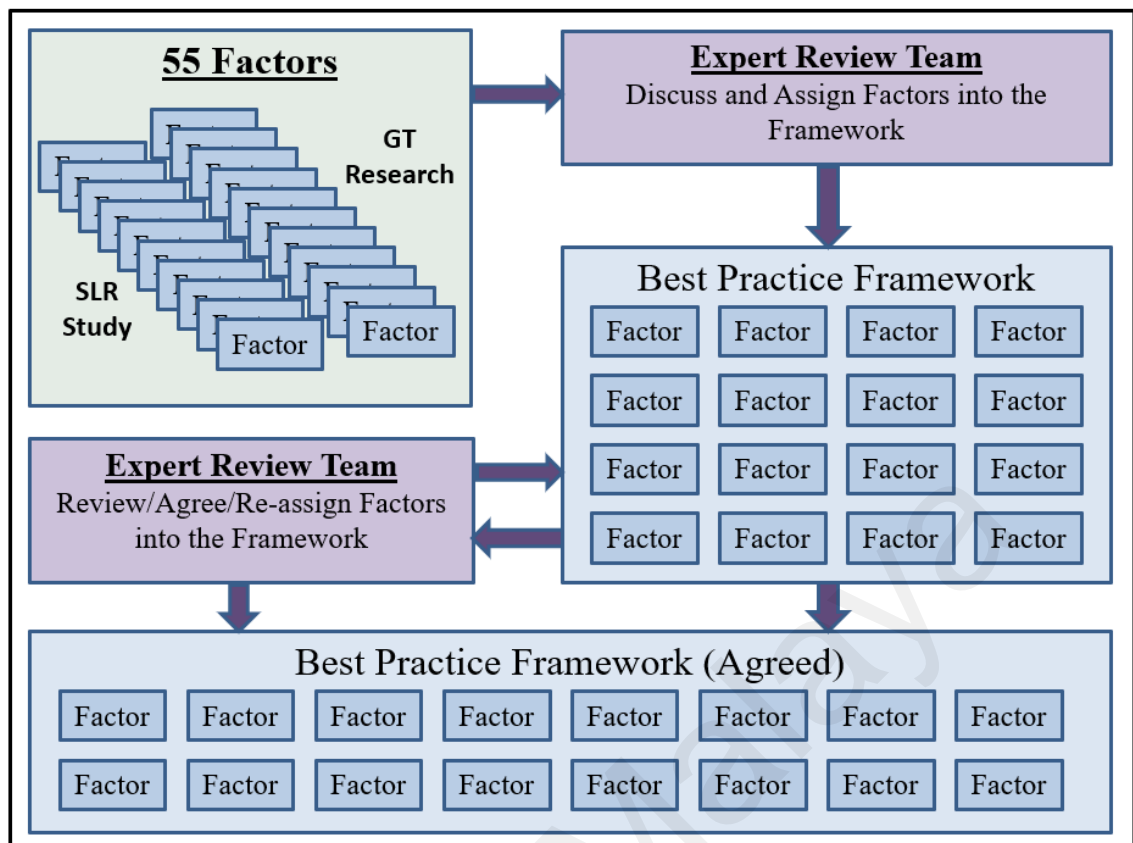


Figure 7.3: Factor mapping process to formulate the Framework

7.6 Summary

The purpose of this study, as defined in Chapter 1 (Section 1.4), has been partially addressed in the previous chapters. The issues and challenges of APs discussed in literature (Chapter 4) and identified within the industry practitioners (Chapter 5) were described, and the findings from both research methodologies were discussed. The gaps between the findings in literature (SLR) and the findings from the industry practitioners (GT), fulfilled the first objective of this study. The second objective was also fulfilled with the identification and verification of the mitigation methods (Chapter 6).

This chapter fulfils the second objective, proposed in Chapter 1 (section 1.5), on the development of an agile best practice framework (HAT-PMFv1.0), which can be used as a guideline for the successful management of IT projects. This proposed framework will

be evaluated by an expert review team, subscribing proven assessment methods, to produce an improvised framework (HAT-PMFv2.0) in the next chapter (Chapter 8). The third and fourth objectives will be fulfilled, with the validation the framework by an expert review team, to produce an improvised framework, along with the support tool, as described in Chapter 9. The final chapter (Chapter 10) concludes this thesis by responding to the ROs, answering the RQs, describing the contributions of the thesis, concluding the chapter with the limitations of this research and proposed future work.

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CHAPTER 8: EVALUATION OF THE FRAMEWORK (HAT-PMFv2.0)

8.1 Overview

The first part of the purpose of this study defined in Chapter 1 (Section 1.4) was to identify the issues and challenges of APs discussed in literature, where an SLR method was subscribed to, as described in Chapter 4. The second part of the purpose of the study was to obtain and compile the issues and challenges in ITPM within both traditional and agile environments from the practitioners from various industries, where a GT research was undertaken, as described in Chapter 5. The findings from both these research methods are discussed in Chapter 6, with suggestive mitigation methods compiled and verified with the practitioners, to produce the third part of the purpose of the study. The theoretical background on the selected assessment method, adapted from literature, was restructured to propose a best practice framework, as described in Chapter 7.

This chapter adapts an evaluation model, previously used by Motorola, to assess the proposed best practice framework, against a scale between 0 and 10, to determine the strength of each of the mitigation methods proposed for the 55 identified factors, tabulated in the framework. The assessment is done with a panel of experts in the field of PMgmt, in both traditional and agile methods. The assessment method, the results of the assessment, along with the demographics of the evaluation team (expert review team) will be described further in the following sections. The proposed improvements will be used to produce an improvised framework, which can be used as a tool by the PMgmt practitioners, to assist in the administration and management of agile, traditional or hybrid projects.

8.2 Evaluation Model

Many organisations adopted the Software Engineering Institute (SEI)'s Capability Maturity Model (CMM), to improve their software-engineering processes, by setting goals to achieve higher SEI levels (Daskalantonakis, M. K., 1994). The assessment method proposed by Daskalantonakis (1994), as shown in Table 8.1, was used at by Motorola's Cellular Infrastructure Group, an organisation of more than 1,000 software engineers working on several projects and products for Motorola's cellular division.

A 3-dimensional evaluation model was used, which consists of the following:

1. Approach – The first dimension evaluates the organisation in terms of its approach in handling the practice, and it's ability to support the practice.
2. Deployment – The second dimension is the breadth and consistency of implementing the practice in the organisation.
3. Results – The third dimension is the breadth and consistency of achieving positive results over time and across the project areas within the organisation.

This assessment method, as proposed by Daskalantonakis (1994) was adapted for the assessment and evaluation of the HAT-PMF framework, as it is an established and proven assessment method, which is applicable in the APM environment, and suitable for the evaluation of the method and processes of PMgmt. This model was also used in other recent research works related to IT evaluation (Niazi et al., 2008; Diaz-Ley et al., 2010; Ali and Khan, 2016; Ali et al., 2018). The adapted assessment model, as shown in Table 8.2, was intended to evaluate each of the factors identified in this research, along with the proposed best practice framework, to determine its relevance, usefulness, practicality, and applicability.

Table 8.1: SEI Progress Assessment Method used in Motorola’s Cellular Infrastructure Group

Score	Key activity evaluation dimensions		
	Approach	Deployment	Results
Poor (0)	<ul style="list-style-type: none"> No management recognition of need No organisational ability No organisational commitment Practice not evident 	<ul style="list-style-type: none"> No part of the organisation uses the practice No part of the organisation shows interest 	<ul style="list-style-type: none"> Ineffective
Weak (2)	<ul style="list-style-type: none"> Management has begun to recognise the need Support items for the practice start to be created A few parts of organisation are able to implement the practice 	<ul style="list-style-type: none"> Fragmented use Inconsistent use Deployed in some parts of the organisation Limited monitoring/verification of use 	<ul style="list-style-type: none"> Spotty results Inconsistent results Some evidence of ineffectiveness for some parts of the organisation
Fair (4)	<ul style="list-style-type: none"> Wide but not complete commitment by management Road map for practice implementation defined Several supporting items for the practice in place 	<ul style="list-style-type: none"> Less fragmented use Some consistency in use Deployed in some major parts of the organisation Monitoring/verification of use for several parts of the organisation 	<ul style="list-style-type: none"> Consistent and positive results for several parts of the organisation Inconsistent results for other parts of the organisation
Marginally qualified (6)	<ul style="list-style-type: none"> Some management commitment: some management becomes proactive Practice implementation well under way across parts of the organisation Supporting items in place 	<ul style="list-style-type: none"> Deployed in some parts of the organisation Mostly consistent use across many parts of the organisation Monitoring/verification of use for many parts of the organisation 	<ul style="list-style-type: none"> Positive measurable results in most parts of the organisation Consistently positive results over time across many parts of the organisation
Qualified (8)	<ul style="list-style-type: none"> Total management commitment Majority of management is proactive Practice established as an integral part of the process Supporting items encourage and facilitate the use of the practice 	<ul style="list-style-type: none"> Deployed in almost all parts of the organisation Consistent use across almost all parts of the organisation Monitoring/verification of use far almost all parts of the organisation 	<ul style="list-style-type: none"> Positive measurable results in almost all parts of the organisation Consistently positive results over time across almost all parts of the organisation
Outstanding (10)	<ul style="list-style-type: none"> Management provides zealous leadership and commitment Organisational excellence in the practice recognised even outside the company 	<ul style="list-style-type: none"> Pervasive and consistent deployment across all parts of the organisation Consistent use over time across all parts of the organisation Monitoring/verification for all parts of the organisation 	<ul style="list-style-type: none"> Requirements exceeded Consistently world-class results Counsel sought by others

Source: Daskalantonakis (1994)

The description of the three dimensions, “Approach, Deployment and Results”, were altered to reflect the impact to the organisation, should the practice be adopted and

implemented within the respective organisation. The scores of ‘0’ to ‘10’ proposed by Daskalantonakis (1994), which has been adopted, was seen to be suitable for the purpose evaluating the HAT-PMF framework.

Table 8.2: HAT-PMF Framework evaluation method used in this research

Score	HAT-PMF Factor Mitigation Evaluation Dimensions		
	Approach	Deployment	Results
Poor (0)	No management recognition of the need, and no organisational ability and commitment, as the practice does not warrant any benefit.	Does not have any impact on any parts of the organisation, and does not garner interest of the management and the organisation.	Will be clearly ineffective.
Weak (2)	Management may recognise the need and provide support, with some parts of the organisation willing to implement the practice.	May be used inconsistently, with deployment only in some parts of the organisation, with limited verification of the results.	May provide inconsistent results, and may be ineffective for most parts of the organisation.
Fair (4)	Implementation roadmap may be defined, but no complete commitment from management, with only minimal support in place for the practice.	Utilised with a low level of consistency, while being deployed in major parts of the organisation, with verification capabilities in several parts of the organisation.	Effective for some parts of the organisation, while it will remain ineffective for the other parts of the organisation.
Marginally qualified (6)	Some management may become proactive and committed, by implementing the practice in most parts of the organisation with support items in place.	Deployed in some parts of the organisation, used consistently across many parts of the organisation, with verification capabilities in many parts of the organisation.	Effective in most parts of the organisation, with expected positive results over most parts of the organisation over time.
Qualified (8)	Majority of management is proactive with total commitment, establishing the practice as an integral part of the process, encouraging and facilitating its use.	Consistent deployed and utilisation in almost all parts of the organisation over time, with organisational verification capabilities on the utilisation of the practice.	Positive and consistent measurable results in almost all parts of the organisation, to be garnered over time.
Outstanding (10)	Zealous leadership and commitment provided by the management, achieving organisational excellence, which is widely recognised within and outside the organisation.	Pervasive and consistent deployment and utilisation across all parts of the organisation over time, with organisational verification capabilities throughout the organisation.	Consistently exceed the expected results, being an exemplary for other organisations.

Source: adapted from Daskalantonakis (1994)

A total of 55 factors were produced from both literature and the industry, by means of the research methodology used, which includes an SLR, described in Chapter 5, and a GT

research described in Chapter 6. These 55 factors were mapped against a 4-dimensional framework as described in Chapter 7, which consist of the following:

- **First Dimension:** The various phases in a project, mapped against two agile methods (Scrum and Kanban) and two traditional methods (Waterfall and PMBOK). This dimension forms the X-Axis at the top of the framework.
- **Second Dimension:** The knowledge areas as described in the PMBOK guide, consisting of 10 areas (Integration, Scope, Schedule, Cost, Quality, Resource, Communication, Risk, Procurement and Stakeholder). This dimension forms the Y-Axis on the left side of the framework.
- **Third Dimension:** The factor category of the identified factors which consists of “Organisation, People, Process and Technical”, which are tabulated for each relevant Knowledge Area. This dimension forms the Y=Axis on the right side of the framework.
- **Fourth Dimension:** The 55 factors tabulated into the framework based on where it is deemed applicable, plotted against the X-Axis and Y-Axis, into the respective cells. This dimension forms the body of the framework.

8.3 Assessment by Expert Review Team

An invitation was sent out to more than 50 experts in the field of PMgmt, who were found to have more than 10 years of experience in PMgmt, and in a senior PMgmt position, to solicit their participation in the assessment of the framework (HAT-PMFv1.0). A total of 12 experts responded with their agreement to voluntarily participate in the assessment process. The following activities was performed on the assessment:

1. The participants were briefed individually on the contents of the framework, the purpose of the framework, and the expected benefit that it would yield.
2. The participants were then briefed on the assessment model which was adapted from Daskalantonakis (1994), as illustrated in Table 8.2, and were asked to affirm their ratings against each of the identified elements (a total of 159 items, within the 55 factors), with a score of between 0 and 10.
3. A duration of two months was accorded to the participants, to assess the framework against their organisational capabilities of adopting the framework and using the proposed best practice, to improve their existing processes and the overall administration and management of projects within their respective organisation.
4. At the end of the 2-month duration, a one-to-one interview was scheduled and held with each of the respondents, to gather their feedback, in the form of ratings for each of the items. The rating process was guided and the scores were compiled into an MS-Excel spreadsheet by the researcher.
5. The responses from all 12 respondents were collected individually, and tabulated in separate sheets within a single MS-Excel file.
6. All the 12 responses were then tabulated into a summary sheet within the MS-Excel spreadsheet, to allow the researcher to obtain the average rankings
7. The average ratings were obtained for each of the 159 items.
8. For the factors with more than one items ranked, the average ratings were tabulated, resulting in obtaining the average ratings for each of the 55 factors.
9. The factors within each area (Organisation, People, Process and Technical) were analysed to obtain the average rating for each area.

The number of items derived from each category of “Organisation”, “People”, “Process”, and “Technical”, totalling 159 items, is shown in Table 8.3.

Table 8.3: Evaluation of 159 items tabulated in the Framework (HAT-PMFv1.0), corresponding to the 55 factors

PMI Knowledge Area (KA)	Category of Factor (items)					Percentage (Category)
	Organisation	People	Process	Technical	Total (Category)	
Project Integration Management			9	3	12	7.5
Project Scope Management	1	1	12	3	17	10.7
Project Schedule Management			11	3	14	8.8
Project Cost Management	1		9	3	13	8.2
Project Quality Management			9	3	12	7.5
Project Resource Management	1	9	10	4	24	15.1
Project Communication Management	1	2	8	4	15	9.4
Project Risk Management	2		7	3	12	7.5
Project Procurement Management	1		8	3	12	7.5
Project Stakeholder Management	6	9	10	3	28	17.6
Total (KA)	13	21	93	32	159	100
Percentage (KA)	8.2	13.2	58.5	20.1	100	

The “Process” category contained the highest number of items, totalling 93 items (58.5%), followed by the “Technical” category, totalling 32 items (20.1%). The “People” and “Organisation” categories contained 21 and 13 items, contributing to 13.2% and 8.2%, respectively. From the perspectives of knowledge areas, “Stakeholder Management” and “Resource Management” contained the highest number of items, 28 (17.6%) and 24 (15.1%) respectively. The knowledge areas of scope, communication, schedule, and cost contained 17 (10.7%), 15 (9.4%), 14 (8.8%), 13 (8.2%) items respectively. The knowledge areas of quality, risk, and procurement contained 12 items (7.5%) each.

The expert review team consist of 12 people, who are all professionals in the field of PMgmt, with a minimum of 10 years of experience in a managerial or leadership role. They are from various organisations, mostly working in Multi-National Corporations or MNCs, and from various different industries as tabulated in Table 8.4.

Table 8.4: Respondents of the Framework assessment consisting of 12 experts

Respondent Code	Job Title/Role	Function	Industry	Agile PMgmt experience
R01	Program Manager	IT Shared Services	Logistics	11
R02	Program Manager	IT Shared Services	IT Equipment Manufacturer	10
R03	Head of IT	IT Shared Services	Pharmaceuticals	8
R04	Head of IT	IT Shared Services	Oil and Gas	7
R05	Head of PMO	IT Services	Telecommunications	12
R06	Head of IT	IT Shared Services	Banking and Finance	14
R07	Senior PM	IT Services	Telecommunications	6
R08	Program Manager	IT Services	Business Investment and Consultants	8
R09	Project Director	IT Shared Services	IT Infrastructure Services	10
R10	Program Manager	IT Shared Services	Network Services	8
R11	Project Director	IT Services	Telecommunications	16
R12	Program Manager	IT Services	Telecommunications	13

Analysing the job roles of the 12 respondents, a majority of them are “Program Managers”, consisting of five persons (42%). The second largest is the job role of “IT Manager” consisting of four persons (33%), followed by the role of “Project Director” with two respondents falling into this category (17%). There was one each in the role of “Head of PMO” and “Senior PM”, as shown in Figure 8.1. All of the respondents voluntarily participated in the assessment exercise of the framework and chose to remain anonymous, hence their names and their organisation names are kept confidential.

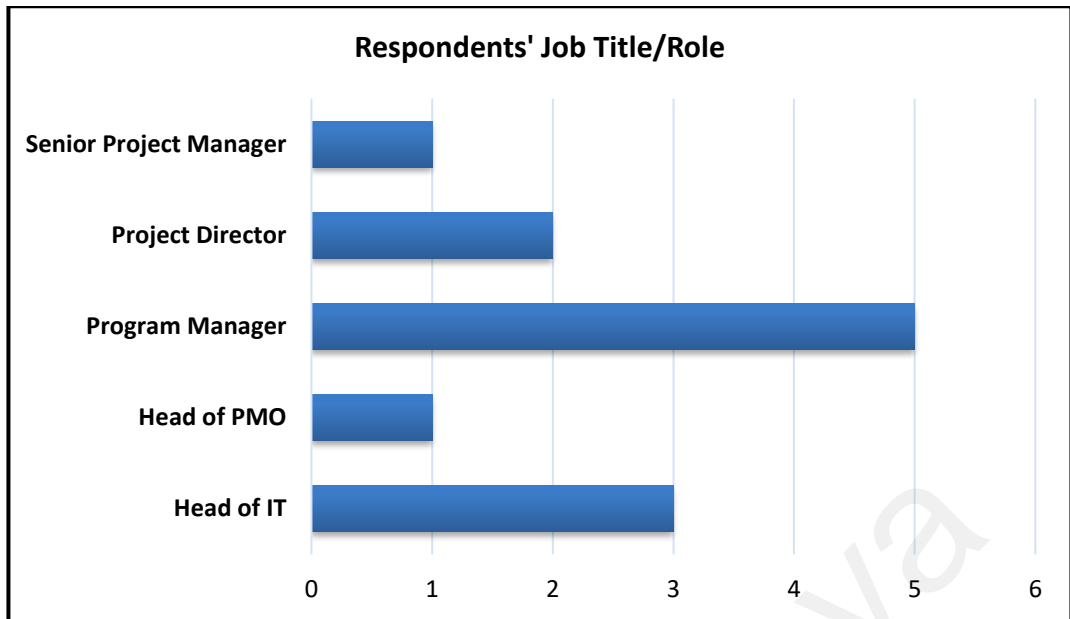


Figure 8.1: Job Title/Role of the Respondents for the assessment of the HAT-PMFv1.0 Framework

As for the functional departments the respondents are based in, all of them are from the IT function, within two broad sub-categories. Seven of them are within the “IT Shared Services” function, while the remaining five are from the “IT Services” function, as shown in Figure 8.2.

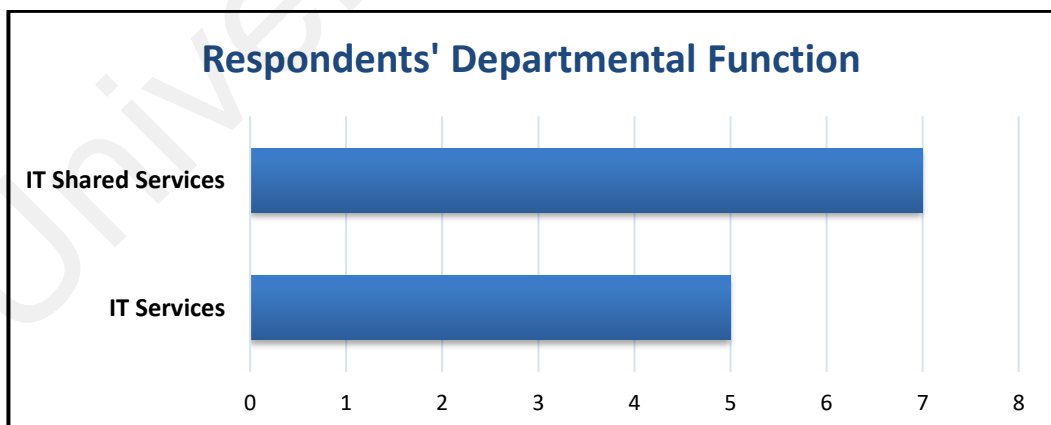


Figure 8.2: Departmental Function of the Respondents for the assessment of the HAT-PMFv1.0 Framework

The “IT Shared Services” function refers to instances where the organisation is providing IT services to the entire organisation, including the parent company, and all of its

subsidiary companies. The “IT Services” function refers to instances where the organisation provides IT services to its cliental or customers in a professional manner, in which, its client organisations acquire wholesome or partial IT services from this organisation.

Analysing the industry of the respondents, they appear from various different industries of expertise, with a majority of them from the “Telecommunications” industry, consisting of four out of 12 respondents (33%). The remaining eight respondents are all from different industries, one respondent each from the industries of “Oil and Gas”, “Banking and Finance”, “Pharmaceuticals”, “Logistics”, “Network Services”, “IT Infrastructure Services”, “IT Equipment Manufacturer”, and “Business Investment and Consultants”. These are shown in Figure 8.3.

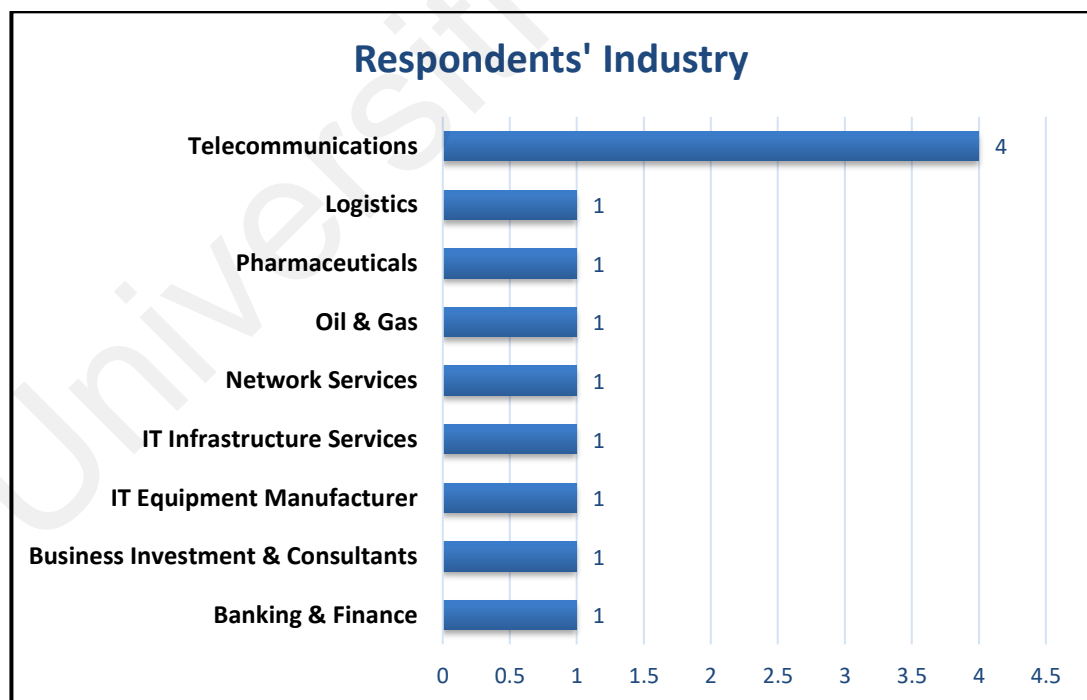


Figure 8.3: Industry of the Respondents for the assessment of the HAT-PMFv1.0 Framework

The results obtained from the assessment will be discussed further in the next section, with explanation on how the 159 items were combined, to create average ratings for each

factor, and how the 55 factors were combined to further obtain the average rating for each of the four areas of “Organisation”, “People”, “Process” and “Technical”.

8.4 Evaluation Results

As the factors were tabulated into each of the cells, there were many instances of the same factors mapped into the different knowledge areas, producing a total of 159 mapped items, which have been broadly discussed in the previous chapter (Chapter 7), reflected in the first version of the framework as shown in Appendix AD (HAT-PMFv1.0). The various items in each of the factors were compiled (Appendix AF), to be ranked by the expert review team. A snapshot of the data in Appendix AF is shown in Table 8.5.

Table 8.5: The different items within a particular factor, when tabulated against the various knowledge areas of PMBOK

Factor	Knowledge Area	Description of Practice
Pro08: Complete project visibility	Project Scope Management	Consistent and timely project updates with complete project visibility, it will be easier to manage the scope and any subsequent scope changes.
	Project Schedule Management	Consistent and timely project updates with complete project visibility, it will be easier to manage the project schedule, keeping track of scope changes as they occur.
	Project Cost Management	Changes to the project parameters, scope or deliverables may attract additional cost, which need to be tracked and key stakeholders should be updated as regularly as required.
	Project Communication Management	The key stakeholders must have complete visibility with consistent updates on the project, via frequent and multiple communication methods, so that all parties will be abreast with the current project status at all times.

In this example, the factor ID is “Pro08” and the factor description is “Complete project visibility”. This factor was mapped into four specific knowledge areas (Scope, Schedule, Cost and Communication), with a specific best practice description for each of the mapping. The expert review team, consisting of 12 experts, with a minimum of 10 years of experience in PMgmt, were required to rank each of the 55 factors, which were

respectively mapped into 159 individual items, based on the evaluation guidelines adapted from Daskalantonakis (1994), described earlier, in Table 8.2. An example of the ranking by one of the expert reviewers, on one of the 55 factors is shown in Table 8.6.

Table 8.6: Ranking results the different items within a particular factor, when tabulated against the various knowledge areas of PMBOK

Factors	Key activities (practice to mitigate the likely issues/challenges)	Evaluation Rating										Rating Value				
		0	1	2	3	4	5	6	7	8	9	10	Item	Factor		
Pro08: Complete project visibility	Scope: Consistent and timely project updates with complete project visibility, it will be easier to manage the scope and any subsequent scope changes.								X					7	6.8	
	Schedule: Consistent and timely project updates with complete project visibility, it will be easier to manage the project schedule, keeping track of scope changes as they occur.								X					7		
	Cost: Changes to the project parameters, scope or deliverables may attract additional cost, which need to be tracked and key stakeholders should be updated as regularly as required.							X								6
	Communication: The key stakeholders must have complete visibility with consistent updates on the project, via frequent and multiple communication methods, so that all parties will be abreast with the current project status at all times.									X						7

As an illustration, the four different items (as per the example shown in Table 8.5) were ranked separately, and the average of these four rankings were used to rank the factor, by adding the four individual rankings, and dividing them by four as shown below.

$$\text{Average ranking for Factor Pro08} = (7 + 7 + 6 + 7) / 4 = 6.8$$

The average ratings for all factors were derived from the individual items, and tabulated against a chart, as shown in Appendix AF (Evaluation Results of HAT-PMFv1.0 by the Expert Review Team against 159 individual items). Based on the score of the assessment model adapted from Daskalantonakis (1994), a score of “0” was considered “Poor”, “2” was considered “Weak”, “4” was considered “Fair”, “6” considered “Marginally Qualified”, “8” considered “Qualified” and a score of “10” considered “Outstanding”. As the purpose of the assessment was to determine if the practice was relevant, useful, practical, and applicable, a ranking of “6” and below is considered not effective, as per the method adapted from Daskalantonakis (1994). Based on the relevance, usefulness, practicality, and applicability of the framework, for possible use as a reference material within the respective organisations, the respondents, consisting of an expert review team of 12 persons, performed the ranking against every item and factor.

A ranking value of “7” to “10” were considered strong, based on the SEI level (Daskalantonakis, 1994), deriving upon the following category of ranking results:

- Ranking of 0 to 6.9 = Weak
- Ranking of 7.0 to 10.0 = Strong

The following procedures were used to collect, compile, tabulate and summarise the rankings:

1. An expert review team of 12 volunteers from various organisations and industries were selected and briefed on the framework (HAT-PMFv1.0).
2. The assessment model (adapted from Daskalantonakis (1994)) was shared with the review team, with the description explained, to ensure they understood every element to facilitate the ranking process.

3. Upon acquiring a reasonable level of understanding on the framework and its mitigation methods, to avoid issues of misunderstanding, the team members were individually interviewed to obtain their rankings on each of the 159 items, corresponding to the 55 factors.
4. The individual rankings results on each of the 159 items (sub-category of each factor) were combined, to calculate the average ranking for each factor.
5. The rankings were then transferred to a summary sheet, to combine all the rankings from all 12 of the respondents.
6. The average ranking from all 12 respondents were tabulated against the 55 factors, with an additional column added, to show the overall score of the 4-dimensional framework against the 55 factors.
7. The strength of each factor were marked, based on the average ranking results obtained.

Upon completion of individual sessions with each of the expert review team member, the individual results were combined to form a holistic ranking view, producing average rankings provided by the 12 respondents on all items, and respectively on all factors. The full compilation of the results of the rankings against all 159 items are shown in Appendix AF (Evaluation Results of HAT-PMFv1.0 by the Expert Review Team against 159 individual items). The summary of the rankings by the 12 respondents against the factors are shown on Appendix AG (Evaluation Results of HAT-PMFv1.0 by the Expert Review Team against 55 factors). Rankings from all 12 respondents, mapped against the 55 factors is shown in Table 8.7, marking an average ranking of 7.3 for the entire framework.

Table 8.7: Summary of the average ranking results by all 12 respondents against the 55 Factors and their Categories

Area	No	Code	Factors (against the average rankings from all 12 respondents)	Rankings		
				Factor	Area	
Organisation	1	Org01	Executive sponsorship	7.6	7.4	
	2	Org02	Management commitment /control	7.3		
	3	Org03	Organisational culture - Traditional Vs Agile	7.5		
	4	Org04	Organisational culture – Political	7.3		
	5	Org05	Organisational size	7.2		
	6	Org06	Agile logistical arrangement	7.4		
	7	Org07	Understanding of Agile method values (& Principles)	7.4		
	8	Org08	Support of Investment on Agile method	7.3		
	9	Org09	Budget to implement Agile methods	7.3		
	10	Org10	Business Vision	7.5		
People	11	Peo01	Availability of necessary skillset	7.4	7.4	
	12	Peo02	PMgmt competence	7.4		
	13	Peo03	Team-work	7.5		
	14	Peo04	Cooperation from groups or individuals (testers)	7.3		
	15	Peo05	Customer relationship	7.3		
	16	Peo06	Communication (for information sharing /decision making)	7.4		
	17	Peo07	Commitment and dedication (Motivation)	7.3		
	18	Peo08	Managing stakeholder expectations	7.7		
	19	Peo09	Stakeholders welcome (embrace) change	7.2		
	20	Peo10	Managers' participation	7.4		
	21	Peo11	PMgmt certification	7.1		
	22	Peo12	Trust and understanding (amongst team members/stakeholders)	7.3		
	23	Peo13	Creativity and problem solving skills	7.6		
	24	Peo14	Agile Mindset	7.2		
	25	Peo15	Understanding of Agile Method	7.4		
	26	Peo16	Team Empowerment	7.1		
Process	27	Pro01	Project scope	7.1	7.4	
	28	Pro02	Project requirements	7.3		
	29	Pro03	Project planning	7.4		
	30	Pro04	Progress tracking and reporting	7.3		
	31	Pro05	Customer presence	7.3		
	32	Pro06	Customer role	7.3		
	33	Pro07	Timely reporting	7.5		
	34	Pro08	Complete project visibility	7.5		
	35	Pro09	Project governance	7.4		
	36	Pro10	Customers collaboration (agreement/expertise/ability to dictate requirements)	7.1		
	37	Pro11	Proper Implementation of Agile Method	7.1		
	38	Pro12	Cost management	7.3		
	39	Pro13	Process Flexibility	7.4		
	40	Pro14	Hybrid method	7.3		
	41	Pro15	Method Match - Agile Vs Traditional	7.1		
	42	Pro16	Clearly Defined PM Role	7.7		
	43	Pro17	Prioritisation and Scheduling	7.7		
	44	Pro18	Project Closure Activities	7.3		
	45	Pro19	Project Team Role Definition	7.5		
	46	Pro20	Proper Change Management and Control	7.7		
	47	Pro21	Quality Management	7.4		
	48	Pro22	Resource Planning	7.6		
	49	Pro23	Manageable Units of Deliverables	7.3		
	50	Pro24	Vendor Management	7.0		
Technical	51	Tec01	Complete set of agile practices	7.1	7.2	
	52	Tec02	Appropriate technology and tools	7.0		
	53	Tec03	Knowledge on tools (technology)	7.1		
	54	Tec04	Communication support tools	7.3		
	55	Tec05	Software (tool) supporting Agile methods	7.3		
				Average Rating:	7.3	7.3

Based on the description tabulated against the ratings of six and eight, the following conclusion can be made against the three dimensions of “Approach”, “Deployment” and “Results”:

Approach:

Some or a majority of management may become proactive and committed, by implementing the practice, and possibly establishing it further as an integral part of the process, encouraging and facilitating its use, while employing support items.

Deployment:

Almost consistently deployed and utilised in many or almost all parts of the organisation over time, with organisational verification capabilities on the utilisation of the practice.

Results:

Effective in most parts of the organisation with highly expected positive and consistent measurable results, in most or almost all parts of the organisation, to be garnered over time.

Analysing the factor grouping, the “Organisation”, “People” and “Process” areas scored an average of 7.4, while the “Technical” area scored a slightly lower value of 7.2, indicating that more emphasis is given to the non-technical items, which are mainly human behaviour related, process related and organisational conduct related. As IT projects themselves are technical in nature, the technical perspectives would have been well established, drawing the reason for the slightly lower ranking results in the “Technical” category.

8.5 Suggested Improvements to the Framework

The initial framework which was produced attracted positive comments from the respondents who evaluated it. During the assessment process, valuable feedback and comments were provided, to garner the creation of the second version of the framework (HAT-PMFv2.0). The areas of improvement, as suggested by the expert review team has been summarised in the following context. The descriptions are provided only for the impacted factors (requiring amendments into the framework).

1. Org02: Management Commitment /Control

Proposed changes: Management commitment should be solicited throughout the project, even during the closing stage, otherwise the expected level of cooperation may not be available for project closure activities.

Response to proposed changes: This item has been extended to cover the maintenance and closing phases.

2. Org03: Organisational Culture - Traditional Vs Agile

Proposed changes: This element is crucial at the beginning of the project, during the initiation and planning stages, where the project should give due consideration to the organisational culture when implementing the method (agile, traditional or hybrid) and its processes.

Response to proposed changes: This item has been extended to cover the planning phase within the stakeholder management knowledge area.

3. Org04: Organisational Culture – Political

Proposed changes: This element is crucial at the beginning of the project, during the initiation and planning stages, where the project should give due consideration to the organisational culture when implementing the method (agile, traditional or hybrid) and its processes.

Response to proposed changes: This item has been extended to cover the planning phase within the stakeholder management knowledge area.

4. Org05: Organisation Size

Proposed changes: The size of the organisation will impact the projects, especially APs. This should be a consideration during the early stages of the project, when initiating a project and planning the project components.

Response to proposed changes: This item has been extended to cover the planning phase within the risk management knowledge area.

5. Org06: Agile Logistics arrangements

Proposed changes: For project cost and procurement related activities, the agile logistical arrangements need to be considered in the initial project stages, including the planning stage.

Response to proposed changes: This item has been extended to cover the planning phase, within the cost management and procurement management knowledge areas.

6. Org10: Business Vision

Proposed changes: The business vision should be cross referenced on any changes to the scope and requirements, to ensure the changing scope is aligned with the business objectives stipulated by the organisation.

Response to proposed changes: This element has been extended into the planning and implementation stages, where it is highly likely that the scope and requirements may change.

7. Peo05: Customer relationship

Proposed changes: Maintaining good customer or client relationship is crucial in APs, where the relationship should be established in the early stages of the project, and maintained throughout the execution phase, until the deployment phase.

Response to proposed changes: This element has been expanded to cover the planning stage in both the communication and stakeholder knowledge areas.

8. Peo06: Communication

Proposed changes: Communications need to be performed effectively throughout the project (which normally starts at the planning stage through the closing stage), especially amongst the stakeholders and within the project team.

Response to proposed changes: This item has been expanded to start at the very beginning of the project, from the initiation stage, in the communication and stakeholder management knowledge areas, and from the planning stage in the resource management knowledge area.

9. Peo10: Managers' participation

Proposed changes: The managers should be committed to participate, cooperate, and support the APs all the way until project closure activities are completed. Normally, the managers do not allocate time for participation on closure activities as they feel that it is of low value, and prefer to perform other functional and operational activities.

Response to proposed changes: This element has been expanded to cover the maintenance (monitoring and closing) phases of the project in all the respective knowledge areas (stakeholder management).

10. Peo14: Agile mindset

Proposed changes: The stakeholders (project team) should have an agile mindset throughout the project, and not just during the project execution phase.

Response to proposed changes: This item has been expanded to cover the full project cycle, for the resource management knowledge area.

11. Peo16: Team empowerment

Proposed changes: Empowerment of team members should be included in the resource management area, in addition to the stakeholder management area, as it is important to recognise this effort when administering and managing resources. This may not apply to all stakeholders, instead it should apply only to the project team members.

Response to proposed changes: This element has been added into the "resource management" knowledge area, within the crucial stages of planning and execution.

12. Pro07: Timely reporting

Proposed changes: It should not be limited to only the "Schedule Management" knowledge area, instead it should be expanded to "Communication" and "Stakeholder" knowledge areas as well, as it is crucial to communicate the progress of the project as frequently as possible to the relevant stakeholders. Different frequency for different stakeholders, according to their role and the need for information related to the progress of the project.

Response to proposed changes: This item (Pro07) has been included in the "Communication" and "Stakeholder" knowledge areas.

13. Pro09: Project Governance

Proposed changes: This should be adhered to, and followed through, for the entire cycle of the project (up to the closing stage), with the exception of the initiating phase, where the decision may be made on which method to follow, and a particular method would have been selected for adherence to project governance.

Response to proposed changes: This element has been expanded to cover the subsequent phases of the project, in all relevant process groups, within all the knowledge areas.

14. Pro11: Proper Implementation of Agile Method

Proposed changes: It only needs to be done at the beginning of the project, and not advisable to be done in any subsequent stages of the project. Thus, the implementation of the method (which could either be a full-fledged agile method, or a hybrid method) should be a requirement at the organisational level, done at the project initiation phase, with the exception of doing it at the planning stage, for projects with a shorter duration and smaller scope.

Response to proposed changes: This item has been extended to cover the initiation phase of the projects. Hence, it will be crucial at the initiation phase and with an exception to be done at the planning phase for smaller or fast turn-over projects.

15. Pro12: Cost Management

Proposed changes: This element should be considered throughout the project lifecycle, and not just during the beginning phases of a project.

Response to proposed changes: The element has been expanded to cover all phases of the project, from "initiation" to "closing", within the "cost management" knowledge area.

16. Pro13: Process Flexibility

Proposed changes: The flexibility of the processes established within the implemented methodology should be considered at the very beginning of the project (from project inception), including the "initiation" phase, and not just limited to the "planning" and "implementation" stages. Although this needs to be considered throughout the project, but due consideration need to be given at the beginning of the project, while the method is being selected and implemented. It is advisable to only include this factor in the beginning stages (initiation and planning), as it will be a matter of project governance within the other phases.

Response to proposed changes: This element has been expanded to be included in the "Initiation" phase, and has been excluded from the "Implementation" phase. Its conformance in the subsequent phases is expected to be monitored under the "project governance" factor.

17. Pro14: Hybrid Method

Proposed changes: If the organisation decides to combine an agile method with certain functions of a traditional method, to produce a hybrid method, this needs to be done at the beginning stages of the project, with proper governance throughout the project. The implementation of a suitable methodology, including a mixed or hybrid method, between an agile and traditional method, should be considered at the very beginning stage of the project (from project inception), including the "initiation" phase, and not just limited to the "planning" and "implementation" stages.

Response to proposed changes: This item has been expanded to be included in the "Initiation" phase, and has been excluded from the "Implementation" phase. Its conformance in the subsequent phases is expected to be monitored under the "project governance" element.

18. Pro15: Method Match - Agile Vs Traditional

Proposed changes: This item relates to Pro14, and should be combined, if possible.

Response to proposed changes: It will still be captured as a separate item, as the consideration on the combination of agile and conventional methods need to be scrutinised prior to producing a hybrid method. If a hybrid method already exists in an organisation, there could also be a need to review the factors, according to the type of project to be managed, and amend the agile Vs conventional weightage accordingly.

19. Pro16: Clearly Defined PM role

Proposed changes: This area should be expanded into the "stakeholder management" knowledge area, as it is important to ensure that the PM is treated as an important stakeholder, to garner project success.

Response to proposed changes: This element has been added into the "stakeholder management" knowledge area, and further expanded into the project initiation phase, in addition to the planning phase.

20. Pro19: Project team role definition

Proposed changes: This area should be expanded into the "stakeholder management" knowledge area as it is important to ensure that the project team members are treated as an important stakeholder, especially with their crucial role in APs, to garner project

success. Furthermore, a “Scrum Master” may be nominated from within team (when the Scrum method is used), so the team members are very important stakeholders within the agile environment.

Response to proposed changes: This element has been added into the "stakeholder management" knowledge area, and further expanded into the project initiation phase, in addition to the planning phase.

21. Pro20: Proper Change Management and Control

Proposed changes: This element should only be included in the beginning stage (initiation and planning) of the scope management knowledge area, as it will be a matter of project governance within the other phases of the project. As this is an important element, which should be monitored very closely, it should be added into the risk management knowledge area, as an element of risk management, to be monitored in all crucial phases of the project.

Response to proposed changes: This item has been omitted from the "implementation" stage, while expanding it into the "initiation" phase of the scope management knowledge area, in addition to the "planning" phase. This item has also been added into the "risk management" knowledge area from the start of the project through the "implementation" phase, but excluded from the "closing" phase.

22. Tec01: Complete set of Agile Practices

Proposed changes: A complete set of agile practices need to be implemented from the beginning, from the project "Initiation" phase, and not just the "Planning" phase.

Response to proposed changes: The element has been expanded into the "Initiation" phase for all 10 knowledge areas.

23. Tec02: Appropriate Technology and Tools

Proposed changes: The appropriate technology and tools is evaluated either before the start of the project, or at the initiation phase, and should be used throughout the project, from the "planning" phase to the "closing" phase.

Response to proposed changes: This element has been expanded into the other phases of the project, to start from the planning phase, covering all subsequent phases of the project, until the closing phase, for all 10 knowledge areas.

24. Tec03: Knowledge on Tools (& Technology)

Proposed changes: This item should not come under the "Resource Management" knowledge area, it should instead be placed under the "Stakeholder" knowledge area, as the knowledge of technology and tools should be possessed by the stakeholders, who should also be kept abreast with the implementation of any new tools, and the emerging technology.

Response to proposed changes: This item has been removed from the "Resource" knowledge area, and added into the "Stakeholder" knowledge area across all project administration phases, from the planning to closing stages.

25. Tec05: Software supporting Agile methods

Proposed changes: The appropriate software supporting the agile methods should be made available throughout the project phases, and not only during the planning and execution phases.

Response to proposed changes: This element has been expanded into the other phases of the project, to start from the planning phase, and cover all subsequent phases of the project, until the closing phase, for all 10 knowledge areas.

The changes described above have also been summarised in Appendix AH (Evaluation feedback on changes to HAT-PMFv1.0), which has been instrumental in the design of version two of the framework (HAT-PMFv2.0).

8.6 Improved Framework (HAT-PMFv2.0)

All the corrections made to the initial framework have been reflected in an interim model (HAT-PMFv1.1), where all additions are indicated in red font, and all deletions are indicated in grey font and crossed out. These changes are shown in Appendix AI (Hybrid Agile-Traditional Project Management Framework version 1.0 (HAT-PMFv1.1) – Interim Model indicating the proposed changes). After a tidy-up exercise, all changes were made permanent to produce the second, and final version of the framework (HAT-PMFv2.0), as shown in Appendix AJ (Hybrid Agile-Traditional Project Management Framework version 2.0 (HAT-PMFv2.0) – Final Model of the Improved Agile Framework). The summary of this improved framework is shown in Appendix AK (Hybrid Agile-Traditional Project Management Framework version 2.0 (HAT-PMFv2.0) – Final Model of the Improved Agile Framework in Summary).

8.7 Best Practice Support Tool

The proposed general document templates are created in MS-Word, MS-Excel and MS-PowerPoint templates respectively as follows:

1. HAT-PMFv2.0.xlsx (MS-Excel spreadsheet)
2. Checklist-Project Initiation Phase v1.0.docx (MS-Word document)
3. Project Charter v1.0.docx (MS-Word document)
4. Project Charter-Presentation v1.0.pptx (MS-Power Point slide)
5. Project Mgmt Plan v1.0.docx (MS-Word document)

6. Governance Mgmt Plan v1.0.docx (MS-Word document)
7. Environment Mgmt Plan v1.0.docx (MS-Word document)
8. Scope Mgmt Plan v1.0.docx (MS-Word document)
9. Scope Statement v1.0.docx (MS-Word document)
10. Requirements Mgmt Plan v1.0.docx (MS-Word document)
11. Schedule Mgmt Plan v1.0.docx (MS-Word document)
12. Cost Mgmt Plan v1.0.docx (MS-Word document)
13. Benefit Realisation Mgmt Plan v1.0.docx (MS-Word document)
14. Human Resource Mgmt Plan v1.0.docx (MS-Word document)
15. Communication Mgmt Plan v1.0.docx (MS-Word document)
16. Risk Mgmt Plan v1.0.docx (MS-Word document)
17. Risks Checklist v1.0.xlsx (MS-Excel spreadsheet)
18. Contract Mgmt Plan v1.0.docx (MS-Word document)
19. Commercial Mgmt Plan v1.0.docx (MS-Word document)
20. Role Inventory v1.0.xlsx (MS-Excel spreadsheet)
21. Issue Mgmt Plan v1.0.docx (MS-Word document)
22. Project Deployment Agreement v1.0.docx (MS-Word document)
23. Requirements Checklist v1.0.xlsx (MS-Excel spreadsheet)
24. Requirements Specification v1.0.docx (MS-Word document)
25. Requirements Mgmt Lifecycle v1.0.pptx (MS-Power Point slide)
26. Project Closeout Report v1.0.docx (MS-Word document)

Based on the feedback from the expert team, a set of general documents templates were created, with the intention of assisting the PM and the project team members, in the administration and management of APs, as shown in Table 8.8.

Table 8.8: Best Practice Support Tool with relevant document templates

Scrum process (Agile)	Sprint Planning meeting: 1) Product Owner solicits input from End-users, Customers, Team and other Stakeholders 2) Product Backlog review 3) Sprint backlog update		Daily Sprint meeting: 1) Review changes 2) Perform changes (if/where required) 3) Issue incremental updates 4) Deliver incremental product			Retrospective: 1) Review delivered products 2) Refine product backlog 3) Update Sprint backlog
Kanban process (Agile)	Pool of Ideas --> Prepare and Select Features		Track Requirements/ Task/Incidents: Backlog, Planned, In-Progress, Developed, Tested, Completed.			
Waterfall Lifecycle Phases (Traditional)	Requirements Analysis		Implementation	Testing	Deployment	Maintenance
PMI Process Groups						
PMI Knowledge Areas	Initiating	Planning	Executing		Monitoring	Closing
(1) Project Integration Management	Checklist-Project Initiation Phase v1.0.docx	Project Mgmt Plan v1.0.docx	Issue Mgmt Plan v1.0.docx			Project Closeout Report v1.0.docx
	Project Charter v1.0.docx	Governance Mgmt Plan v1.0.docx	Project Deployment Agreement v1.0.docx			
	Project Charter-Presentation v1.0.pptx	Environment Mgmt Plan v1.0.docx				
(2) Project Scope Management		Scope Mgmt Plan v1.0.docx	Requirements Checklist v1.0.xlsx			
		Scope Statement v1.0.docx	Requirements Specification v1.0.docx			
		Requirements Mgmt Plan v1.0.docx	Requirements Mgmt Lifecycle v1.0.pptx			
(3) Project Schedule Management		Schedule Mgmt Plan v1.0.docx				
(4) Project Cost Management		Cost Mgmt Plan v1.0.docx				
(5) Project Quality Management		Benefit Realisation Mgmt Plan v1.0.docx				
(6) Project Resource Management		Human Resource Mgmt Plan v1.0.docx				
(7) Project Communication Management		Communication Mgmt Plan v1.0.docx				
(8) Project Risk Management		Risk Mgmt Plan v1.0.docx				
		Risks Checklist v1.0.xlsx				
(9) Project Procurement Management		Contract Mgmt Plan v1.0.docx				
		Commercial Mgmt Plan v1.0.docx				
(10) Project Stakeholder Management		Role Inventory v1.0.xlsx				

The proposed list of document templates have been created based on the limited knowledge and capacity of the researcher, are not exhaustive, and may not be complete, but is expected to provide the project team, especially those new in their roles, a basic and general guide on what is expected within the different phases of the project. It also provides the project team with a guideline of the different types of documents which needs to be created and maintained for all 10 knowledge areas. These documents have been embedded into a document named 'HAT-PMF Toolkit version 1.0', as shown in Appendix AN.

8.8 Guidelines on Framework and Toolkit usage

The improvised framework (HAT-PMFv2.0), as shown Appendix AJ (full version with factor code and description for all factors) and Appendix AK (summarised version with factor code only, without the description for the factors), should be used together with the toolkit (HAT-PMF Toolkit v1.0), shown in Appendix AN. The prospective users of the "Agile Best Practice Framework" proposed in this study, are mainly aimed at the stakeholders managing projects using the agile or hybrid methods. The framework was designed in a generic manner, which also enables it to be used in a traditional PMgmt environment. The PM and the project team members are expected to be the main and direct users of the best practice framework. The customers/clients and vendors/contractors may also be classified as direct users, depending on their respective roles. The executives/leadership team, portfolio managers, program managers, functional managers, and other relevant stakeholders (PMO, designers, technical advisors, agile coach, agile task force, trainer, project consultant), are perceived to be indirect users (illustrated in Figure 8.4).

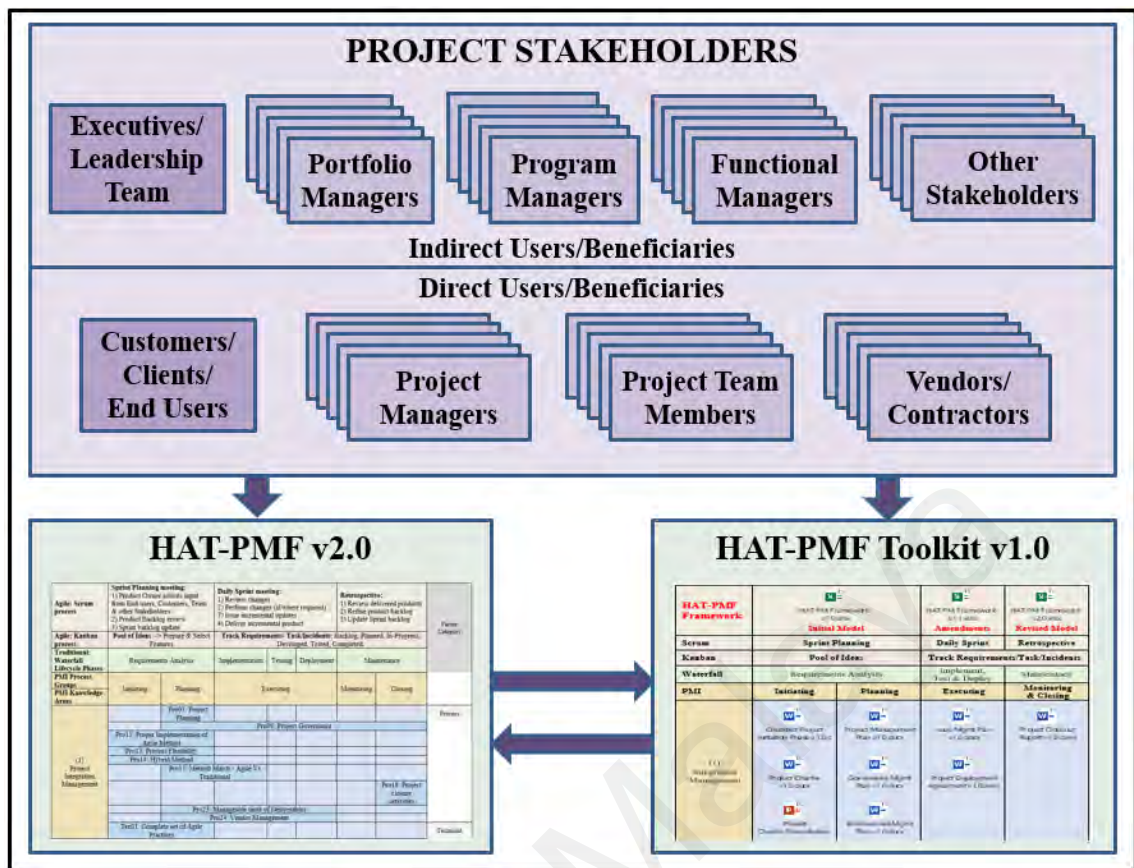


Figure 8.4: Prospective Users (Direct and Indirect) of the Framework and Toolkit

The document templates contained in the HAT-PMF Toolkit itself act as a guide for the users. When traversing the path of the respective projects, the users should refer to the project phases, which they are in, depending on the method they are using, and refer back to the framework (HAT-PMF v2.0) to check the entire column on all the factors they need to be vary of. The respective column in the toolkit (HAT-PMF Toolkit v1.0) will provide them with guidance on what type of documents will be required, and the proposed contents of the respective documents. These are self-explanatory, and the users of the best practice framework are expected to be guided accordingly, and will become familiar with the framework, as they start using it. They are expected to become more familiar with the framework over time, and over more frequent use of the framework.

As an example, when a project is initiated, it should be mapped to the “Initiation” phase of both, the framework, and the toolkit, respectively. All the factors contained within the

initiation phase in the framework (HAT-PMF v2.0) should be considered, for any mitigation required, as described in Section 9.5 (Proposed Mitigation Methods), for all 10 knowledge areas. The respective and applicable document templates for the initiation phase can be found in the Toolkit (HAT-PMF Toolkit v1.0), which are the checklist document (Checklist-Project Initiation Phase v1.0.docx), project charter document (Project Charter v1.0.docx), and the project charter presentation slides (Project Charter-Presentation v1.0.pptx).

8.9 Comparing HAT-PMF with other frameworks

In a broad perspective, the developed framework (HAT-PMF v2.0) were compared with other relevant works in the development of frameworks or models surrounding the IT, or specifically, APs. An analysis was done within 15 identified studies, resulting in findings based on the areas of: **(1)** strategic PMgmt framework (Shenhar, 1999), **(2)** framework for the classification of information systems (IS) methodologies (Iivari et al., 2000), **(3)** PMO framework (Kaufman and Korrapati, 2007), **(4)** framework on understanding organisational PMgmt through a PMO (Aubry et al., 2007), **(5)** agile software process assessment framework (Zhu, 2010), **(6)** agile PMgmt framework (Molhanec, 2010), **(7)** framework for agile transition and adoption (Gandomani and Nafchi, 2015), **(8)** hybrid framework for agile and stage gate model (Conforto and Amaral, 2015), **(9)** agile and stage-gate hybrid model (sommer et al., 2015), **(10)** agile software development maturity framework (Fontana et al., 2015a), **(11)** software outsourcing evaluation framework (Ali and Khan, 2016), **(12)** agile distributed software development framework (Vallon et al., 2016), **(13)** PMO evaluation framework (Szalay, 2017), **(14)** maturity model for scaled agile framework (Turetken, 2017), and **(15)** adaptation of the scrum framework (Hidalgo, 2019).

The description of the respective studies, along with the research gap, in terms of the findings of this research, identifying that none of the proposed framework, or models holistically analyses the issues and challenges in both literature, and the industry, further combining them to produce a best practice framework for the administration and management of hybrid and APs (extended further to include traditional IT projects). The findings have been summarily described and presented in Table 8.9.

Table 8.9: Best Practice Support Tool with relevant document templates

No.	Reference (APA)	Comparison (description, limitation and research gap)
1	Shenhar, A. J. (1999, July). Strategic project management: the new framework. In PICMET'99: Portland International Conference on Management of Engineering and Technology. Proceedings Vol-1: Book of Summaries (IEEE Cat. No. 99CH36310) (pp. 382-386). IEEE.	The paper deals with strategic, cultural, organisational, and operational issues, claimed to be neglected in PMgmt practice and education. The framework is built around three major concepts: (1) style (strategy, attitude, organisation, processes, and tools), (2) adaptation (organisation style against the projects), and (3) continuous learning (self and organisational learning). It doesn't prescribe a model based on best practise, and doesn't provide issue analysis and mitigation.
2	Iivari, J., Hirschheim, R., & Klein, H. K. (2000). A dynamic framework for classifying information systems development methodologies and approaches. Journal of management information systems, 17(3), 179-218.	The paper examines literature on IS development methodologies, proposing a 4-tiered framework: (1) paradigms, (2) approaches, (3) methodologies, and (4) techniques, claiming to provide a deep structure to understand methodologies and approaches, and their interrelationships. The paper also introduces and illustrates a procedure for "accommodating" and "assimilating" new information systems development methodologies. It doesn't include analysis within the industry, prescribe a best practise model, or analysis on the issues to propose mitigation methods.
3	Kaufman, C., & Korrapati, R.B. (2007). A project management office (PMO) framework for successful implementation of information technology projects. Proceedings of the Academy of Information and Management Sciences, 11(1), 1-6.	The paper proposes a PMO Framework for IT projects, proposing 4 elements: (1) Organisational (mandate, charter, scope), (2) Philosophy (results focus), (3) Mechanics (PMO operations), and (4) Domain Competency (Portfolio Mgmt and Project Delivery). It doesn't provide details of the PMgmt issues, its analysis, or mitigation methods.
4	Aubry, M., Hobbs, B., & Thuillier, D. (2007). A new framework for understanding organisational project management through the PMO. International journal of project management, 25(4), 328-336.	The paper presents a theoretical contribution to the study of organisational project management and the PMO, proposing 3 complementary fields: (1) innovation, (2) sociology, and (3) organisational theory, to attain an understanding of the PMO and organisational project management, arguing that a PMO is part of a network of complex relations that links strategy, projects and structures. It doesn't prescribe a best practice framework, or analysis on the issues to propose mitigation methods.

Table 8.9, continued

No.	Reference (APA)	Comparison (description, limitation and research gap)
5	Zhu, J. (2010, July). Study on assessment framework of software process in agile. In 2010 2nd International Conference on Industrial and Information Systems (Vol. 1, pp. 498-501). IEEE.	The paper does an assessment of software process to support agile, based on the agile attributes and a series of competitive bases, identified in literature. The framework is based on an assessment model of: (1) Speed, (2) Flexibility, (3) Innovation, (4) Quality, and (5) Cost, enabling the identification of the agile utilisation trends adopted by organisation in the utilisation of agile software process to gain competitive predominance. It doesn't provide the details of the PMgmt issues, prescribe a best practice framework, or analysis on the issues to propose mitigation methods.
6	Molhanec, M. (2010, May). Agile project management framework. In 33rd International Spring Seminar on Electronics Technology, ISSE 2010 (pp. 525-530). IEEE.	The paper analyses the Object Oriented Software Process PMgmt framework produced by Scott W. Ambler (www.ambysoft.com), aiming to clearly define the phases and stages of the PMgmt process, reflecting the whole product life cycle, based on agile PMgmt. It doesn't prescribe a best practice framework, or analysis on the issues to propose mitigation methods.
7	Gandomani, T. J., & Nafchi, M. Z. (2015). An empirically-developed framework for Agile transition and adoption: a Grounded Theory approach. <i>Journal of Systems and Software</i> , 107, 204-219.	The study develops an agile transition and adoption framework, with the primary characteristics of: (1) iterative, (2) gradual, (3) continuous, and (4) value-based, to determine if they are in line with the Agile approach, regardless of project size, and to help software organisations in achieving Agile transformation. It doesn't provide the details of the PMgmt issues, prescribe a best practice framework, or analysis on the issues to propose mitigation methods.
8	Conforto, E. C., & Amaral, D. C. (2015). Agile project management and stage-gate model—A hybrid framework for technology-based companies. <i>Journal of Engineering and Technology Management</i> , 40, 1-14.	The study conducts an empirical analysis of a hybrid management framework, claiming to balance stability with flexibility, as a potential solution in managing technology-based innovation projects, considering critical aspects of: (1) proper diagnosis of organisational factors and implementation of practices, and (2) alignment of agile project tools with traditional IS. It analyses a limited scope of project issues (factors), but does not provide a holistic analysis of issues and its mitigation methods.
9	Sommer, A. F., Hedegaard, C., Dukovska-Popovska, I., & Steger-Jensen, K. (2015). Improved product development performance through Agile/Stage-Gate hybrids: The next-generation Stage-Gate process?. <i>Research-Technology Management</i> , 58(1), 34-45.	The paper proposes a hybrid process, combining agile (Scrum) and traditional (stage-gate) processes, claiming to offer flexibility, improved performance, and other advantages, based on best practices identified in the industry. It doesn't really perform a holistic analysis on literature to identify the issues, and to propose mitigation methods.
10	Fontana, R. M., Meyer Jr, V., Reinehr, S., & Malucelli, A. (2015a). Progressive Outcomes: A framework for maturing in agile software development. <i>Journal of Systems and Software</i> , 102, 88-108.	The study empirically investigates how agile teams attain maturity, proposing a framework to describe the agile software development maturity process, centred at: (1) the central role of people, (2) key ability to maturity, and (3) improvement based on the outcomes of agile teams, instead of prescribed practices. It concentrates on certain people issues, but doesn't really perform a holistic analysis on literature to identify the issues, and to propose mitigation methods.
11	Ali, S., & Khan, S. U. (2016). Software outsourcing partnership model: An evaluation framework for vendor organisations. <i>Journal of systems and software</i> , 117, 402-425.	The paper analyses the factors involved in the conversion of existing outsourcing relationships to partnerships, in literature, presenting an evaluation framework for vendor organisations. It doesn't holistically analyse all the issues and mitigation methods in literature, except for the vendor related issues.

Table 8.9, continued

No.	Reference (APA)	Comparison (description, limitation and research gap)
12	Vallon, R., Strobl, S., Bernhart, M., Prikładnicki, R., & Grechenig, T. (2016). ADAPT: A Framework for Agile Distributed Software Development. <i>IEEE Software</i> , 33(6), 106-111.	The paper proposes an agile distributed framework, as a guide on the implementation of agile practices in distributed environments, analysing challenges in the areas of: (1) coordination, (2) control, and (3) communication. It only covers these 3 aspects, and is not a holistic study on all aspects of issues of APs.
13	Szalay, I., Kovács, Á., & Sebestyén, Z. (2017). Integrated framework for project management office evaluation. <i>Procedia engineering</i> , 196, 578-584.	The paper proposes an integrated framework to analyse PMOs, containing: (1) processes, (2) maturity, (3) context, (4) services, (5) performance, and (6) typology. to foster better understanding of PMOs. It doesn't particularly focus on issues of Aps, and the mitigation methods to attain project success.
14	Turetken, O., Stojanov, I., & Trienekens, J. J. (2017). Assessing the adoption level of scaled agile development: a maturity model for Scaled Agile Framework. <i>Journal of Software: Evolution and process</i> , 29(6), e1796.	The paper develops a maturity model for the Scaled Agile framework (SAFe) in terms of: (1) collaborative, (2) evolutionary, (3) Effective, (4) Adaptive, and (5) Encompassing. It is expected to provide guidance on the adoption of SAFe, in terms of : (1) assessing progress, (2) establishing a roadmap, and (3) level of adoption. However, it doesn't provide a holistic analysis on the issues and mitigation methods of APs.
15	Hidalgo, E. S. (2019). Adapting the scrum framework for agile project management in science: case study of a distributed research initiative. <i>Heliyon</i> , 5(3), e01447.	The paper explores the adoption of the scrum framework in software development projects, in terms of: (1) method, (2) practice, and (3) tools, analysing the contribution to collaborative management and coordination of tasks in research processes, concluding the requirement as: (1) flexibility, and (2) progressive learning. It is specific to a research environment, and not reflective of the industry, and it does not provide a holistic analysis of the issues and mitigation methods for a broader perspective of agile methods.

8.10 Summary

The purpose of this study, as defined in Chapter 1 (Section 1.4), has been partially addressed in the previous chapters. The issues and challenges of APs discussed in literature (Chapter 4), and identified within the industry practitioners (Chapter 5), were described, and the findings from both research methodologies were discussed. The gaps between the findings in literature (SLR) and the findings from the industry practitioners (GT), fulfilled the first objective of this study. The second objective was also fulfilled with the identification and verification of the mitigation methods, leading towards the formulation of the best practice framework. To fulfil the third and final objective, an

evaluation model, previously used by Motorola, was adapted, and used to assess the proposed pilot best practice framework (HAT-PMF v1.0), to produce an improvised version of the framework (HAT-PMF v2.0). The evaluation of the pilot framework was done with a panel of experts in the field of PMgmt, in both traditional and agile methods. The evaluation method, the results of the evaluation, along with the demographics of the evaluation team (expert review team), has been described in this chapter. The proposed improvements by the expert review team were used to produce the improvised framework (HAT-PMF v2.0), along with a toolkit (HAT-PMF Toolkit v1.0), which can be used as guidance by the PMgmt practitioners, to assist in the administration and management of agile, traditional or hybrid projects.

The next chapter (Chapter 9) discusses the validation of the improvised framework, with the relevant findings analysed, discussed, and documented. The final chapter (Chapter 10) concludes this thesis by responding to the ROs, answering the RQs, describing the contributions of the thesis, and concluding this research study with the limitations of this research and proposed future work.

CHAPTER 9: VALIDATION OF THE FRAMEWORK (HAT-PMFv2.0)

9.1 Overview

The improvised framework (HAT-PMFv2.0), which was previously evaluated (Chapter 8), will be validated by a panel of experts. Out of the 12 experts selected for the validation, only eight of them were able to participate. Finstad (2010) proposed the use of a 7-point scale for a greater level of accuracy, ease-of-use and to produce a better reflection of the participants' true evaluation. A 7-point Likert scale analysis was used, where each panellist were required to answer a questionnaire consisting of 60 questions (Appendix AL). The panellist were guided by the researcher, when filling out the questionnaire, through one-to-one interview sessions. The results were tabulated in a MS-Excel spreadsheet, where an analysis will be conducted, with discussions on the findings, which will be documented, with a summarised conclusion.

9.2 Validation through an Expert Panel

This section presents the results of the validation process, using an expert panel team, which was done via a questionnaire survey. The following sub-section describes the selection and participation process of the expert panel team, and discusses the demographic information of the expert panel team.

9.2.1 Selection of the Expert Panel Team

The researcher shortlisted and invited 67 experts based on the minimum criteria as follows:

1. Minimum of 15 years of overall working experience.
2. Minimum of 10 years of experience in managing projects.
3. Minimum academic qualification of a Bachelors' Degree.
4. Certification in PMgmt (PMP, Prince2, or equivalent).
5. Currently working within the IT industry or within the department directly providing IT services within the organisation, to the parent company, or to the client organisation.

Out of the total of 67 experts invited, only 12 of them responded with a willingness to participate. Out of the 12 respondents, only eight of them were able to attend the scheduled one-to-one interview sessions in filling out the questionnaire. The remaining four persons declined, mainly due to time constraints. The interview sessions were conducted online, through the available and preferred video conferencing facilities by the respective experts (i.e. Zoom meeting, Google-Meet, WhatsApp, Viber, and Telegram). The duration of each interview session was about two hours on average. As some of the experts had work commitments, the sessions were split into two or three sessions accordingly, to suite their individual work schedule.

9.2.2 Demographics of the Expert Panel Team

The demographics of the expert panel team, consisting of eight experts, are tabulated in Table 9.1, who are respectively name-coded as Expert 1 (E1) to Expert 8 (E8). Their names and the organisation they are from are not shown due to confidentiality purposes. All of the experts conform to the minimum requirements set out in the previous section (Section 9.2.1) based on self-declared information. The researcher recorded the information as dictated by each expert, employing trust and professionalism, as they are

all deemed professionals, and SMEs, hence the researcher did not attempt to verify the details (qualifications, certifications, experience and organisation) further.

Table 9.1: Demographic Data of the Expert Panel team

Expert Code	Highest Academic Qualification	Certification	Job Title/Role	Experience (Years)		Industry	Function
				Total	PM		
E1	Masters' Degree	PMP, PgMP, PMI-ACP, Prince2	Program Manager	23	15	Logistics	IT Shared Services
E2	Masters' Degree	BCS, Prince2	Program Manager	25	12	Computer Equipment Manufacturer	IT Shared Services
E3	Bachelors' Degree	Prince2	Head of IT	20	10	Oil and Gas	IT Shared Services
E4	Bachelors' Degree	PMP, PgMP, PMI-ACP	Head of PMO	28	16	Telecommunications	IT Services
E5	Masters' Degree	PMP, Prince2	Head of IT Projects	22	12	Banking and Finance	IT Shared Services
E6	Masters' Degree	PMP, PgMP	Program Manager	22	12	Business Investment Services	IT Services
E7	Bachelors' Degree	PMP	Project Director	19	13	IT Infrastructure Services	IT Shared Services
E8	Masters' Degree	PMP, PgMP, PfMP, PMI-ACP	Project Director	22	15	Telecommunications	IT Services

As elaborated in Figure 9.1, the experts are all holders of a formal university degree, where five out of eight of them (62.5%) have a Masters' Degree, while the remaining three experts (37.5%) possess a Bachelors' Degree as the highest academic qualification.

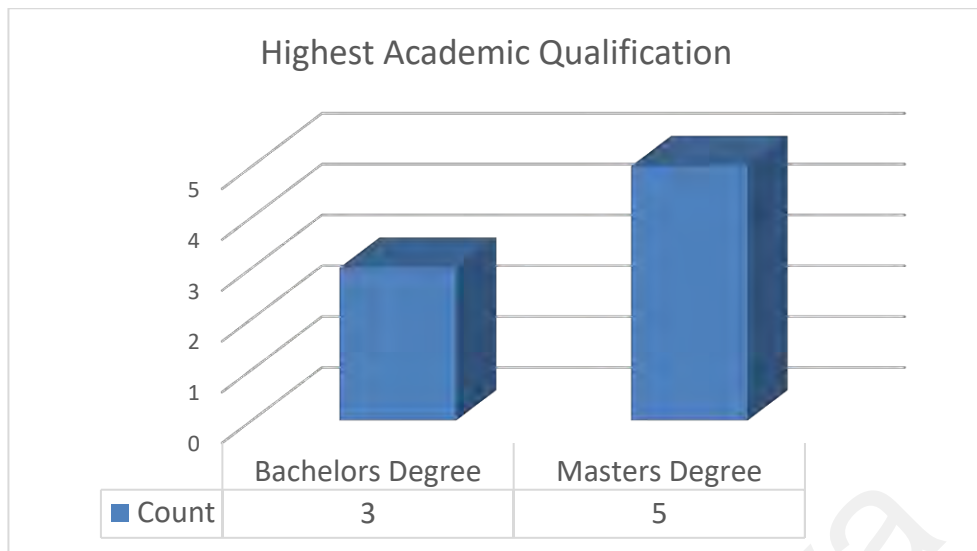


Figure 9.1: Highest Academic Qualifications (self-declared) held by the Panel of Experts

All of the experts possess certification credentials in PMgmt, as shown in Figure 9.2. Out of the eight experts, six of them (75%) have a PMP (Project Management Professional) certification, out of which, four of them (50%) are additionally certified in Program Management (PgMP), with one expert (12.5%) possessing the Portfolio Management (PfMP) certification and three experts (37.5%) possessing the Agile Certified Practitioner (PMI-ACP) certification. The other three experts are minimally certified in Prince2, however four of the experts (50%) possess a Prince2 practitioners certification.

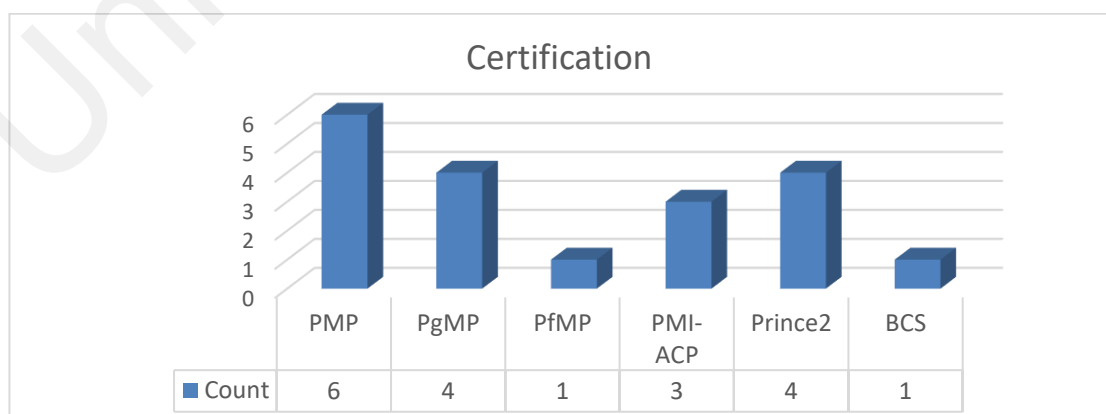


Figure 9.2: Relevant Certifications (self-declared) held by the Panel of Experts

Figure 9.3 shows the Job Title or Role the experts hold in their respective organisation, where all of them are in a senior management position, at the minimum.

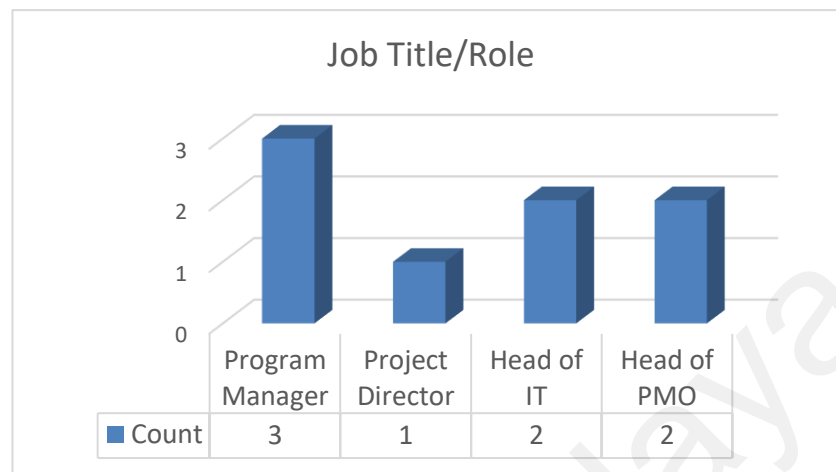


Figure 9.3: Job Title/Role held by the Panel of Experts in their respective organisations

Three of them (37.5%) hold the position of “Program Manager”, while one person (12.5%) holds the position of a “Project Director”. Four experts (50%) are heads of their particular departments, with two of them (25%) with the position of “Head of PMO” and another two of them (25%) with the position of “Head of IT”. They are all within the IT service portfolio, responsible for the delivery of IT services, either to their own organisation, or to their client organisation, as shown in Figure 9.4.

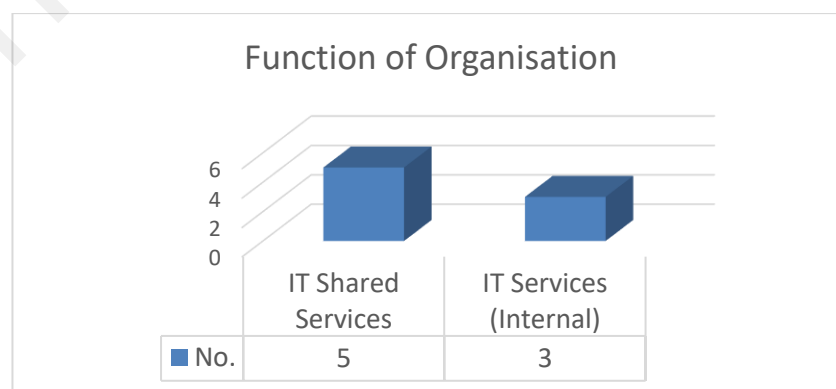


Figure 9.4: The function of the organisation of the respective Panel of Experts

Figure 9.5 illustrates the industry in which, the organisations, in which the experts are working for, are categorised in.

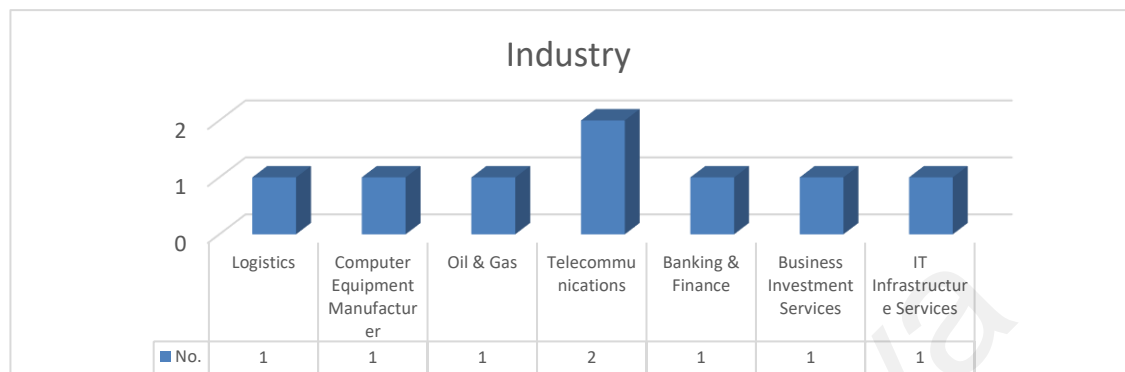


Figure 9.5: Industries of the relevant organisations of the respective Expert Panel of Experts

Two experts (25%) are from the Telecommunications industry, while the rest of them are from the other respective industries (12.5%) which are the Logistics, Equipment Manufacturing, Oil and Gas, Banking and Finance, Business Investment, and IT Infrastructure Services industry. None of the experts are from the same organisation, however, the researcher is not able to confirm if they have worked with each other in the past, or know each other presently, as this was not discussed with the experts during the one-to-one interview sessions, and in the various communication sessions held (email, phone, messaging, video conferencing).

As shown in Figure 9.6, all the experts have a minimum of 10 years of experience in the field of PMgmt, with a minimum of 15 years of overall industrial experience. All of the experts are from large organisations (more than 200 employees), which have international presence, and classified as Multi-National Companies (MNCs). This had provided the researcher with confidence of the review process, and assurance of the feedback received in the questionnaires, to be of good value and quality. The expert review team had, during the time of the validation, a combined total overall working experience of 181 years, and

105 years of experience in the field of PMgmt. This is considered a very high and sufficient number of years of overall working experience, contributing to the validation process of the framework. On average, the experts have 23 years of overall working experience and 13 years of years of experience in PMgmt.

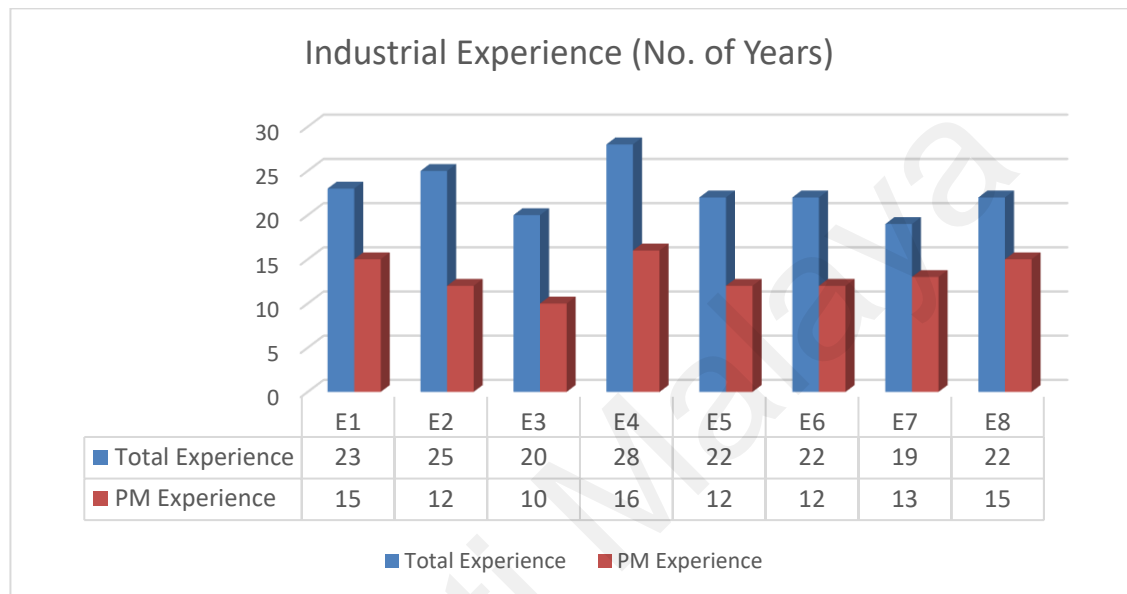


Figure 9.6: Duration (years) of experience attained by the Panel of Experts

9.3 Analysis of the Results

The questionnaire consist of 60 questions (Appendix AM), with 10 questions each on each identified criteria's. There are a total of 10 identified criteria's, adapted from Beecham et al. (2005), Nasir et al. (2015), and Kihn and Ihantola (2015), as follows:

1. Relevance: The level of which the framework appears relevant to the organisation and the respective functions.
2. Usefulness: The level of usefulness of the framework within the organisation and the functional areas.
3. Practicality: The level of practicality of the framework.

4. Applicability: The level of applicability of the framework to the organisation and its operational processes.
5. Appropriateness: The level of appropriateness of the framework towards the objectives of the organisation.
6. Consistency: The level of consistency provided by the framework.
7. Understandability: The amount of effort required in understanding of the framework.
8. Ease-of-use: The level of ease provided by the framework in its utilisation.
9. Adaptability: The level of adaptability of the framework to the organisational culture and practices.
10. Adherence: The level of adherence of the framework to the existing processes and policies of the organisation.

Each of the 10 criteria's above were mapped against six organisational perspectives, based on the group of most prominent users and prospective beneficiaries of the framework. The acceptance of the framework by individuals may influence the adoption of the organisation, and the preparedness of the organisational may facilitate the acceptance of the individuals (Shin and Hwang, 2017). The validation is designed to cover these aspects, so that both, top-down and bottom-up perspectives can be considered, as follows:

1. Organisation – the perspectives from the Organisational level.
2. Leadership Team – the point of view of the leadership or executive team.
3. Management Team – the senior or mid-level management team who are either heading departments or responsible for a function or portfolio within the organisation.

4. Project Manager (PM) – the PM responsible and accountable for the delivery of projects.
5. Project Team – the project team who are actively involved in the day-to-day operational activities of the projects within the organisation/function/department.
6. Customer/Client – the customer or client who can also be the user or sponsor of the projects, or the product manager or business counterpart with responsibilities of the end products to be produced by the projects.

The mapping between the 10 criteria's against the six organisational perspectives are shown in Figure 9.7.

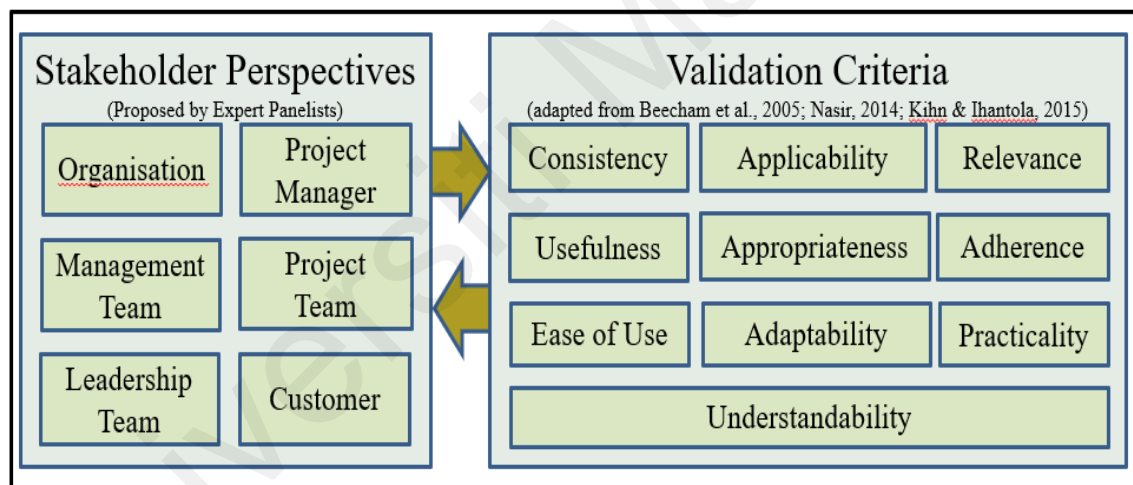


Figure 9.7: Mapping of the 10 Criteria's against the 6 Perspectives

The matrix of each scenario-perspective combinations, with each of them producing one question, formed the questionnaire with a total of 60 questions (10 scenario's X 6 perspectives = 60 questions). Each expert was required to fill out the questionnaire of 60 questions, guided by the researcher at every step of the process, to ensure the questionnaire was well understood and answered as accurately as possible. This action was taken by the researcher to minimise the error rate and wastage, while maximising the contact time between the researcher and each of the experts, and to provide an opportunity

to discuss the questions and attain the most accurate response from the experts. Based on the original questionnaire with the questions organised based on the perspectives, the corresponding results from the experts are shown in Figure 9.8 as a consolidated view.

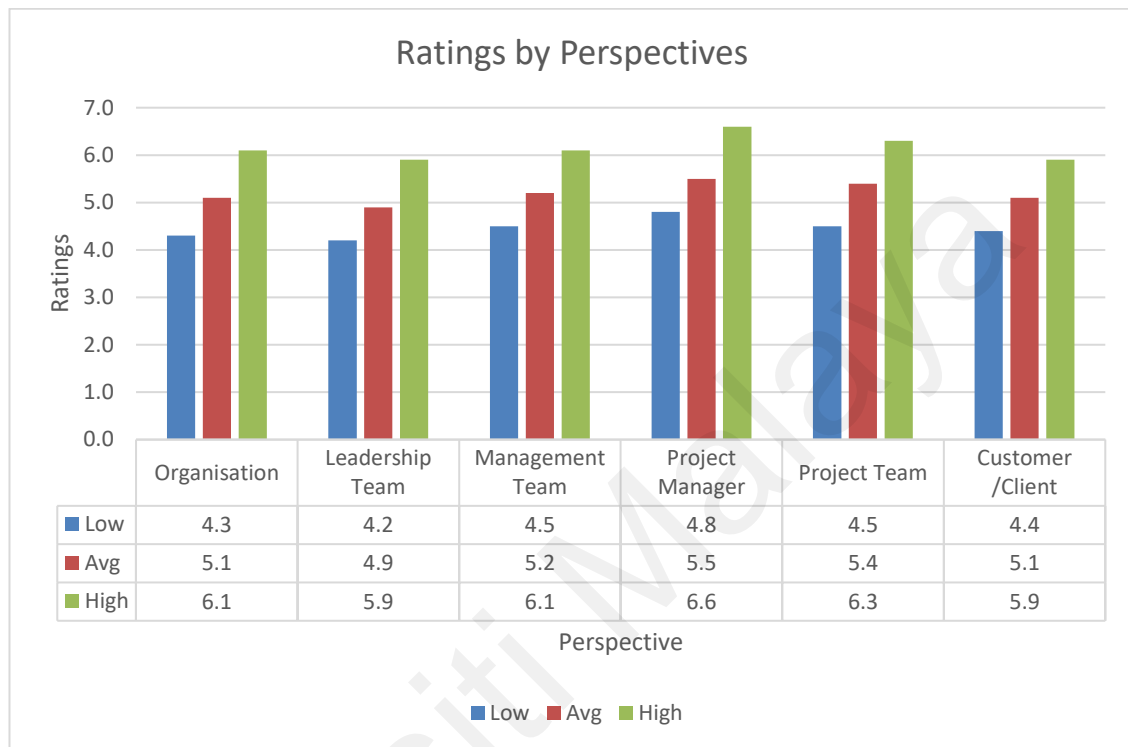


Figure 9.8: Ratings obtained from the Panel of Experts based on Perspectives

Based on the analysis on the results, the following is deduced:

1. The PM (average rating of 5.5) will be the most affected, and also can be deemed as the greatest beneficiary of the framework if it was implemented within the organisation. The PM is also seen as the person who mostly desires project success.
2. The project team members (average rating of 5.4) are the second most impacted group, and are also regarded as a group which will benefit mostly from the guidelines offered by the framework.
3. The third ranking are the management team (average rating of 5.2), where in this instance, are seen to be in support of the framework, and may be the group of people who will champion the implementation, and drive the change.

4. The overall organisation, with an average ranking of 5.1, shows that they are keen on the change and have an appetite for the implementation of the framework, but there may exist certain sectors of people, or functional departments, that do not see the benefit of the framework.
5. The customer or the client also scored an average ranking of 5.1, seen to be at the similar level of the overall organisation, and will probably require a certain level of motivation in order to be convinced of the benefits of the framework for best practice.
6. The leadership team scored an average rating of 4.9, which is the lowest amongst the other perspectives, indicating that the leadership team may either, not be aware of the issues within the project teams, or may need to be convinced of the benefits that a process change may yield. The leadership team may also be sceptical on new processes, due to the burden of additional investments, unless they are made to understand the benefits, and believe that the benefits will supersede the investment efforts and financial commitments.

To summarise the rating results based on the perspectives, the PM, project team and management team are seen to be most aware of the PMgmt methods and processes, and are also the group of people, who are seen to be looking for effective and efficient ways of managing and delivering the projects, with greater success rates.

Figure 9.9 shows the ratings based on the criteria's of validation. Based on the average ratings received, "Consistency" appears to be the most popular, and demanding (average rating of 5.4). "Applicability" and "Relevance" both scored an average rating of 5.3 each, indicating that there is a demand for a framework, which is both relevant and applicable to the existing processes, while demanding its cultural fit into the organisation. "Usefulness", "Appropriateness" and "Adherence" ranked 5.2 each on average,

indicating the demand the next level of priority in the implementation of the best practice framework. “Ease-of-use” and “Adaptability” scored an average ranking of 5.1 each, being the second lowest ranking. “Practicality” and “Understandability” both ranked an average rating of 5.0 each, which is the lowest ranking amongst the 10 criteria’s.



Figure 9.9: Ratings obtained from the Panel of Experts based on Criteria’s

9.4 Findings

Based on the discussions held with the experts on reviewing the summarised feedback of the ratings, the following has been deduced, based on the six organisational perspectives:

1. The PM is the most impacted when it comes to methods and processes, and he/she is also the most concerned for project success.
2. The project team are committed in delivering successful projects and will acquire any kind of guidance, to achieve greater success rates of executing and delivering projects.

3. The management team are also very concerned on the deliverables of the respective functional departments, showing that they rely heavily on project delivery, which impacts their departmental or functional performances.
4. The PM, project team and management team will support changes to the method or processes, and will welcome best practice advise in order to be more productive.
5. The leadership team may not be aware of the precise benefits that will be offered by a best practice framework. The PM and the management team are mainly responsible in ensuring that the leadership team are aware of the benefits of the improvised methods and processes, and that it may offer long term cost savings.
6. The customer or the client may also not be aware of the direct benefit of the implementation of an improvised method, or a best practice framework. Again, the PM and the management team would probably be best placed, in ensuring their support is obtained, in convincing them of the many benefits they may be obtaining.
7. A good level of communication and awareness needs to be created within the organisation, for them to accept changes. They are believed to be supportive in the implementation of new or improvised processes or methods, provided they are aware of the benefits it would offer them. They need to be convinced of the long term benefits, as process implementation normally does not yield short term benefits.
8. Looking at the overall picture, it may be a good and timely idea to empower a dedicated team in spearheading the review on the processes and methods and the implementation of the best-suited method and process. These group of people should actively liaise with the organisation in a systematic manner before, during and after the implementation process, and continue to render support to the project stakeholders, as a standard suite of service offering (i.e. through a PMO).

The analysis on the 10 criteria's are summarised in Figure 9.10.

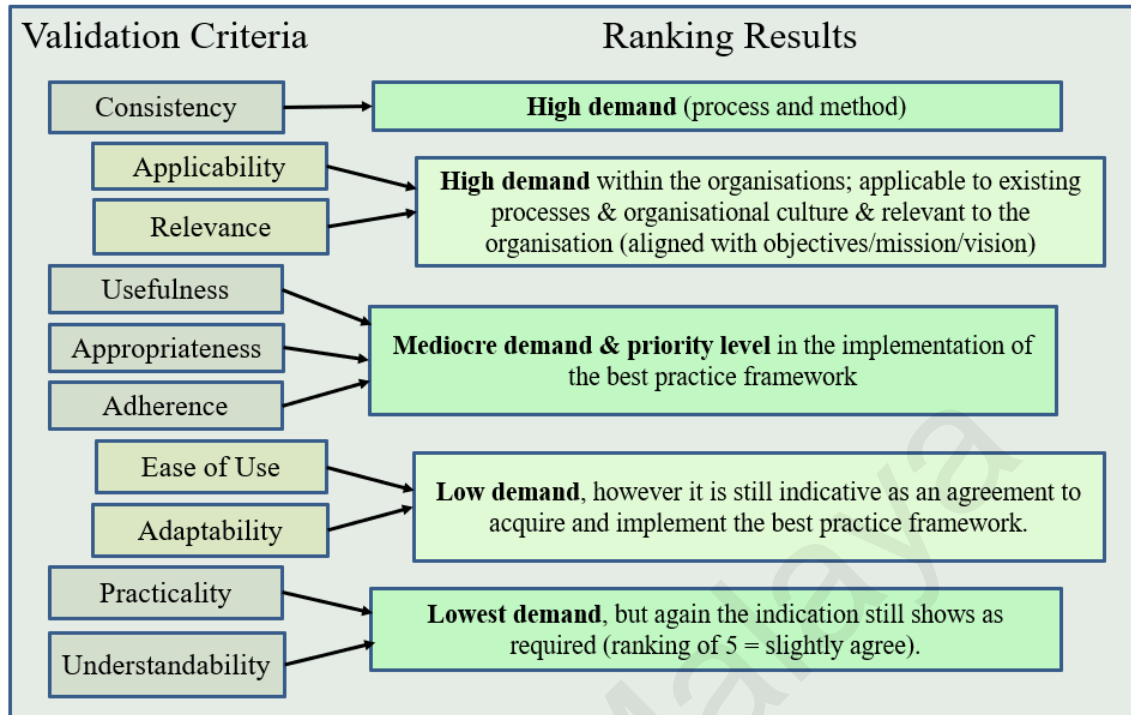


Figure 9.10: Overall ranking results based on the 10 Validation Criteria's

Based on the discussion with the expert panel members, they can be summarised as follows:

1. There is a high demand for “Consistency” in the process and method,
2. There is also a high demand for “Applicability” and “Relevance” within the organisations. The processes should be applicable to existing processes and the organisational culture, and also relevant for the organisation, aligned with the organisational objectives, mission and vision.
3. “Usefulness”, “Appropriateness” and “Adherence” all have a mediocre demand and level of priority in the implementation of the best practice framework.
4. “Ease-of-use” and “Adaptability” didn't mark the highest ranking, however it is still indicative as an agreement to acquire and implement the best practice framework.
5. “Practicality” and “Understandability” ranked the lowest, but again the indication still shows as required (ranking of 5 = slightly agree).

6. Overall, all scenario's scored a minimum of 5, indicating that it is important and is deemed helpful in the organisation.

9.5 Proposed Mitigation Methods

Multiple rounds of discussions were held with the experts to obtain feedback on mitigation methods for all the possible issues and challenges (factors) included in the HAT-PMFv2.0 best practice framework. The suggested mitigation methods were combined and re-arranged according to the 10 PMI knowledge areas, and against the relevant factors impacting the respective knowledge areas. The compiled mitigation methods were discussed with all eight experts through multiple rounds of meetings until a point where all proposed mitigation methods were agreed upon and accepted by all eight experts. The first round of discussion contained the proposed mitigation methods for all 55 factors. Based on the agreement by the experts, the accepted mitigation methods were removed from the list, while the disputed mitigation methods were retained on the list for the next round of discussion. The necessary amendments were made to cater for additional comments from the experts, and the amended mitigation methods were used in the following discussion session to obtain agreement from all the experts. Several rounds of discussions were held until all the mitigation methods were accepted by all eight experts. The consolidated proposed mitigation methods, which have been agreed to and accepted by all experts, are listed and described in the following sections.

9.5.1 Mitigation Methods – Project Integration Management

The following mitigation methods were proposed by the expert review team, for the factors impacting the “Project Integration Management” knowledge area. Based on the overall discussions held with the experts, project planning is deemed to be the most

important function in a project. Both agile and traditional projects require planning. Literature has discussed that planning can also be extensive for APs, even if not expected to be, hence the planning function should not be underestimated or downplayed.

Table 9.2: Consolidated Proposed Mitigation Methods within the Integration Management Knowledge Area.

Code	Factor	Proposed Mitigation Method (Integration)
Pro03	Project planning	The integration of the project needs to be planned properly for all areas of the project (i.e. scope, schedule, cost, quality, resource, communication, risk, procurement and stakeholder) as much as possible at the early stages of the project. Identify corresponding risks for all the areas which applies to avoid surprises at later stages of the project. Involve the relevant project stakeholders (i.e. budget holder, product owner, PM, project team), identify and interact with SMEs and keep the product owner abreast of the crucial elements of the project.
Pro09	Project governance	It is crucial to ensure proper project governance is adhered to at the planning stage itself, and throughout the project while progressing the project. Governance should be adhered to at every stage of integration of the project.
Pro11	Proper Implementation of Agile Method	Whichever agile method chosen (i.e. Scrum, Kanban, XP, FDD, LSD, ASD, Crystal Methodology), or a hybrid method incorporating traditional methods (i.e. waterfall, PMBOK) need to be implemented properly, and followed systematically. The integration of project elements should adhere to the implemented method.
Pro13	Process Flexibility	The processes contained and dictated by the selected methodology should be flexible enough to allow the flexibility in performing project integration work (combining elements of project deliverables as they are produced, completed, testes and implemented in stages).
Pro14	Hybrid method	For projects that doesn't really work well in either a complete conventional or agile environment, a customised hybrid method would be well suited. Once implemented, the method should be followed through on all project integration efforts.
Pro15	Method Match - Agile Vs Traditional	The projects should be evaluated based on the type, their size, scope and other parameters to determine the most appropriate method to be implemented. The selected method could either be a pure conventional method or an agile method, or a sensible combination of both to produce a customised hybrid method, which should be aligned with the project integration requirements.
Pro18	Project Closure Activities	Project closure activities may include capturing lessons learnt, identifying the mistakes endured in the project along with how they can be improved, generally capturing what can be done better through the experience gained, while documenting them to make them available as reference material for future projects. The necessary time and resources need to be anticipated, allocated, and budgeted for at the beginning of the project, and throughout all stages of project integration.
Pro23	Manageable Units of Deliverables	The deliverables must be of the right size which should be measurable. The unit of deliverables need to be managed effectively and efficiently within all of the integration activities of the project.
Pro24	Vendor Management	During the crucial stages of project integration, the vendors and contractors need to be aligned and managed properly, according to the established method and principles dictated by the implemented methodology.
Tec01	Complete set of agile practices	The appropriate and complete set of agile practices should be followed as dictated by the selected methodology. In the case of a hybrid method, the employed agile principles should be used accordingly. These agile practices need to be closely followed during every stage of project integration to attain a maximum level of project success.
Tec02	Appropriate technology and tools	Employing the use of appropriate technology and tools will enable better capabilities of managing a project, especially an AP, or its hybrid counterpart. The proper tools will help in the integration of the various components of the project deliverables in enabling the process to be more effective and efficient.
Tec05	Software (tool) supporting Agile methods	Due to the nature of APs, which are fast phased and change oriented, software support will likely enhance the administration and management of APs. The appropriate software should be made available to support the integration of project deliverables.

9.5.2 Mitigation Methods – Project Scope Management

The following mitigation methods were proposed by the expert review team for the factors impacting the “Project Scope Management” knowledge area.

Table 9.3: Consolidated Proposed Mitigation Methods within the Scope Management Knowledge Area.

Code	Factor	Proposed Mitigation Methods (Scope)
Org10	Business Vision	There should be a clear business vision which supports the scope of the project and the changing nature of APs. These should be documented in the business case. If the organisational vision supports the implementation of an agile method to support its core and/or business objectives, it will be easier to implement the agile methodology.
Peo09	Stakeholders welcome (embrace) change	The project team should be open to new ideas, concepts, tools and technology. They should be open to accepting manageable change, and have the ability to align the project accordingly (i.e. schedule, budget, requirements, scope). There should be a cultural alignment and an open mindset to embrace change willingly. As the agile method facilitates frequent change, the team need to be educated on the characteristics of APs and invoke their willingness to accept change without resentment. All relevant stakeholders involved in managing scope change should have a similar understanding and should have hand in hand to agree on scope changes and align the requirements and project deliverables accordingly.
Pro01	Project scope	Scope is captured at the initial stage of the project and is used as input towards the formulation of the requirements. Scope change is inevitable in an agile environment, hence the project stakeholders, especially the project team members need to have the flexibility to accept and embrace changes in scope at various stages of the project. However, scope creep need to be controlled as there is a tendency for the customers to feel that an AP should accept changes consistently, however, due consideration need to be given to the schedule and cost of the project, with possibilities of variations for the demand of project resources. Upfront engagement with the customer is required to set and balance the expectations of scope creep against increasing costs and timelines. It is important that the scope definition be established, and the initial scope clearly documented, with subsequent changes documented with alignment against the schedule and cost, to be agreed by the customer. Checkpoints can be created at different stages of the project describing the impact of scope change at different stages. There will typically be minimum impact on scope change during the initiation and planning stages, and to the contrary, a maximum impact during the testing and implementation stages. The customer or client need to be educated on the repercussions and consequences of scope change, which may most likely impact the project cost and schedule. All scope changes should be documented clearly, with sign-off from the customers or clients agreeing to the impact it may cause the project. The agile team can be flexible to determine and accept minor changes which doesn't have an adverse impact on the team's performance, budget, resources and milestone of the project. Scope changes should be tied to a contractual agreement and managed very carefully.
Pro02	Project requirements	The requirements need to be carefully derived from the project scope, to ensure it meets all angles of the customers' requirements, well documented to be able to track changes properly and completely. All changes need to be tied to the associated impact on the project, documented and presented to the customer for agreement. Scope creep is a very important element in the risk register, which should be given high importance and handled with utmost care.

Table 9.3, continued

Code	Factor	Proposed Mitigation Methods (Scope)
Pro03	Project planning	Capture the project scope, and plan the elements carefully, leading towards the creation accurate requirements. Resources need to be planned based on the scope of the project. Prepare for scope-change situations and include as a risk item in the risk register, tracking it frequently to ensure all other elements associated to scope change are captured (i.e. requirements, budget, schedule, scope). Involve the product owner, especially on owning the budget and schedule, being responsible for budget and schedule overruns when the project scope changes.
Pro08	Complete project visibility	Consistent and timely project updates with complete project visibility, it will be easier to manage the scope and any subsequent scope changes.
Pro09	Project governance	It is crucial to ensure proper project governance is adhered to at the planning stage itself, and throughout the project while progressing the project. Project scoping is done at the beginning of the project, and scope changes need to be tracked throughout its lifecycle in accordance with the methodology used to manage and administer the project.
Pro11	Proper Implementation of Agile Method	The initial project scope and subsequent changes should be administered according to the processes dictated by the implemented methodology.
Pro13	Process Flexibility	The processes contained and dictated by the selected methodology should be flexible enough to allow scope changes to be managed easily, and in a flexible manner.
Pro14	Hybrid method	For projects that doesn't really work well in either a complete conventional or agile environment, a customised hybrid method would be well suited. Once implemented, the correct process as dictated in the customised hybrid method need to be followed on capturing scope changes, and tracking it against the cost, resource and schedule changes.
Pro15	Method Match - Agile Vs Traditional	The selected method should be aligned with the project scoping and re-scoping (for scope change) requirements.
Pro18	Project Closure Activities	Project closure activities, including mistakes endured in the project, methods of preventing the mistakes, what can be done better through the experience gained,, and lessons learnt need to be documented to have them available as reference material by future projects. These activities need to be included as part of the overall scope of the project.
Pro20	Proper Change Management and Control	As APs are expected to change frequently, a proper set of controls need to be in place to track changes against the cost, timelines, resourcing needs, quality of deliverables, and other components. These components need to be captured in the scoping exercise at the beginning of the project, documented and managed.
Pro23	Manageable Units of Deliverables	The project deliverables need to be broken down into manageable units from the scope from the project, progressing into requirements of the project, turning them into manageable units of work consisting of manageable and measurable tasks and activities.
Tec01	Complete set of agile practices	The implemented agile practices need to be closely followed when capturing the initial project scope, and throughout the project, especially when there are scope changes in subsequent phases of the project.
Tec02	Appropriate technology and tools	Employing the proper tools may help in the task of managing scope creep and the changing requirements more effectively and efficiently.
Tec05	Software (tool) supporting Agile methods	The appropriate software should be made available to support the changing nature of the scope and requirements.

9.5.3 Mitigation Methods – Project Schedule Management

The following mitigation methods were proposed by the expert review team for the factors impacting the “Project Schedule Management” knowledge area.

Table 9.4: Consolidated Proposed Mitigation Methods within the Schedule Management Knowledge Area.

Code	Factor	Proposed Mitigation Methods (Schedule)
Pro03	Project planning	The schedule will be planned against the scope and requirements. Plan the schedule against all possibilities, incorporating the necessary buffer on risk acceptance or mitigation efforts. Include schedule overrun as a risk item and track it closely, involving the product owner so that he/she will be aware of the consequences of scope change during the project execution stage. Involve the product owner on owning the schedule, being responsible for a schedule overrun when the project scope and requirements are altered.
Pro04	Progress tracking and reporting	Maintenance of a proper and complete project schedule incorporating all project elements with the necessary buffer is required from the beginning through completion of the project. The schedule should be communicated to all relevant stakeholders, and their understanding need to be secured to ensure their expectations are controlled. The specific requirements demanded by the agile method (i.e. sprints for the Scrum method) need to be incorporated into the schedule, allocating time for daily meetings, communication sessions, anticipated scope creep and changing requirements. The project team need to be briefed, coached and guided on the traits of maintaining and controlling a proper project schedule. The project lead should track all schedule changes against impact on resources, investment decisions and variance on expenditure.
Pro07	Timely reporting	Reporting in an AP environment should be timely, more frequent, less formal, brief and concise, to enable any alarms and disparities to be raised at the soonest possible time, to the relevant stakeholders, for a quick turnaround of decisions. The reporting contents, method and frequency should be agreed and tabulated into the schedule as a regular activity and deliverable.
Pro08	Complete project visibility	Consistent and timely project updates with complete project visibility, it will be easier to manage the project schedule, keeping track of scope changes as they occur.
Pro09	Project governance	Project timelines need to be tracked as frequently as required by the method used, more often for APs, and reported on a timely basis to the various stakeholders.
Pro11	Proper Implementation of Agile Method	The initial project timelines and all changes to the schedule due to scope or other changes should be administered according to the processes dictated by the implemented methodology, along with the suggested tools.
Pro13	Process Flexibility	The processes contained and dictated by the selected methodology should be flexible enough to allow a flexible project schedule, with appropriate buffers, to be able to adjust the timelines while still being focused on the quality of the deliverables, and the cost of the project.
Pro14	Hybrid method	The correct process as dictated in the customised hybrid method need to be followed on capturing changes on timelines, and tracking it against the scope, cost and resource changes.
Pro15	Method Match - Agile Vs Traditional	The selected method should be aligned with the project scheduling requirements.

Table 9.4, continued

Code	Factor	Proposed Mitigation Methods (Schedule)
Pro17	Prioritisation and Scheduling	The project activities need to be broken down to manageable components of tasks. The conventional approach of a work breakdown structure (WBS), or similar approaches can be used to break down bigger tasks into smaller tasks. Each task need to be prioritised and charted against the project schedule, which should then be monitored for progress status towards completion, reprioritising as per the prevailing project, business, industry and organisational demands.
Pro18	Project Closure Activities	Project closure activities may include capturing lessons learnt, identifying the mistakes endured in the project along with how they can be improved, generally capturing what can be done better through the experience gained, while documenting them to make them available as reference material for future projects. This activity need to be factored into the schedule in the beginning of the project itself.
Tec01	Complete set of agile practices	The implemented agile practices need to be closely followed during the initial setup of the project schedule, and when making schedule changes in subsequent phases of the project.
Tec02	Appropriate technology and tools	A proper scheduling tool will help in keeping track of schedule changes, performing a critical path analysis, automatically aligning the schedule according to the critical path(s), providing capabilities on performing independent tasks in parallel and sequential tasks in the most effective order, and maintaining the schedule in real time. Different types of reports can also be generated automatically and timely for different stakeholders as deemed necessary.
Tec05	Software (tool) supporting Agile methods	The appropriate software should be made available to support variations in the project schedule.

9.5.4 Mitigation Methods – Project Cost Management

The following mitigation methods were proposed by the expert review team for the factors impacting the “Project Cost Management” knowledge area.

Table 9.5: Consolidated Proposed Mitigation Methods within the Cost Management Knowledge Area.

Code	Factor	Proposed Mitigation Methods (Cost)
Org06	Agile logistical arrangement	As it is a given that APs will go through more change than a traditionally managed project, expecting to attract additional cost in the arrangements of logistics for the projects, the necessary costs should be included in the project budgetary process. It should also include additional cost which may be incurred for the additional cost which needs to be borne by the project for the requirements of a faster logistics turnaround time. Sudden and temporary arrangements may need to be made to acquire logistical items, which may attract a higher cost.
Pro03	Project planning	The budget will be planned against the scope and requirements. Identify all project cost elements and include them in the project budget. Incorporate the necessary buffer for cost overruns, especially on the acceptance or mitigation of risk elements (i.e. policy changes, legislative changes, business direction, and varying customer demands). Include cost overrun as a risk item and track it closely, involving the product owner so that he/she will be aware of the consequences of scope change during the project execution stage. Reflect all cost changes in the budget, and keep the management and product owner abreast at the very instance there is a change in budget (especially when there is an increase, while decreases should also be reported). Involve the product owner on critical budgetary changes.
Pro08	Complete project visibility	Changes to the project parameters, scope or deliverables may attract additional cost, which need to be tracked and key stakeholders should be updated as regularly as required.
Pro09	Project governance	Project cost need to be tracked all the time, with budgetary changes monitored closely, at all stages of the project.
Pro11	Proper Implementation of Agile Method	The cost should be closely monitored as per the organisational standards, combined with the specific processes commanded by the implemented methodology.
Pro12	Cost management	The cost of the project need to be consistently tracked against the allocated budget. There are high chances that the changes in project scope will attract additional cost, which should have been budgeted for. Costing and expenditure (project spend) reports should be generated and shared with the key stakeholders, especially the project sponsor.
Pro13	Process Flexibility	The processes contained and dictated by the selected methodology should be flexible enough to allow the project budget to be altered based on prevailing and changing project costs, due to the change in scope and project deliverables.
Pro14	Hybrid method	The correct process as dictated in the customised hybrid method need to be followed on capturing changes to the cost of the project against the allocated budget, and tracking it against the scope, resource and schedule changes.
Pro15	Method Match - Agile Vs Traditional	The selected method should be aligned with the project costing and budgetary requirements.
Pro18	Project Closure Activities	Project closure activities may include capturing lessons learnt, identifying the mistakes endured in the project along with how they can be improved, generally capturing what can be done better through the experience gained, while documenting them to make them available as reference material for future projects. The necessary budget for this activity need to be anticipated and allocated at the beginning of the project.
Tec01	Complete set of agile practices	The implemented agile practices need to be closely followed from the initial budget preparation until the end of the project, especially at every stage when there is a change in project costing due to scope or resource changes.
Tec02	Appropriate technology and tools	Employing the proper financial management tools may assist in aligning the planned budget with the actual cost, while providing hints on all cost elements in terms of spending capacity, cost savings opportunity, options for scrutiny of cost according to organisational and project requirements.
Tec05	Software (tool) supporting Agile methods	The appropriate software should be made available to support variations in the project cost, and the alignment of cost with the planned budget.

9.5.5 Mitigation Methods – Project Quality Management

The following mitigation methods were proposed by the expert review team for the factors impacting the “Project Quality Management” knowledge area.

Table 9.6: Consolidated Proposed Mitigation Methods within the Quality Management Knowledge Area.

Code	Factor	Proposed Mitigation Methods (Quality)
Pro03	Project planning	The quality of the project will be impacted by all other elements of the project, especially in delivering the outcome and deliverables of the project as per the expectations of the key stakeholders, especially the customers. Ensure the product owner and customers are aware of the importance of the delivery of project outcomes on acceptable quality, tied to the scope, cost and schedule.
Pro09	Project governance	Project quality can be maintained with proper governance and management of projects.
Pro11	Proper Implementation of Agile Method	The proper implementation of the method will determine the quality of the project and its deliverables.
Pro13	Process Flexibility	The processes contained and dictated by the selected methodology should be flexible enough to allow changes in scope, schedule and cost, while being able to maintain an acceptable level of quality.
Pro14	Hybrid method	The correct process as dictated in the customised hybrid method need to be followed on delivering the project on expected quality, and tracking it against the scope, cost, resource and schedule changes.
Pro15	Method Match - Agile Vs Traditional	The selected method should be aligned with the expected quality of the project deliverables.
Pro18	Project Closure Activities	Capturing lessons learned from the execution of the project is a continuous process, and not something which is done briefly at the end of the project to merely fulfil project closure requirements. Failing to perform this activity properly will result in the organisation missing the opportunity to capture valuable lessons to include into the organisation's knowledge database. If performed properly and holistically, the quality of projects can be improved in the organisation.
Pro21	Quality Management	The management of quality of the project in terms of delivering against the scope and requirements, on time and budget, and producing the expected deliverables. This activity need to be monitored closely throughout the project, from the initiation phase through the closing phase.
Pro23	Manageable Units of Deliverables	The unit of deliverables need to be managed effectively and efficiently which should not affect the quality of the deliverables, which should be the delivery of the project on time, within budget, and as per the scope and requirements, as expected by the customer/client.
Tec01	Complete set of agile practices	The implemented agile practices need to be closely followed to maintain the quality of deliverables, dictated as on schedule, within the allocated budget, as per the scope and requirements, and with user/client/customer acceptance.
Tec02	Appropriate technology and tools	Employing the proper tools may help in maintaining the quality of project deliverables by enabling the processes to be more executed in an effective and efficient manner.
Tec05	Software (tool) supporting Agile methods	The appropriate software should be made available to support variations in scope, requirements, resources, cost, timelines, and other elements of the project that may affect the quality of the project.

9.5.6 Mitigation Methods – Project Resource Management

The following mitigation methods were proposed by the expert review team for the factors impacting the “Project Resource Management” knowledge area.

Table 9.7: Consolidated Proposed Mitigation Methods within the Resource Management Knowledge Area.

Code	Factor	Proposed Mitigation Methods (Resource)
Org06	Agile logistical arrangement	When acquiring project resources for APs, anticipate the changing needs of the scope of the projects, allowing the flexibility of changes in resource types and the duration in which they are required by the respective projects.
Peo01	Availability of necessary skillset	The PM and the project team managers should first be trained in or should at least be familiar with the Agile method of PMgmt. All the other required and crucial skillset need to be evaluated prior to recruiting the project team.
Peo02	PMgmt competence	It is a given that the project team members, especially the PM, must possess PMgmt skills, with an expected level of competency in the crucial areas of PMgmt (i.e. planning, scheduling, cost tracking, reporting, budgeting). The team should be able to adapt to cross functional skills. The competency gap should be identified at the beginning (prior to the start of the project), and the necessary TNA and TNI need to be established, and carried on as deemed necessary. Motivation and coaching need to be arranged as appropriately required.
Peo03	Team-work	The ability of the entire project team to work together is crucial towards the success of the project and its deliverables. There must be a good level of integration amongst the project stakeholders, with a good level of understanding with the customers/clients. Synergy, collaboration, alignment and cooperation is expected amongst the project team members. The emotional intelligence level of the team members need to be assessed for alignment, while identifying and managing the diversity of egos amongst them. Establish clear roles and communicate clearly to all stakeholders, with multiple and enhanced communication channels. Training, education, coaching and mentoring should apply where required, with possible team-building related sessions held to garner a better working relationship amongst the stakeholders, especially the project team members.
Peo06	Communication (for information sharing/decision making)	The resources need to be trained in communication, and they need to know when to communicate, the amount of information to communicate at various stages of the project, and who to communicate to. Communication is an important activity in APs and the project team need to be well attained in the skills of communication, including the utilisation of communication tools (i.e. email, messaging, daily meetings, weekly reporting, periodic updates to the leadership team).
Peo07	Commitment and dedication (Motivation)	The resources recruited into the project teams need to be of high calibre, with high levels of commitment and dedication to the project and to effectively carry out the tasks demanded by the project. APs will demand a higher level of dedication due to the nature of the projects which are executed using the agile method.
Peo11	PMgmt certification	It is indeed ideal for the PMs and possibly the project team members to possess a formal certification in PMgmt (i.e. Prince2, CAPM, PMP, PgMP, PfMP, PMI-ACP, CSM). However, it is not an absolute necessity to possess a formal qualification, as skill and experience will matter most. It is regarded as a good-to-have element in the academic arena, creating more job matches as organisations use it to screen prospective employees in cases where the competition is steep.

Table 9.7, continued

Code	Factor	Proposed Mitigation Methods (Resource)
Peo12	Trust and understanding (amongst team members/stakeholders)	As APs require a very close working relationship between the various stakeholders, especially between the project team members, trusting and understanding each other will enable a better working relationship between them.
Peo13	Creativity and problem solving skills	Due to the nature of APs which requires the team members to be able to solve problems quickly and produce relevant solutions, the team members or key and relevant stakeholders should be creative and possess problem solving skills.
Peo14	Agile Mindset	The team members should be properly trained in the agile principles and its expectations. People who have been used to managing projects using traditional methods need to be willing to “let-go” and be willing to adapt the agile culture. A continuous learning environment and required awareness sessions need to be made available, with coaching and mentoring on the agile principles, with the assistance of a dedicated support team.
Peo16	Team Empowerment	The team should be empowered to perform their task, without interference from the superiors. In the scrum method, the scrum master may not necessarily be the PM or project lead, and should be given the empowerment to lead and direct the project. The team leaders should understand the agile concept clearly and not interfere with the scrum master unnecessarily. Leadership team support is necessary in ensuring the agile principles are adhered to.
Pro03	Project planning	Resource planning is a very crucial element of a project, especially on resource identification and allocation, based on the availability of the necessary budget for payments towards expected regular project work and unexpected additional work anticipated (i.e. overtime, recruiting additional resources, replacing resources on absence or medical situations). Prepare for situations of varying requirements, increase in scope, changes to policies which affects the project requirements, or any other situations demanding for additional budget in managing resources.
Pro09	Project governance	Project resources (i.e. people, equipment, machinery, tools) will inherently change, due to the changing nature of APs, which needs to be anticipated (with experience), planned as much ahead as possible, closely monitored, especially for APs, that will impact the project timelines and budget.
Pro11	Proper Implementation of Agile Method	The hiring or acquiring, and management of resources should follow the processes dictated by the implemented methodology.
Pro13	Process Flexibility	The processes contained and dictated by the selected methodology should be flexible enough to allow changes in resources (i.e. to be managed easily, and in a flexible manner).
Pro14	Hybrid method	The correct process as dictated in the customised hybrid method need to be followed on managing the resources, while tracking it against the scope, cost and schedule changes.
Pro15	Method Match - Agile Vs Traditional	The selected method should be aligned with the project resourcing requirements.
Pro16	Clearly Defined PM Role	The role of the PM should be clearly defined. The necessary training and coaching need to be rendered to the PM to equip them with the correct understanding, along with the assistance of a dedicated support group (i.e. PMO, agile or hybrid implementation team, agile or hybrid task force).
Pro18	Project Closure Activities	Project closure activities may include capturing lessons learnt, identifying the mistakes endured in the project along with how they can be improved, generally capturing what can be done better through the experience gained, while documenting them to make them available as reference material for future projects. The necessary resources (i.e. PM and key project staff) need to be allocated in advance and included into the resourcing plan.
Pro19	Project Team Role Definition	The role of project team members, who are the crucial resources of the project, should be clearly defined, especially in APs. The necessary training and coaching need to be rendered to the project team members to equip them with the correct understanding, along with the assistance of a dedicated support group (i.e. PMO, coach, agile or hybrid implementation team, agile or hybrid task force).

Table 9.7, continued

Code	Factor	Proposed Mitigation Methods (Resource)
Pro22	Resource Planning	The planning of resources, which is normally done during the planning phase, and sometimes initiated earlier in the project initiation phase, is a crucial activity to identify all required resources for the project. The planning for resources would include the type of resources (i.e. people, material, equipment, tools), when and for how long they will be required, and when they can be disbanded. Resource planning will also be included in the budget planning and scheduling exercise, based on the scope and requirements of the project.
Tec01	Complete set of agile practices	The implemented agile practices need to be closely followed for all resourcing needs, and when there are changing needs of resources during the project execution phase.
Tec02	Appropriate technology and tools	Employing the proper tools will help in managing resources effectively and efficiently by enabling the integration of resource management efforts with scope, schedule and cost management. Any changes in resourcing needs, due to changing requirements, can be quickly analysed and acted upon by the project team.
Tec05	Software (tool) supporting Agile methods	The appropriate software should be made available to support the administration and scheduling of resources.

9.5.7 Mitigation Methods – Project Communication Management

The following mitigation methods were proposed by the expert review team for the factors impacting the “Project Communication Management” knowledge area.

Table 9.8: Consolidated Proposed Mitigation Methods within the Communication Management Knowledge Area.

Code	Factor	Proposed Mitigation Methods (Communication)
Org10	Business Vision	The business vision, envisaged to support the changing nature of APs, should be documented clearly in a business case. The business case should be well communicated to the executives of the organisation, tapered down to all levels of management and their respective teams.
Peo05	Customer relationship	Fostering a good relationship with the stakeholders via a good communication protocol, which should be planned at the early stages of the project. The communication should be managed well, at all levels of the project. Each project phase will demand different levels and frequency of communication, with varying details. High level summaries at the start of the project, with detailed technical information during the design stage, and overall summary during the closing stage, are some examples of varying details and density of the information to be communicated to the stakeholders at different stages of the project.
Peo06	Communication (for information sharing/decision making)	The standard and formal communication methods are dictated in the traditional methods (i.e. PMBOK), which should be scrutinised to include elements of informality for APs. The communication need to be managed properly in terms of when to communicate, amount of information to communicate, and the relevant stakeholders to be included in the communication.

Table 9.8, continued

Code	Factor	Proposed Mitigation Methods (Communication)
Pro03	Project planning	Plan the communication in terms of who to communicate with, when to communicate with them and what methods to use as deemed appropriate. Understand and acknowledge that as the project progresses, the level of communication may get technical and detailed, which may gradually reduce as it traverses towards the end of the project. The product manager and the customer should be given importance in communicating the correct information and the right time.
Pro07	Timely reporting	Reporting in an AP environment should be more frequent, less formal, brief and concise. Alarms and disparities should be raised at the soonest possible time, to the attention of the key stakeholders, for a quick turnaround of decisions.
Pro08	Complete project visibility	The key stakeholders must have complete visibility with consistent updates on the project, via frequent and multiple communication methods, so that all parties will be abreast with the current project status at all times.
Pro09	Project governance	Proper communication need to be administered as per the established process. APs, apart from the required frequent level of communication, would also attract informal and irregular communication due to its nature and characteristics.
Pro11	Proper Implementation of Agile Method	Agile methods demand a high level of communication, which would be frequent and informal, in addition to formal methods.
Pro13	Process Flexibility	The processes contained and dictated by the selected methodology should be flexible enough to allow the free flow of information between the stakeholders, to encourage frequent and constant communication.
Pro14	Hybrid method	The correct communication process and principles, as dictated in the customised hybrid method need to be followed on delivering the project against the scope, cost, resource and schedule changes.
Pro15	Method Match - Agile Vs Traditional	The selected method should be aligned with the project communications requirements.
Pro18	Project Closure Activities	The things done correctly, including the ones not done correctly are to be captured along the progress of the project as they occur, and documented during the project closure stage. These learnings are to be communicated to the relevant stakeholders, and made available as reference material for future projects. The communication of these information need to be planned and executed prior to project closeout.
Tec01	Complete set of agile practices	The implemented agile practices need to be closely followed during all stages and levels of communication.
Tec02	Appropriate technology and tools	Employing the proper communication tools will help in enabling effective and efficient communication between the project team and the dissemination of information and project updates to the stakeholders on a timely manner.
Tec04	Communication support tools	The appropriate tools should be obtained and used to support communication, especially within the administration of APs, due to the need of frequent and constant communication. The project plan and budget should make provisions for these tools due to the critical role of communication. Some tools are even available without cost, as provided in the social media (email, voice calls, video conferencing and messaging portals), but may impose a risk on privacy. For high profile and confidential projects, it is best to secure explicit use of tools with a valid license for its utilisation. These are normally organised and provided at the organisational level.
Tec05	Software (tool) supporting Agile methods	The appropriate software should be made available to support the varying communication needs within the project and the organisation.

9.5.8 Mitigation Methods – Project Risk Management

The following mitigation methods were proposed by the expert review team for the factors impacting the “Project Risk Management” knowledge area.

Table 9.9: Consolidated Proposed Mitigation Methods within the Risk Management Knowledge Area.

Code	Factor	Proposed Mitigation Methods (Risk)
Org05	Organisational size	Agile implementation to be closely monitored in terms of team empowerment, non-interference by the management team, non-control by the PM, and to allow the team to fulfil their responsibilities without imposing controls over them.
Org09	Budget to implement Agile methods	The leadership team and the project sponsor should clearly understand the investment needs of the agile methodology, prior to making decisions to implement the method. The necessary budget should be allocated so that the agile method can be executed within the organisation with its intended strength and support, and not go into a cashflow situation during project execution. Additional budget should be anticipated for logistical arrangements (i.e. face to face meetings, collocation of team members and customers, tools to support a higher frequency of communication). Leaders must first see the benefits that the agile method yields, and should drive agile methods in a manner in which they will be able to sponsor willingly and objectively. These should be documented in a business case, and shared with the executives for understanding and support prior to execution.
Pro03	Project planning	Risk planning should start at the project infancy stage, and continuously monitored for the inclusion of newly identified risks, changes in risk category and impact, and closing of items not imposing a risk to the project any longer. Perform risk identification and management at an early stage to avoid surprises at a later stage in the project. Identify and interact with subject matter SMEs on all areas in the identification of risks, and keep the product owner abreast of the risks and the management or mitigation protocol employed.
Pro09	Project governance	Proper risk management and tracking need to be carried out, especially whenever there is a change in scope, with the necessary risk mitigation methods in place.
Pro11	Proper Implementation of Agile Method	Risk management should be performed in accordance to the frequency and requirements of the implemented methodology.
Pro13	Process Flexibility	The processes contained and dictated by the selected methodology should be flexible. This flexibility should be factored in as an element of risk, monitored and managed accordingly.
Pro14	Hybrid method	The proper risk identification and management process and principles, as dictated in the customised hybrid method need to be followed on delivering the project against the scope, cost, resource and schedule changes.
Pro15	Method Match - Agile Vs Traditional	The selected method should be aligned with risk management activities and outcomes.
Pro18	Project Closure Activities	As APs are expected to change frequently, a proper set of controls need to be in place to track changes against the cost, timelines, resourcing needs, quality of deliverables, and other components. This needs to be included as an element of risk and managed accordingly and carefully. These are to be reviewed at the project closeout stage to ensure all elements have been attended to.

Table 9.9, continued

Code	Factor	Proposed Mitigation Methods (Risk)
Pro20	Proper Change Management and Control	As APs are expected to change frequently, a proper set of controls need to be in place to track changes against the cost, timelines, resourcing needs, quality of deliverables, and other components. This needs to be included as an element of risk and managed accordingly and carefully.
Tec01	Complete set of agile practices	The implemented agile practices need to be closely followed when performing the risk management tasks, as the agile method may have ne or different types of associated risks.
Tec02	Appropriate technology and tools	Employing the proper tools will help in the identification of risks, and the effective management and timely mitigation of the identified risks.
Tec05	Software (tool) supporting Agile methods	The appropriate software should be made available to support the project risk management activities, including the mitigation (or acceptance) of the identified risks. The software should also provide the projects with the ability to quickly add newly identified risks quickly into the risk management portfolio, which may impact the schedule, cost and quality of the project deliverables.

9.5.9 Mitigation Methods – Project Procurement Management

The following mitigation methods were proposed by the expert review team for the factors impacting the “Project Procurement Management” knowledge area.

Table 9.10: Consolidated Proposed Mitigation Methods within the Procurement Management Knowledge Area.

Code	Factor	Proposed Mitigation Methods (Procurement)
Org06	Agile logistical arrangement	When procuring project resources, equipment, tools, material, or any other items required for use by the project either internally within the organisation or externally through a third party (i.e. vendor, supplier, contract for services), an effective procurement process should be in place. The process should complement the anticipated changing needs of the scope of the APs, leading to amendments in the type and quantity of the procured items.
Pro03	Project planning	Based on the scope of the project, the procurement of items need to be planned properly (i.e. human resources, contractors, equipment, devices, services). Include any procurement related item which may impose a risk to the overall project, and add them to the risk register, while keeping the product owner abreast on any impact which may be stimulated by the procured elements.
Pro09	Project governance	Procurement for the projects need to adhere to the established processes and regulations to ensure it will be able to cope with the fast pace of APs.
Pro11	Proper Implementation of Agile Method	Properly organised procurement need to be undertaken as agile methods demand a faster mode of procurement (i.e. securing material, and resources from third party vendors).

Table 9.10, continued

Code	Factor	Proposed Mitigation Methods (Procurement)
Pro13	Process Flexibility	The processes contained and dictated by the selected methodology should be flexible enough to allow an easy and efficient procurement process, along with a flexible delivery and payment process.
Pro14	Hybrid method	The correct procurement process and contracting principles, as dictated in the customised hybrid method need to be followed on delivering the project against the scope, cost, resource and schedule changes.
Pro15	Method Match - Agile Vs Traditional	The selected method should be aligned with contracting and procurement requirements.
Pro18	Project Closure Activities	All procurement elements need to be reviewed to ensure they have been properly handled prior to project closure. A checklist need to be established with the list of all items procured, capturing and tracking the status of each element, requiring sign-off post deployment, during the project closure stage.
Pro24	Vendor Management	The vendors and contractors need to be aligned and managed properly, according to the established method and principles dictated by the implemented methodology. The process for managing the vendors should be aligned with the employed methodology (i.e. conventional, agile or hybrid).
Tec01	Complete set of agile practices	The implemented agile practices need to be closely followed for all procurement needs as the nature of procurement and contracting may be different due to a different level of demand by the agile method of PMgmt.
Tec02	Appropriate technology and tools	Employing the proper tools may assist in performing and fulfilling the procurement needs of the projects efficiently.
Tec05	Software (tool) supporting Agile methods	The appropriate software should be made available to support effective and efficient procurement needs of the project.

9.5.10 Mitigation Methods – Project Stakeholder Management

The following mitigation methods were proposed by the expert review team for the factors impacting the “Project Stakeholder Management” knowledge area.

Table 9.11: Consolidated Proposed Mitigation Methods within the Stakeholder Management Knowledge Area.

Code	Factor	Proposed Mitigation Methods (Stakeholder)
Org01	Executive sponsorship	Obtain executive sponsorship for every project, prior to the execution of the project via a project charter (or similar document) during the project initiation phase to obtain support and sign-off from the executives.
Org02	Management commitment/control	The leadership team to set-up a task force to continuously engage the management team to ensure compliance and understanding, to provide support and act as advisors to the management team, and to ensure the managers are capable of delivering along the agile method and principles.
Org03	Organisational culture - Traditional Vs Agile	Culture to be adopted top down, with the leadership team driving its implementation and the management team supporting the notion.

Table 9.11, continued

Code	Factor	Proposed Mitigation Methods (Stakeholder)
Org04	Organisational culture - Political	The agile teams should be allowed to independently deliver on their tasks, without exerting undue control over them. The AP team should be isolated from any political agenda of the organisation, and the management team should not be reluctant to allow self-management of the project teams.
Org07	Understanding of Agile method values (and Principles)	The project stakeholders should be well versed with the principles of agile methods, while acquiring a good understanding on the values it will bring to the project, and to the organisation in general. The leadership team, through a task force, should ensure this understanding is achieved, and should further provide support and guidance to all levels of the AP stakeholders so that the agile method will be understood, adhered to and followed holistically. There should be a common understanding of the agile values throughout the organisation, and amongst all the project stakeholders. The business challenges of the organisation should be mapped to the values of agile, and communicated clearly to the executives for buy-in and support. Active engagement and participation of a product owner should be employed, who is an expert in the business needs being resolved and empowered to make decisions to drive the project.
Org08	Support of Investment on Agile method	Executives should clearly understand the investment needs prior to anticipating and expecting the hypes of success. The leadership team, through a task force, should ensure this understanding is achieved, and should further provide support and guidance to all levels of the AP stakeholders so that the cost of running an AP is anticipated and accepted by them. A business case would clearly spell out the benefits and encourage support by the executives.
Peo04	Cooperation from groups or individuals (testers)	The cooperation from the individual stakeholders are expected, especially the testers, in support of the activities executed in the project, towards the achievement of project success.
Peo05	Customer relationship	There should be a good relationship established with the all stakeholders, especially the main stakeholders (i.e. budget holder, approvers, customer, client, project sponsor). Having a good relationship will foster better support for the project, especially during crucial project activities (i.e. approval processes, critical path traversal, resource variance and backfilling, cost and schedule overruns, scope changes, testing and acceptance).
Peo06	Communication (for information sharing/decision making)	Upon identifying the various stakeholders and their roles, the necessary communication plan need to be drawn out, which includes the level of communication, amount to communicate, frequency and method of communication. Communication is normally informal in APs, however having a firm communication plan is always an added value.
Peo08	Managing stakeholder expectations	The expectations of the stakeholders need to be managed carefully, with sufficient engagement with all levels of stakeholders. There should be constant communication with the stakeholders, especially the key stakeholders who are capable of influencing the project either positively or negatively. A reasonable amount of time and effort need to be allocated in identifying the project attributes that work for the organisation, to determine a best-fit methodology. For APs, there should be a product owner to ensure agile success. The methodology used need to be validated, and proper communication and training to be conducted at the early stages to ensure all relevant stakeholders become familiar with the methodology.
Peo09	Stakeholders welcome (embrace) change	The stakeholders should be attuned to having a change mindset, with the ability to anticipate, accept and deal with frequent change, with minimum or no resistance to change. People should not be afraid of change, and the expectations need to be set at the beginning of the project. Foster the necessary coaching and motivation elements, and perhaps an additional element of compensation, tied to the stakeholders' ability to accept and handle change.
Peo10	Managers' participation	The absolute participation of departmental and functional managers is important, at all stages of an AP, to garner project success. Hence, it is important that the agile method and its expectations are well understood by them. Ensure the managers are trained in agile methods, driving it top down from the leadership team. The agile method should be supported by the leadership team. It will be most ideal if the leaders sponsor the implementation of agile methods in the organisation, as managers at all levels will be committed to understand, accept and manage them without much issues.

Table 9.11, continued

Code	Factor	Proposed Mitigation Methods (Stakeholder)
Peo14	Agile Mindset	Project stakeholders need to understand the agile principles and be willing to adapt to its methods seamlessly, with an open mind. The organisational culture need to adapt the agile way of thinking, and foster its principles top down.
Peo15	Understanding of Agile Method	The stakeholders need the proper understanding on the agile methods, prior to proceeding with using the method to manage and administer projects. There should be an acceptable level of confidence by the stakeholders, and especially by the project team members, prior to moving into the agile way of PMgmt. The demands and expectations should be well scrutinised, and accepted by the key stakeholders. Situations of backtracking to traditional methods due to lack of understanding on agile methods should be avoided. It involves enabling an infrastructure, senior management team support and align the organisational culture to foster APM.
Pro03	Project planning	Identify the stakeholders (i.e. customer, product owner, investors, public, peers, superiors, subordinates, PM, project team members, contractors, vendors, clients, government, and regulators) and chart them against an impact matrix, identifying the level of influence each of these stakeholders have against the different phases and deliverables of the project. Perform risk identification related to all the identified stakeholders.
Pro05	Customer presence	In an AP, customer presence throughout the development stages of the project is crucial, especially during the testing phases. It is important to establish this expectation and ensure the customers are committed in participating in crucial activities in the project which demands their presence. Secure customer agreement on their anticipated commitment upfront, and ensure they allocate the relevant time in their schedule for these activities.
Pro06	Customer role	The roles and responsibilities of the customer need to be identified and clearly documented. The customer need to understand his or her role, and carry out his or her responsibilities accordingly. Any vague role or responsibility need to be carefully scrutinised and clarified, with the expectations clearly spelled out and agreed by all relevant parties.
Pro07	Timely reporting	Frequent communication to the key stakeholders on any alarms and disparities based on timely, less formal, brief and concise reporting which should be done as frequently as necessary, for a quick turnaround of decisions from the key stakeholders who play the role of decision makers.
Pro09	Project governance	The stakeholders of the project, especially the PM and team members need to be trained in the established processes demanded by the PMgmt methodology and should be aware of the importance of project governance, working together to consistently deliver with conformance.
Pro10	Customers collaboration (agreement/ expertise/ability to dictate requirements)	The customer or client should be well understood, their role well defined and the relationship should be well maintained. Due to the requirements of customer collaboration in APs, frequent and constant communication with the customer is expected for the success of APs.
Pro11	Proper Implementation of Agile Method	All stakeholders must be trained in the implemented method, and an expert team (i.e. central agile implementation and support team, or PMO) need to be available to provide support and guidance to the stakeholders.
Pro13	Process Flexibility	The processes contained and dictated by the selected methodology should be flexible for the stakeholders at every stage of the project, effected at the beginning stages of the project, practised throughout the project.
Pro14	Hybrid method	The correct process and principles to liaise with and handle the stakeholders, as dictated in the customised hybrid method need to be followed on delivering the project against the scope, cost, resource and schedule changes.
Pro15	Method Match - Agile Vs Traditional	The selected method should be aligned with the anticipated expectations of the stakeholders, especially the key stakeholders who may adversely impact the project should they be unsatisfied with the processes. The implemented method should be well understood by all project stakeholders, and accepted by them to a reasonable extend via the means of training, coaching, briefing, support groups and through informal sessions.

Table 9.11, continued

Code	Factor	Proposed Mitigation Methods (Stakeholder)
Pro16	Clearly Defined PM Role	The role of the PM should be clearly defined. The necessary training and coaching need to be rendered to the PM to equip them with the correct understanding, along with the assistance of a dedicated support group (i.e. PMO, agile or hybrid implementation team, agile or hybrid task force).
Pro18	Project Closure Activities	The key stakeholders of the project should drive the project closure activities to ensure it is done properly and correctly, as the project team will normally "rush" to close off a project as this activity will be deemed unimportant, hence will be given a low priority with probably no budget and resource allocation.
Pro19	Project Team Role Definition	The role of project team members, who are key stakeholders directly responsible for the project deliverables, should be clearly defined, especially in APs. The necessary training and coaching need to be rendered to the project team members to equip them with the correct understanding, along with the assistance of a dedicated support group (i.e. PMO, coach, agile or hybrid implementation team, agile or hybrid task force).
Tec01	Complete set of agile practices	The implemented agile practices need to be closely followed by all project stakeholders to ensure cooperation is rendered at all levels of the project. A task force consisting of either SMEs of the methodology or a governing PMO should ensure all stakeholders understand the common practices in the organisation and specific process variations within the respective projects.
Tec02	Appropriate technology and tools	Employing the use of appropriate technology and tools will enable better capabilities of managing a project, especially an AP, or its hybrid counterpart. The enablement of tools will help in providing the stakeholders with the ability to monitor the project effectively. All relevant stakeholders need to be trained or be familiar with the tools and technology employed, preferably with the necessary support from a dedicated technology support team.
Tec03	Knowledge on tools (technology)	The project stakeholders, especially the PM and the team members should be kept abreast with new tools in the market and the emerging technology in the industry. The appropriate training on tools and exposure on technology should be provided to them, with continuous learning on new and improvised tools and knowledge on the latest emerging technology. Support on tools should be provided throughout all phases of the project, preferably administered by the PMO or a dedicated team.
Tec05	Software (tool) supporting Agile methods	The appropriate software should be made available to support the effective management of the various stakeholders, to fulfil their various needs and demands in an efficient manner.

9.6 Proposed Mitigation by Project Phases

To achieve project success from the perspectives of the progressive stages of the project, the following general advisory, as compiled from the feedback received from the expert validation team, is summarised and organised in sequence of the various project phases, based on the five PMI process groups (initiation, planning, execution, monitoring and closing). Each of the experts were first asked to tabulate the 55 factors against all relevant project phases.

Each of the 55 factors contained in the HAT-PMFv2.0 framework are described in the following context. The factors have been described within the respective phases where they commence, from then on, they should be placed on a radar, through the other subsequent phases, as the project progresses and moves into the subsequent phases, until the project reaches the end of the project closure phase.

9.6.1 Project Initiation Phase

A total of 24 factors need to be considered in the initiation phase, with 10 factors each within the organisational and process perspectives, three in the people perspective, and one factor in the technical perspective, described as follows:

1. Organisational perspective (10 factors commences in this phase)
 - **Org01 – Executive sponsorship:** Obtain sponsorship from the executives or the leadership team at the earliest possible time, as this is a great determinant factor for project success. Get them to own the project outcomes, buy obtaining their support and buy-in prior to project initiation. Update them regularly on the progress of the project, especially in terms of project expenditure, timelines, resources, risks, dependencies, and external influences.
 - **Org02 – Management commitment/control:** Obtain commitment from the management team, especially within the PMgmt support function (i.e. PMO Manager, Finance Manager, Human Resource Manager, Procurement Manager, Logistics Manager). Provide them with frequent updates on the progress of the project. Include them as custodians for functional sign-off at the beginning of the project.

- **Org03 – Organisational culture - Traditional Vs Agile:** Ensure the organisational culture is attuned with the method. A traditional culture will not tolerate frequent changes, and would expect more details and structure upfront. For an agile environment to work, it first needs to ensure that the stakeholders embrace the “new” culture, and are prepared to support the project team, and run by the agile principles.
- **Org04 – Organisational culture – Political:** The organisation may be influenced by political agendas. Identify them as project risks and manage them accordingly. For organisations that are very political, identify the stakeholders who may impose influence on the project, build relationships with them, and ensure their influence would help the project, rather than being a threat to the project.
- **Org05 – Organisational size:** The size of the entire organisation, or the size of the project organisation may have a great influence in the manner in which projects are executed in the organisation. A large project team usually inhibits a high level of management complexity, as opposed to a small project team which may have a very clear and simplistic way of management. Face to face stand-off’s are likely easier in small teams which are collocated, compared to large teams which can be geographically disbursed, and within different time-zones, imposing vast communications challenges.
- **Org06 – Agile logistical arrangement:** The agile approach may attract a lot of logistical challenges, especially for geographically disbursed teams, or for scenarios where the customer and the project team are located in different countries or regions, on different time-zones. For example, if the customer is located in America, the management team are located in Europe, and the project teams are located in Asia, the communication protocol may become very challenging. When America wakes up, Asia will be preparing to go to bed, while

Europe may be having their lunch. The number of contact hours per day may be very limited in this scenario.

- **Org07 – Understanding of Agile method values (and Principles):** This accords to the willingness to understand and adopt the values and principles of the agile practice. This factor needs to be dealt with from a management's perspective, with the involvement of the leadership team. Without acquiring this understanding upfront, project may suffer variations in opinions from the various stakeholders.
- **Org08 – Support of Investment on Agile method:** Investment on the implementation of agile methods should be willingly allocated by the leadership team, after acquiring a proper understanding of the benefits it yields. The investment decisions are beyond the control of projects and the project team. Ensure the support is available prior to running APs.
- **Org09 – Budget to implement Agile methods:** Ensure the necessary budgets are available to implement agile methods. An agile environment attracts a different level of operational requirements, which will in turn, attract additional implementation costs. The leadership team and sponsors need to be well aware of these costs, and their support must be acquired upfront.
- **Org10 – Business Vision:** The project goals and objectives should be aligned with the business vision. A business plan and project charter will be best suited to ensure compliance to this alignment.

2. People perspective (three factors commence in this phase)

- **Peo06 – Communication (for information sharing/decision making):** Set up the communication protocol and rules clearly, and communicate accordingly. APs require a huge amount of communication, and most likely on a daily basis (i.e. daily stand-up meetings). Relevant project information should be shared with the

relevant stakeholders, in the required frequency. Escalation on issues should be done promptly, to attain a quick decision for action. Key stakeholders should be updated on all key decisions on the project, and consulted on advisory, as deemed necessary.

- **Peo08 – Managing stakeholder expectations:** The stakeholders of the project consists of anyone who have any level of interest in the project, or are impacted by the project in any way. All stakeholders need to be identified upfront, their influence on the project tabulated, and their expectations managed. Some of these items will go into the risk register as a risk item, which requires the necessary risk management.
- **Peo14 – Agile Mindset:** The project team members and the managers should adopt an agile mindset, reflecting the agile principles. This is closely tied to the organisational culture, and the level of organisational maturity. Acquiring an agile mindset can only come from top-down, and cannot be pushed from bottom-up. So, it is extremely important to involve the leadership and executive team in driving this element.

3. Process perspective (10 factors commences in this phase)

- **Pro01 – Project scope:** The project scope need to be determined as early a possible. The greater the level of accuracy, the higher the success rate of the project. Ensure the project scope conforms to all organisational regulations, and does not adversely impacted any legislative, safety, security, health, or environmental factors. Consult the relevant specialists, if required, and ensure the project scope is achievable within the available budget and expected implementation timelines, with acceptable quality.

- ***Pro11 – Proper Implementation of Agile Method:*** The method should be implemented properly, with all loose ends tied up. It is best that a PMO, or a special task force spearheads this activity, of ensuring all relevant components of the method is implemented, and adhered to by the project stakeholders.
- ***Pro12 – Cost management:*** Project budgeting is normally performed by an experience person, or is done in consultation with financial experts within the organisation. The PMO function normally assigns a team to assist PMs in the budgeting exercise, to ensure organisational financial goals are met, with minimal overspend. Good projects will exceed 90% accuracy of the planned budgets, with the necessary financial buffers (i.e. 10%) put in place. Maintain a close tab on project expenditure as they occur, and maintain a spreadsheet on budgets against actuals, marking the delta between the two, and adjusting the data as the project progresses. The executive or leadership team, management team and project sponsor(s) need to be kept abreast on any variances to the budget.
- ***Pro13 – Process Flexibility:*** The implemented processes need to complement the project activities, and have a certain level of flexibility, to defer the processes based on the rigidity of the project environment. The PMO function or the special project task force need to carefully designate the relevant processes, with built-in flexibility, and assist PMs and the project teams to navigate and implement the flexibility, on a case to case basis, when required.
- ***Pro14 – Hybrid method:*** Ensure that the method is suitable for the project, and use a hybrid method if the project demands for it as the best approach, to gain the maximum level of success. Though the agile and traditional methods have their own principles which may contradict each other, combining the ‘best of both worlds’ may sometime seem like a better approach. The organisation should

dictate which elements to combine, in order to achieve the maximum level of benefits from the hybrid method.

- ***Pro16 – Clearly Defined PM role:*** The role of the PM must be clearly defined at the beginning of the project, and must be understood and agreed by the PM, prior to taking on the project. For APs, the PM's role may appear very different, hence the same expectations of traditional methods cannot be imposed on the PM's managing APs. For hybrid projects, the role need to be specialised and agreed upfront.
- ***Pro19 –Project Team Role Definition:*** The role of the respective project team members must be spelled out and documented at the beginning of the project, and must be understood and agreed to by all the team members prior to getting involved in the project. For APs as an example, a team member may be appointed as a SCRUM master, with associated levels of responsibility. The PM or functional managers should provide empowerment, and should not override their subjected authority. For hybrid projects, the role need to be specialised and agreed upfront.
- ***Pro20 – Proper Change Management and Control:*** Set-up the change management process, so that changes can be tracked, controlled, and reported. Define what type of changes are to be approved by which level of authority, and communicate the rules at the beginning of the project. Track changes with sign-off and agreement from the customer or client on any change in project costing and timelines.
- ***Pro21 – Quality Management:*** The overall quality of the project will depend on many individual elements of the project. All of these elements need to be managed properly. For example, the quality of a project may be determined by the amount of project spend, the time taken to deliver the project outcomes, the level of

usefulness and acceptance of the deliverables, and the applicability of the end product to the prevailing business needs.

- ***Pro24 – Vendor Management:*** If the project employs the use of services provided by third party companies or vendors, these parties need to be managed properly, with the relevant contracts in place, and payment terms agreed upfront, which should be based on the deliverables. Associated penalty clauses should be built into the contracts, negotiated, and implied by qualified contract specialists.

4. Technical perspective (one factor commences in this phase)

- ***Tec01 – Complete set of agile practices:*** If agile practices are used, ensure a complete and comprehensive set of practices are employed. The agile practices should be one that is agreed and followed, as it will be difficult to determine the correct set of practices, which will depend on the experience of the practitioners and the organisational maturity, in the implementation and utilisation of the appropriate practices.

9.6.2 Project Planning Phase

The planning phase also has 24 factors that need to be considered, with eight factors in the people perspective, 12 factors in the process perspective, and four factors in the technical perspective. Some of the factors which had commenced in the previous phase (initiation phase) requires attention in this phase (as shown in the HAT-PMFv2.0 framework), and need to be followed through.

1. People perspective (eight factors commences in this phase)

- ***Peo01 – Availability of necessary skillset:*** The necessary skillsets need to be available within the organisation, prior to the commencement of the project. The

project team members should be recruited based on the required level of expertise for the project. Should there be an absence of a particular type of expertise, the necessary training need to be identified and administered prior to commencing the specialised level of work. This activity needs to be planned properly, charting the expertise of the available resources, analysing, and identifying training needs, pertaining to knowledge gaps.

- ***Peo02 – PMgmt competence:*** There should be competence in terms of PMgmt expertise. For example, a basic requirement could be the possession of relevant and/or desired PMgmt certification, and other related certifications which is expected of a PMgmt practitioner (i.e. finance and risk management, recruitment and resource management specialist, analysis and design expert, procurement and contracting specialty, vendor negotiation skills, general management and leadership skills).
- ***Peo05 – Customer relationship:*** It is important to maintain a good relationship with the customer or the client. In APs, the customers are expected to be a part of the team, with regular communications and meetings, organised with them. In certain instances, the customer is also required to be collocated with the project team. This expectation need to be set upfront so that the customer will be aware of the requirements and be guided accordingly, for conformance.
- ***Peo09 – Managing stakeholder expectations:*** The expectations of the stakeholders need to be acquired early in the project, so that they can be managed, either with regular communication, or with other suitable methods. The expectations can also be classified as risks and tracked accordingly.
- ***Peo10 – Managers' participation:*** The managers are important stakeholders, and usually have a huge amount of influence on the project, and the project team members. Their participation in projects can be crucial towards project success

rates. Their participation need to be anticipated and managed properly, by involving them early in projects, and setting expectations on the level of support required from them.

- **Peo11 – PMgmt certification:** PMgmt certification is not mandatory, but having an accredited PMgmt certificate renders confidence on the PM, or the project team member. There are certain certification which are globally recognised, and are desired by project organisations, prior to recruiting them into the project teams. The contention is that, if a PM is good, he/she should get certified and accredited accordingly.
- **Peo15 – Understanding of Agile Method:** The agile methods need to be well understood before its implementation. The agile principles need to be well comprehended, and the team need to be attuned with the agile way of thinking.
- **Peo16 – Team Empowerment:** The team need to be empowered to make decisions and certain judgemental calls, without rapid intervention from the management team. This empowerment is based on trust and confidence.

2. Process perspective (12 factors commences in this phase)

- **Pro02 – Project requirements:** The requirements of the project needs to be aligned with the project scope, the business objectives, and the goals of the organisation. The requirements need to be captured, compiled, and consolidated to form a uniform set of requirements, then disseminated to the relevant stakeholders. The final “agreed requirements” need to be signed-off by all responsible parties. Any changes in requirements should be tracked and documented, along with the impact on the cost and time (if any). Every change should attract a “requirements addendum” sign-off, after the stakeholders are

made to understand all repercussions of the changes, and after soliciting their agreement.

- **Pro03 – Project planning:** All planning activities need to be set-up properly, based on the relevant knowledge areas (i.e. scope, schedule, cost, resource, communication, risk, procurement, and stakeholder). Set-up a separate plan for each knowledge area, as they would attract different levels of priority and frequency of updates.
- **Pro04 – Progress tracking and reporting:** Control the timelines of all planned units of work as one single view, which will enable the progress to be tracked accordingly. Report project progress on a regular basis. The frequency of reporting should be agreed upfront, as different stakeholders will have different needs of frequency and level of details of the reports. The reports to the executive team should be simple, brief, and straight to the point. To the contrary, the reporting documents to the technical teams should contain a great deal of details. Determine the appetite of the beneficiaries of the reports, and prepare them accordingly.
- **Pro05 – Customer presence:** The expectations of a higher level of involvement in APs need to be clearly communicated, and supported by the management or leadership team. This directly involves their presence and level of involvement in the project, particularly APs.
- **Pro06 – Customer role:** The role of the customer should be clearly documented, and communicated to the customer, and their understanding solicited. It is important that the customer understands and acknowledges their defined role in the project.
- **Pro07 – Timely reporting:** The various reporting functions within the project must be planned in advance, with its frequency pre-determined. Reporting should

not be too frequent, if there is nothing much to report, as it may “bore” the audience. At the same time, it should not be too far apart, that the audience need to be ‘re-introduced’ to the project in some way.

- **Pro09 – Project governance:** Adhere to project governance, seek advice and guidance from the respective teams (i.e. PMO, project task force) where required. There should also be associated flexibilities in governance, especially for APs.
- **Pro10 – Customers collaboration (agreement/expertise/ability to dictate requirements):** The customer and the project team should work in a collaborated effort, to be able to discuss project details, and be able to dictate clear requirements, and also assume the ability to discuss changes to requirements in a transparent and seamless manner.
- **Pro15 – Method Match - Agile Vs Traditional:** Select the best approach to manage the project (agile Vs traditional), and implement the selected method, and ensure compliance by all project stakeholders. If required, use a combination of methods to employ a hybrid method which is best suited for the respective projects. This should be the responsibility of the PMO or the management team, in the form of an established method, or choice of methods in the organisation, prior to the initiation of projects.
- **Pro17 – Prioritisation and Scheduling:** The tasks within the project need to be well planned, captured in the project schedule, and prioritised based on agreement with the key stakeholders, with sign-off.
- **Pro22 – Resource Planning:** The required resources for the project should be planned in advance, with the required level of expertise identified and the respective personnel recruited into the project. Backup resourcing should also be planned, to prepare for leave of absence, additional workload, and un-scheduled scope-creep with fixed timelines. The necessary budget should also be allocated

as an additional buffer for backup resources, including the possibility of acquiring external resourcing, or outsourcing certain project efforts as deemed required.

- ***Pro23 – Manageable Units of Deliverables:*** Organise the deliverables into manageable units and implement the appropriate vendor management principles.

3. Technical perspective (four factors commences in this phase)

- ***Tec02 – Appropriate technology and tools:*** Identify the right technology, and employ the appropriate tools that will assist in the management of projects (i.e. Microsoft Excel, Microsoft Project, Diagramming and flow chart software, scheduling software, and other PMgmt tools), where necessary.
- ***Tec03 – Knowledge on tools (technology):*** Ensure the relevant project team members, and other project stakeholders alike, are familiar with the use of the employed technology and tools. Identify knowledge gaps and organise the relevant training programs, or request for the necessary training from the relevant stakeholders (i.e. management team, training department, PMO, project task force)
- ***Tec04 – Communication support tools:*** Identify appropriate communication support equipment and tools that will assist in the communication requirements of the project and in the organisation (i.e. Phone, Radio, Email, Computers, WhatsApp, Skype, Google-Meet, Zoom, and other Conferencing facilities). Ensure the tools are readily available and usable (purchase, licensing, bandwidth) and the stakeholders are familiar with the tools and will be comfortable using them, without causing any impairment to them (radiation, vision, hearing issues).
- ***Tec05 – Software (tool) supporting Agile methods:*** There are specific software and tools that support agile methods, which need to be identified and acquired, if

required. Readily available tools, like MS-Excel, MS-Word, MS-PowerPoint, and other similar tools, can also be used for the management of APs.

9.6.3 Project Execution Phase

Six factors need to be considered in the execution phase, with five factors and one factor respectively within the people and process perspectives. The factors which had commenced in the previous two phases (initiation and planning phases), requires attention in this phase (as shown in the HAT-PMFv2.0 framework). They need to be followed through, as required by the project.

1. People perspective (five factors commences in this phase)

- ***Peo03 – Team-work:*** During the execution of the project, team-work becomes a crucial factor to produce successful project outcomes. If the teams members are not known to each other during the project set-up stage, then an effort need to be placed to get them acquainted with each other (i.e. orientation, induction, team building activities, social events, “ice-breaking” activities, collaborative workplace).
- ***Peo04 – Cooperation from groups or individuals (testers):*** There should be a good level of support and cooperation amongst the team members, between them and the customer, users, and testers (if the roles are held by different people). The level of cooperation expected should be anticipated in the beginning of the project, the expectations set, and the relationship managed.
- ***Peo07 – Commitment and dedication (Motivation):*** Each member of the team should be committed and dedicated to the each other, and to the project, striving to deliver a quality outcome. These elements cannot be forced onto anyone, but should come naturally as a means of motivation, hence the project team members

should be motivated to work in the project and appear enthusiastic in delivering the project outcomes.

- ***Peo12 – Trust and understanding (amongst team members/stakeholders):*** Trust and understanding should be embedded in the project team as part of the culture. A culture which demonstrates a high level of trust and understanding amongst its employees is deemed to produce high outcomes. Trust can be expected and built, but cannot be demanded; it is part of the character of the individuals.
- ***Peo13 – Creativity and problem solving skills:*** Creativity and the ability to solve problems efficiently is a skill that can be acquired over time, through experience and academic maturity. These should be part of the requirement during the recruitment process into the organisation, or the screening process to recruit team members into the projects.

2. Process perspective (one factor commences in this phase)

- ***Pro08 – Complete project visibility:*** Ensure the project vision is clear, along with a set of clearly defined project scope. Document all activities clearly, along with their progress, and report them as frequently as possible to all relevant parties. The project stakeholders need to have complete visibility of the project at all times.

9.6.4 Project Monitoring Phase

There are no factors which commences in this phase, but some of the factors which had commenced in the previous phases, and requires attention in this phase (as shown in the HAT-PMFv2.0 framework), need to be observed and followed through during this phase.

9.6.5 Project Closure Phase

Only one factor need to be considered in the final project phase, which is the closure phase, as described in the following context. This factor may not create much value for project, which would have been completed and delivered at this juncture, but can be considered very important for the organisation and for future projects. Some of the factors which had commenced in all the previous phases (initiation, planning, execution and monitoring phases), would still need attention in this phase (as shown in the HAT-PMFv2.0 framework), which needs to be observed and followed through until the end of the closure phase.

1. Process perspective (one factor commences in this phase)

- ***Pro18 – Project Closure Activities:*** Allocate the required amount of time at the beginning of the project, and perform the closure activities properly and completely, capturing lessons learnt, and storing them for learning and future retrieval. Capture information on “what went right”, “what went wrong”, “what could have been done better”, “what could have been avoided”, and other relevant perspectives of the project which will foster learnings for the organisation, and contribute to the knowledge base.

9.7 Summary

The purpose of this study, as defined in Chapter 1 (Section 1.4), has been partially addressed in the previous chapters. The issues and challenges of APs discussed in literature (Chapter 4), and identified within the industry practitioners (Chapter 5), were described, and the findings from both research methodologies were discussed. The gaps between the findings in literature (SLR) and the findings from the industry practitioners

(GT), fulfilled the first objective of this study. The second objective was also fulfilled with the identification and verification of the mitigation methods, leading towards the formulation of the best practice framework. To fulfil the third and fourth objective, an evaluation model was used (Chapter 8), to assess the proposed pilot best practice framework (HAT-PMF v1.0), to produce an improvised version of the framework (HAT-PMF v2.0), along with a toolkit (HAT-PMF Toolkit v1.0), which can be used as guidance by the PMgmt practitioners, to assist in the administration and management of agile, traditional or hybrid projects.

In this chapter, the complete and final framework and toolkit were validated by a panel of 8 experts, with their demographics presented and discussed. The results obtained from the validation process were discussed, with the relevant analysis performed on them, and the findings described. The proposed mitigation methods were described, in terms of the knowledge areas (integration, scope, schedule, cost, quality, resource, communication, risk, procurement, and stakeholder) and project phases (initiation, planning, executing, monitoring, and closing). These mitigation methods are to be used as advisory and guidance, while managing projects based on the proposed framework and toolkit.

Based on the results of the validation process, it can be concluded that the HAT-PMFv2.0 framework is deemed to be helpful to the organisations, as they would find it relevant and useful to implement the best practice framework, as it is deemed to yield benefits in administrating and managing projects to attain greater success. Capturing all the proposed mitigation methods as suggested by the expert panel team, and including them in the best practice framework, is expected to assist the prospective users, in managing projects with greater success rates. Furthermore, the creation of the templates, presented as a tool, and

the built-in advisory notes and comments placed within these templates is expected to act as a guide to the project team, especially the members who are new to their roles.

The next and final chapter (Chapter 10) concludes this thesis by responding to the ROs, answering the RQs, describing the contributions of the thesis, and concluding this research study with the limitations of this research and proposed future work.

Universiti Malaya

CHAPTER 10: CONCLUSION

10.1 Overview

This chapter summarises the entire study undertaken by this research, which has met the proposed “purpose of study” defined in Chapter 1 (Section 1.4), which was to:

- identify the documented issues and challenges faced by APs within existing literature over the last two decades through an SLR,
- tap into the breadth of the experience of the PMs or PMgmt practitioners to obtain and compile the issues and challenges in ITPM within both traditional and agile environments from various industries via a GT research,
- perform verification of the issues and challenges to be able to delineate a clear list of project challenges, in the form of projects factors,
- attain mitigation methods for the factors for verification and realignment with the new findings of challenges and issues in the industry and to validate the mitigation factors,
- produce a best practice framework to assist in the successful management of IT projects for the agile environment; and
- assess the framework through experienced agile practitioners in the industry, with feedback collected and used to produce an improvised hybrid agile-traditional best practice framework.

This chapter examines the ROs, describing the fulfilment of the objectives based on the activities undertaken in this research, which has examined the issues and challenges discussed in literature over the last two decades, in way of an empirical study, compiling the issues and challenges discussed in literature. This research has further compiled the issues and challenges faced by the PMgmt practitioners in various industries, comparing

them to those in literature, removing the duplicates and consolidating them into a list of combined and unique issues and challenges, classified as factors in ITPM.

A best practice framework was developed, which was assessed by an expert review team, compiling suggestions on improving the framework to fine-tune the framework to subsequently produce an improvised version of the best practice framework. The initial contributions of the research methodologies, SLR and GT, are described, followed by the general contributions of this research. The limitations of the research are then described, with proposed future work in this area. Finally, a conclusive summary is provided on this research within the context of this chapter.

10.2 Response to Research Objectives (ROs)

This research attempted to fulfil the ROs set out at the beginning of the study, in Chapter 1 (Section 1.5), consisting of three ROs, as described in the following context.

Research Objective 1: *To compare Agile ITPM issues and challenges between literature (theory) and the industry (practice).*

This first objective was fulfilled by examining an initial compilation of literature to identify the number and magnitude of issues and challenges addressed in them. This objective was achieved using a 2-phase research methodology approach, SLR as discussed in “Chapter 4” and GT as discussed in “Chapter 5”. Upon affirming that the issues and challenges in managing APs were prominent, via a preliminary literature review, an SLR study was then undertaken, to systematically review the literature over the last two decades, from year 2001 to year 2019 (Chapter 4). A total of 175 papers were

selected for the detailed analysis, with 37 factors identified from literature. To identify the issues and challenges in the industry, a GT research was conducted amongst 42 industry practitioners who voluntarily participated in the study (Chapter 5). A total of 111 factors were compiled, resulting from the SLR study and the feedback received from the 42 industry experts. Upon merging similar data, the resulting 78 factors were further consolidated to produce the final list of 55 unique factors. The gaps, between the issues and challenges addressed in literature, and the issues and challenges identified within the industry, were identified.

Research Objective 2: To develop a best practice framework for APs.

The second objective was achieved by reviewing the list of the 55 unique factors with the industry practitioners, by capturing the suggested/proposed mitigation methods, to either avoid or overcome the prominent issues and challenges of agile PMgmt (Chapter 6). The existing literature was also reviewed, to obtain additional mitigation data, for the issues and challenges discussed in literature. Based on the most popular PMgmt methodology used by the industry practitioners, two methods each were selected, from the agile and traditional environment respectively. PMBOK and Waterfall was the most popular methods used within the traditional environment, while Scrum and Kanban was the most popular methods used within the agile environment. These four methods were tabulated to form the first dimension of the framework, while the PMI knowledge areas were used as the second dimension of the framework. The factors were segregated into the four areas of “Organisation”, “People”, “Process” and “Technology”, which was used as the third dimension of the framework. The 55 factors was then tabulated into the cells in the framework, contributing to the fourth dimension of the framework, thus producing the best practice framework for the administration and management of IT projects within an

agile environment (Chapter 7). The framework was produced in a general context to enable PMgmt in a hybrid environment, as well as a traditional environment.

Research Objective 3: *To validate the proposed framework.*

The initial model of the best practice framework (HAT-PMFv1.0) was reviewed by an expert review team consisting of 12 PMgmt professionals (expert review team), with a minimum of 10 years of experience in PMgmt, assuming a management or leadership role in PMgmt (Chapter 8). These 12 experts voluntarily participated in an assessment process, adapted from the Motorola CMM evaluation model. Each of the factors were evaluated and assessed against the three dimensions of approach, deployment, and results, with the evaluation results captured, consolidated, and analysed. Relevant feedback was solicited from the expert review team on the suggested changes to the model, to fine-tune the framework, producing an improvised framework (HAT-PMFv2.0), described in “Chapter 8”.

Research Objective 4: *To develop a tool for ITPM.*

Based on the feedback received from the expert review team, during the evaluation process, further data was collected from them, and used as input to produce a supporting toolkit. Relevant document templates were produced, which were embedded into the support toolkit (HAT-PMF Toolkit v1.0), to be used as part of the framework, intended to assist the PMgmt professionals in the successful management of IT projects.

10.3 Answers to Research Questions

This research has attempted to answer all the initial RQs listed in Section 1.6 (Chapter 1). There are a total of nine RQs (RQ1a, RQ1b, RQ1c, RQ2a, RQ2b, RQ2c, RQ3a, RQ3b and RQ4a), with the corresponding answers to each of these questions provided in the following context.

RQ1a, RQ1b, and RQ1c corresponds to RO1: “To compare Agile ITPM issues and challenges between literature (theory) and the industry (practice)”, which has been summarised in Figure 10.1.

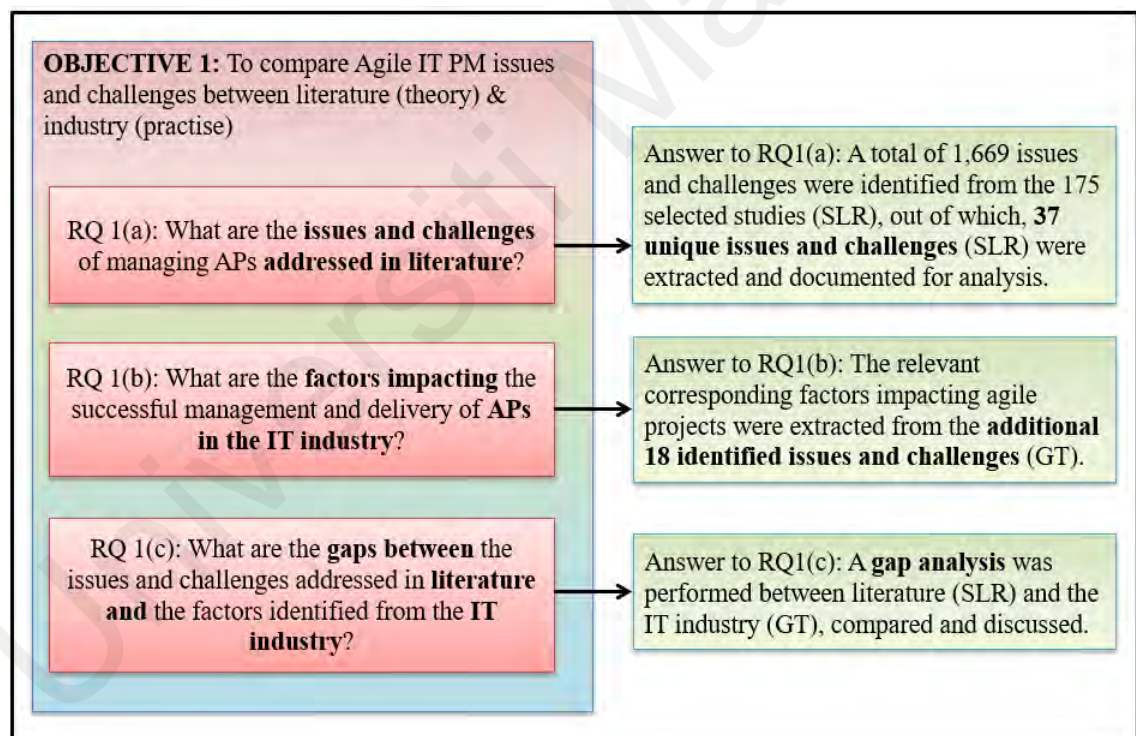


Figure 10.1: Research Objective 1, with the corresponding Research Questions (RQ1a, RQ1b and RQ1c)

As an answer to **RQ1(a)**: “What are the issues and challenges of managing APs addressed in literature?”, a total of 19 issues and challenges were initially identified in managing APs based on the study presented by Chow and Cao (2008), as described in Table 4.3,

presented in Section 4.8.2 (Chapter 4). On reviewing various other literature, a total of 18 additional factors were identified for the governance and management of APs (Ambler, 2009; Drury et al., 2012; Ebert and Paasivaara, 2017; Farashah et al., 2019; Guerra, 2010; Hochmüller and Mittermeir, 2008; Joslin and Müller, 2015; Lalsing et al., 2012; Lee et al., 2006b; Lloyd et al., 2017; McHugh et al., 2012; Nerur et al., 2005; Silvius and Schipper, 2014; Tilk, 2016; Yang et al., 2016) shown in Table 4.4 (Chapter 4). The original 19 issues and challenges presented by Chow and Cao (2008) were further simplified, as the basic factors for the successful governance of management of APs, which are classified as the original factors. The other 18 factors identified from various other literature were further consolidated, to create a combined list of 37 factors (Table 4.5), which have been listed and briefly described in Section 4.8.2 (Chapter 4). The summary is shown in Appendix Y.

As an answer to **RQ1(b)**: “What are the factors impacting the successful management and delivery of APs in the IT industry?”, a total of 111 issues and challenges were compiled from the industry, using the opinions of 42 APM practitioners from various industries, via a GT research (Chapter 5). These findings were categorised into the four categories as proposed by Chow and Cao (2008), which are “Organisation”, “People”, “Process” and “Technical”. The compilation is shown in Appendix Y.

As an answer to **RQ1(c)**: “What are the gaps between the issues and challenges addressed in literature and the factors identified from the IT industry?”, a mapping was done between the factors identified in literature and the factors compiled from the industry, as shown in Appendix Z and Appendix AA. The gaps between the factors from literature (37 factors) and the factors from the industry (101 factors) were analysed (Appendix X), with the duplicates combined to produce 18 additional factors (Appendix AB), to further

produce a consolidated list of 55 unique factors, as shown in Appendix AC. The gaps between the factors from literature and the industry, segmented into four broad categories, have been broadly discussed and addresses in Section 7.4 (Chapter 7).

RQ2a, RQ2b, and RQ2c corresponds to RO2: “To develop a best practice framework for APs”, which has been summarised in Figure 10.2.

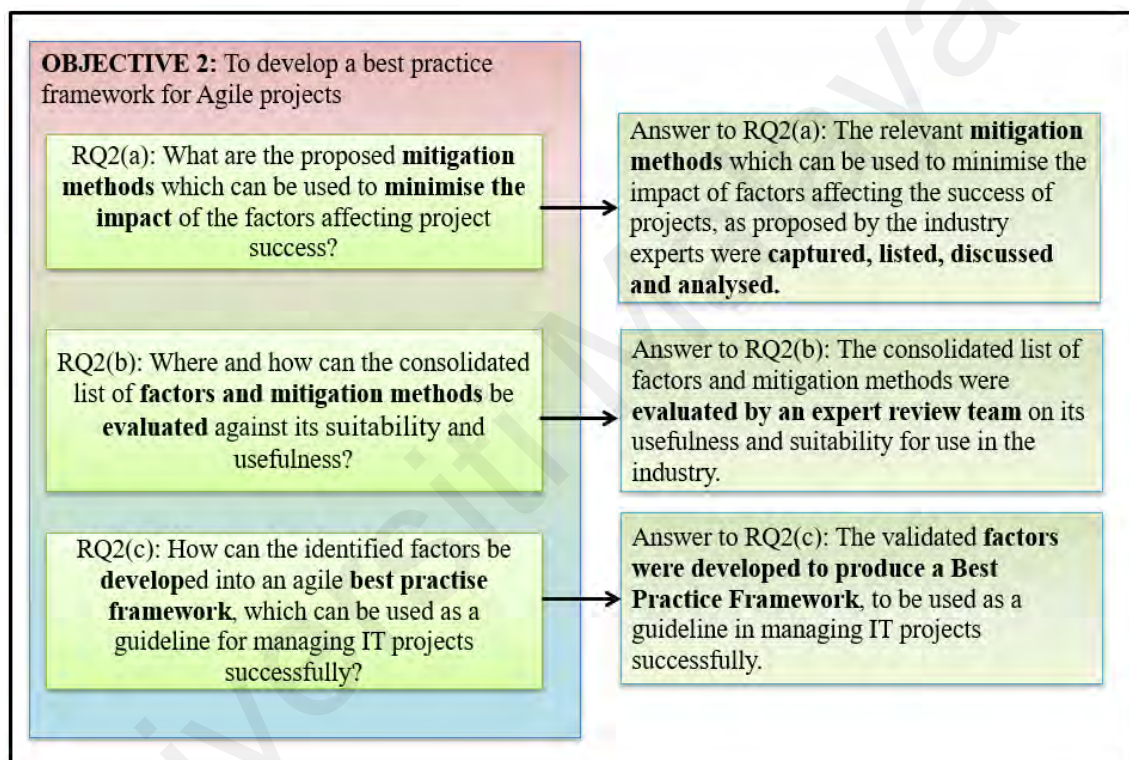


Figure 10.2: Research Objective 2, with the corresponding Research Questions (RQ2a, RQ2b and RQ2c)

To provide an answer to **RQ2(a)**: “What are the proposed mitigation methods which can be used to minimise the impact of the factors affecting project success?”, the proposed mitigation methods for each of the 55 unique factors were compiled from the practitioners. These mitigation methods were reviewed by the practitioners, as described in Section 6.3.2 (Chapter 6).

To provide an answer to **RQ2(b)**: “Where and how can the consolidated list of factors and mitigation methods be evaluated against its suitability and usefulness?”, the consolidated list of 55 factors were evaluated by the industry practitioners. The feedback received was used to fine-tune the mitigation model, as described in Section 6.3 (Chapter 6).

To provide an answer to **RQ2(c)**: “How can the identified factors be developed into an agile best practice framework, which can be used as a guideline for managing IT projects successfully?”, the 55 consolidated factors were used as key inputs in developing the best practice framework (HAT-PMFv1.0), as shown in Appendix AD. This framework was developed to be used as a guideline for the PMgmt professionals in managing projects. The formulation of the framework is described in Section 7.4 (Chapter 7). A 3-dimensional evaluation model consisting of “Approach”, “Deployment” and “Results”, adapted from Motorola, was used for the evaluation of the framework. As the 55 factors were tabulated into each of the cells, there were many instances of the same factors mapped into the different knowledge areas, producing a total of 159 mapped items. These 159 items were individually ranked by each of the expert review team member using the prescribed assessment model against its relevance, usefulness, practicality, and applicability, simulated against their existing projects within their respective organisations.

RQ3a and RQ3b corresponds to RO3: “To validate the proposed framework”, which has been summarised in Figure 10.3.

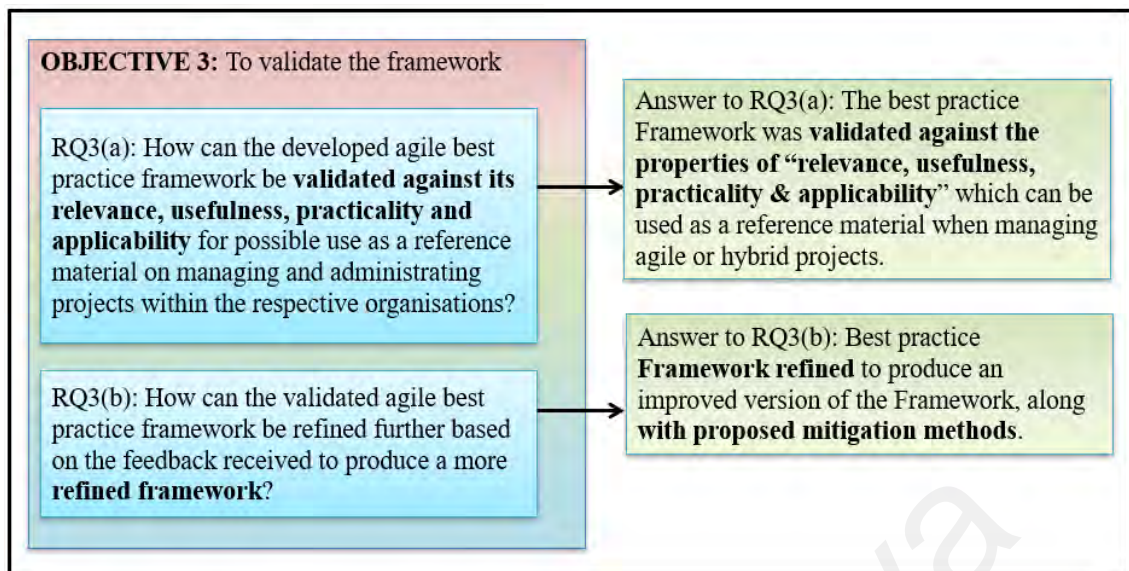


Figure 10.3: Research Objective 3, with the corresponding Research Questions (RQ3a and RQ3b)

In answering **RQ3(a)**: “How can the developed agile best practice framework be validated against its relevance, usefulness, practicality, and applicability for possible use as a reference material on managing and administrating projects within the respective organisations?”, the framework was validated by an expert review team consisting of 8 people, who are all professionals in the field of PMgmt, with a minimum of 10 years of experience in a managerial or leadership role, as described in Chapter 8.

In answering **RQ3(b)**: “How can the assessed agile best practice framework be refined further based on the feedback received to produce a more refined framework?”, the rating results obtained from the evaluation exercise (Appendix AF and Appendix AG), along with the feedback received on proposed amendments to the framework (Appendix AH), were used to refine the initial framework (HAT-PMFv1.0) to produce an improvised and refined version of the framework (HAT-PMFv2.0), as shown in Appendix AJ. The amendments to the framework are shown in Appendix AI (HAT-PMFv1.1).

RQ4a corresponds to RO4: “To develop a tool for ITPM”, which has been summarised in Figure 10.4.

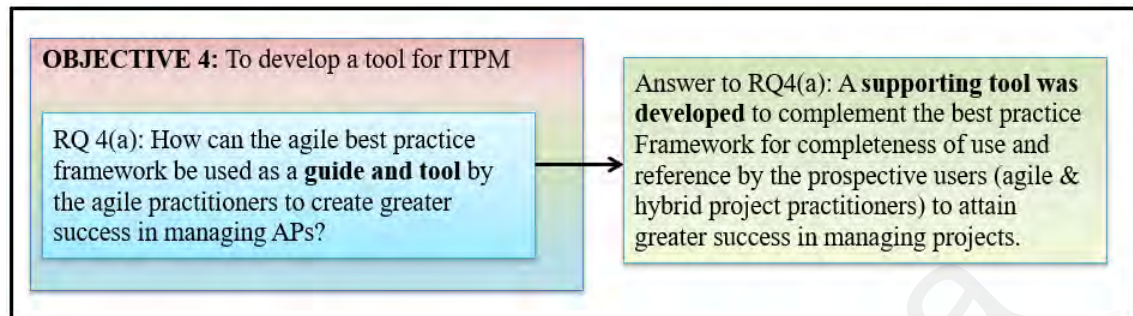


Figure 10.4: Research Objective 4, with the corresponding Research Question (RQ4a)

In answering **RQ4(a)**: “How can the agile best practice framework be used as a guide and tool by the agile practitioners to create greater success in managing APs?”, the produced improvised version of the framework (HAT-PMFv2.0), along with the respective proposed mitigation methods, developed into a toolkit (HAT-PMF Toolkit v1.0), described in Section 8.7, can be used by the participating practitioners, and other PMgmt professionals alike, as a best practice guideline to manage APs.

10.4 Research Contributions

An SLR study was undertaken to assist in identifying relevant studies and analysing the issues and challenges in the governance and management of APs (Chapter 4). A total of 175 papers were selected for the detailed analysis, identifying a unique list of 37 issues and challenges, which were addressed, or discussed in the selected studies. These factors can possibly impact the governance and management of APs successfully. The factors were analysed against the year of publication and it was identified that the factors were most discussed in the studies published between years 2014 and 2016, recording 2015 as the peak year. The detailed findings were presented in Section 6.2 (Chapter 6).

A GT research was undertaken to identify the issues and challenges faced by the agile practitioners in the industry, as described in Chapter 5. Based on information obtained from the initial literature, a survey instrumentation was designed and distributed to 42 identified agile practitioners on voluntary participation, followed by several rounds of interviews, to capture the factors impacting the successful management of APs. A comprehensive list of 111 factors, impacting the management of APs in the industry, along with suggestive mitigation methods, were recorded. The GT method produced 38 additional factors, made out of 20, 10, six and two factors in the Process, People, Organisation and Technical categories respectively, as its findings.

The contributions from the SLR (37 factors) and GT studies (38 factors), combined into a unique list of 55 factors, with the corresponding mitigation methods, are summarised in Figure 10.5, along with the other research contributions.

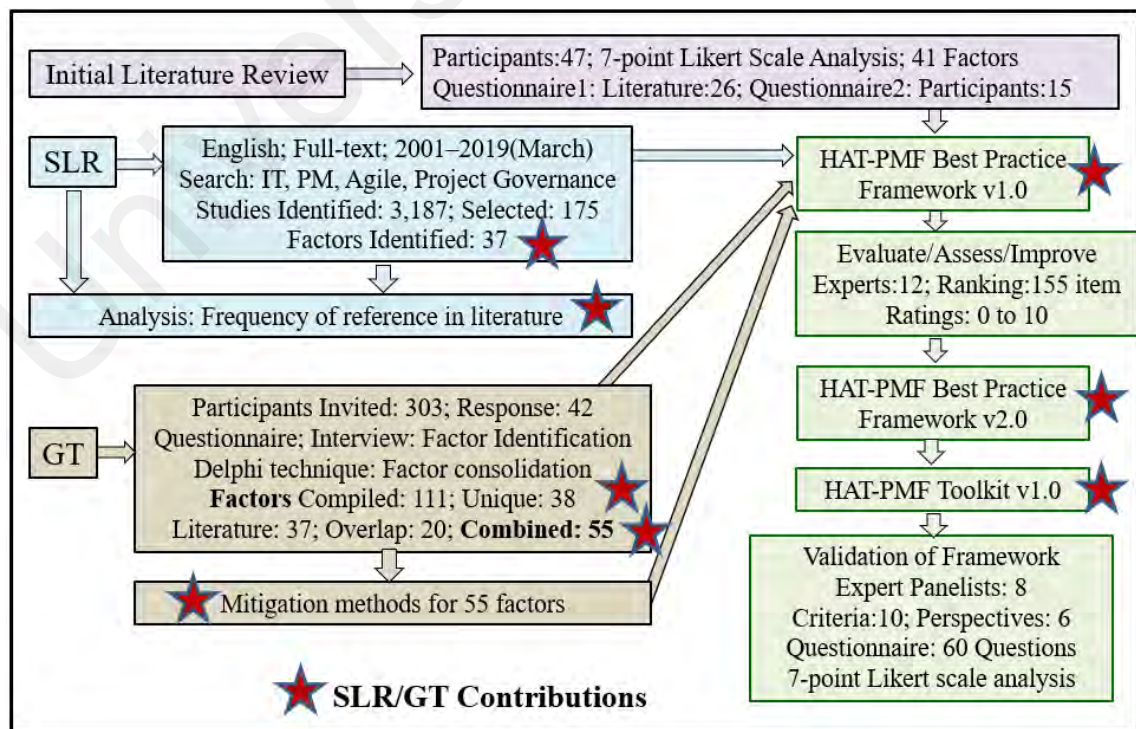


Figure 10.5: Contributions from the SLR and GT Research

The combined list of 55 unique factors were categorised into four broad categories of Organisation, People, Process and Technical. Existing literature stressed on executive sponsorship and support, with the proper allocation of budget for the implementation of the agile method, with proper logistical arrangements. However, the practitioners had greater concerns in the mismatch of organisational objectives with the agile principles, raising concerns that the executive team rush to implement the agile method without ensuring a fit-for-purpose method, which rhymes with the organisational objectives. Literature also suggested the possession of certification and skills by the team members, but the practitioners did not emphasise them as crucial factors, instead they indicated that a lack of team empowerment, the absence of an agile mindset, and the understanding of the agile method was of great concern in the industry. Though literature highlighted a few process related factors, the practitioners reported it as an area of the biggest concern, suggesting a hybrid model or a staggered implementation process, to enable the organisation to adopt the agile principles in stages, while allowing sufficient time for learning and adaptation. The industry demands thorough attention on the process, with all roles clearly defined, and with clear cost, quality, resource and communication management protocols defined, prior to the implementation of the agile method. While literature included technical factors, involving technology and tools to support the agile method, the practitioners did not find that much of an issue, except for the provision of sufficient training prior to the implementation of any support tools.

This study provides a consolidated list of factors, both from literature and the industry, highlighting the factors only found in literature but not reported by the practitioners versus the factors only reported by the practitioners which are not found in literature. It also describes the factors which are common in both literature and the industry, making it possible to identify the gaps in both areas and the ability to bridge this gap. A further

contribution of this research is the formulation of a best practice framework (HAT-PMF v1.0) which was assessed by an expert review team, providing inputs on fine-tuning the framework to produce an improvised version of the best practice framework (HAT-PMF v2.0), including a supporting toolkit (HAT-PMF Toolkit v1.0). These contributions are shown in Figure 10.6, and summarised as follows:

1. A unique list of 37 issues and challenges which were discussed in 175 selected literature over the last two decades, from year 2000 to year 2019 (Chapter 4).
2. The 37 issues and challenges were simplified as factors, and the frequency of these factors being addressed or discussed, within the 175 studies selected for the SLR, were identified and analysed (Section 6.2).
3. A list of 111 issues and challenges were identified from PMgmt practitioners in the industry, producing a unique list of 38 unique issues and challenges faced by PMgmt practitioners in the industry (Chapter 5).
4. A combined list of 55 factors, derived from the issues and challenges, which was used as the main input in producing the best practice framework (Chapter 6).
5. Mitigation methods for all 55 factors were obtained, as discussed, and proposed by the industry practitioners (Section 6.3).
6. The formulation of the initial best practice framework (HAT-PMF v1.0) as a guideline for the successful management of APs (Chapter 7).
7. Evaluation of the best practice framework (HAT-PMF v1.0), obtaining suggestive improvement feedback from the expert review team, which was used to fine-tune the framework to produce an improvised framework (HAT-PMF v2.0) (Chapter 8).
8. A support toolkit was developed (HAT-PMF Toolkit v1.0), to be used together with the framework, for the management of APs, which was validated by a panel of experts against 10 criteria's and 6 perspectives.

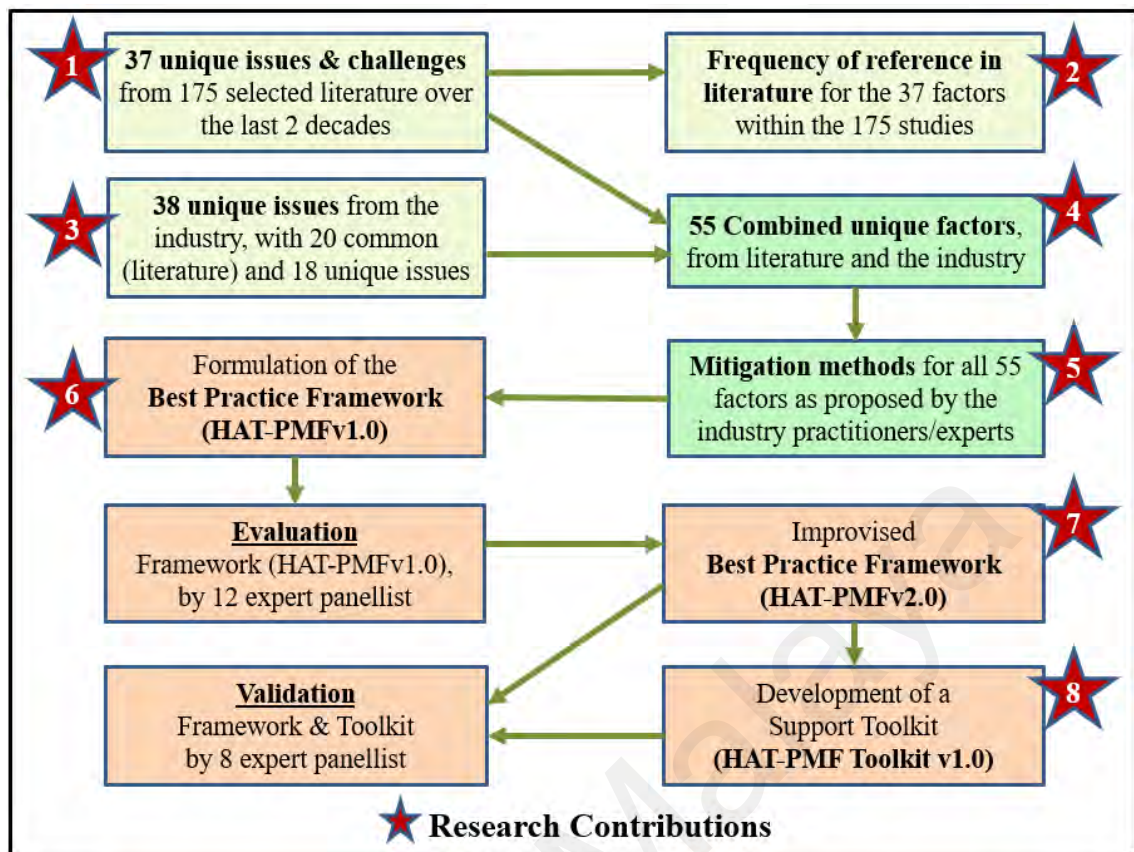


Figure 10.6: Summary of the overall Research Contributions

10.5 Research Limitations

The type of research which was embarked on is unique as this type of work could not be identified in the selected studies. This research was conducted with the following known limitations (summarised in Figure 10.7):

1. The SLR, and the minor and major literature review within the GT research was done on selected databases which have been subscribed to by the research organisation, and available in full text and in the English language.
2. The studies reviewed in both the SLR and GT research were only until March 2019, and should be extended beyond this date as there was many interesting studies in the later years as more and more emphasis has placed in agile methods and more people are embracing agile principles.

3. Non-IT studies was excluded from this research due to time constraints and scope of work, nevertheless the researcher feel that this area could yield interesting results.
4. The GT research was conducted only amongst members of LinkedIn (LinkedIn, 2019), which is a portal consisting of voluntary self-registration of professionals. It has not included any persons who is not registered in LinkedIn (LinkedIn, 2019), who could have been prospective contributors for the study.
5. Non-IT professionals were excluded from this study due to the scope of the study, which is based on IT projects, however the non-IT professionals could have also contributed to a different dimension of data or could have further supported the elements of the findings.
6. The evaluation of the best practice framework was done by an expert review team, who volunteered to participate and provide feedback, consisting of 12 people within various industries, but limited to the IT functions of those industries. The evaluation of the framework was not expanded to experts within non-IT functional areas.
7. The best practice framework was not tested against live projects for the entire duration of the projects. Hence, the evaluation feedback against live projects using the proposed evaluation model adapted from Motorola could not be obtained, to be able to determine its true value and its relevance, usefulness, practicality and applicability.
8. The development of the framework was restricted to the dimensions of only 2 agile methods (Scrum and Kanban) and 2 traditional methods (Waterfall and PMBOK). It was not modelled against other popular agile methods, especially XP, which is a widely used method within the software development industry.

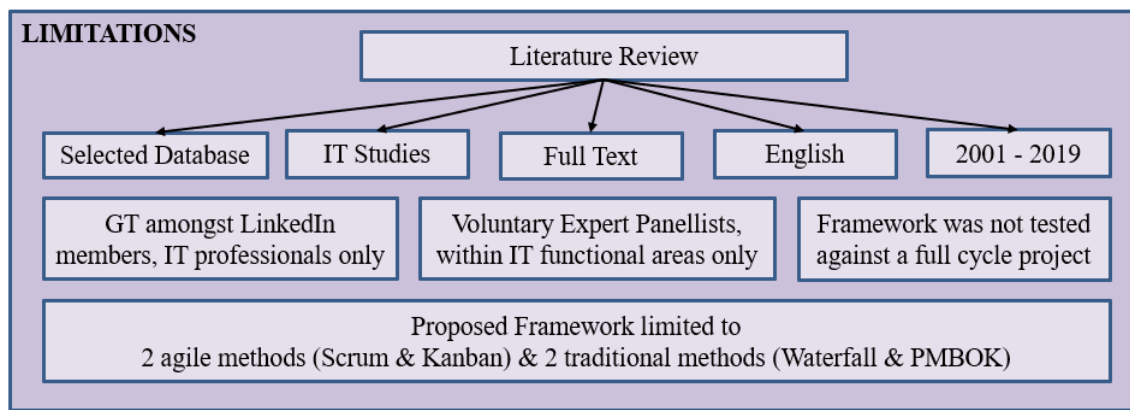


Figure 10.7: Identified Limitations of this Research

10.6 Future Work

Based on the research limitations identified in the previous section, future research work can be undertaken in the following proposed areas (summarised in Figure 10.8):

1. To extend the research work by reviewing (and selecting) other studies from the databases not included in this research and to also review studies done in other languages apart from English.
2. To analyse the studies beyond March 2019 to capture the latest trend in agile governance and management, while identifying the latest trends of factors impacting these projects.
3. To do an in-depth study on the “People” category as it is seen to be an important category in the management and governance of APs.
4. To include more parameters to the analysis of studies, such as the type of projects, size of projects, size of organisation, level of PMgmt and PMO maturity, type of method implemented, the extend of method utilisation, project outsourcing indicator, offshore development indicator, and other indicators which would produce interesting results for further analysis.
5. To include more respondents to a wider number and category of professionals to possibly capture more factors impacting APs, and suggested mitigation methods.

6. To propose and test a comprehensive project issue mitigation model which would solve most, if not all the issues and challenges by the industry practitioners.
7. To utilise other possible methods of research and analysis (i.e. quantitative research methods) against the list of factors to identify other possible areas of impact on APs in the various industries.
8. Comparative study to include Non-IT studies to identify similar factors impacting inter-industry projects, which could yield interesting and curiously unexpected results.
9. The GT research should be extended to practitioners using other methods, other than Scrum and Kanban. The XP method should be used as it is a method mostly used, within the context of software development, in the current environment.
10. To analyse and propose a “best-fit” hybrid method which are suitable for both agile and traditional projects, with the flexibility of customisation of the method to suite organisational and project requirements.
11. To analyse project agility in the perspectives of a distributed project environment, emphasising on hybrid methods encompassing the combination of agile and stage-gate models to produce a method tailored to the needs of the current organisational needs.
12. To analyse the governance and management of APs from the angle of offshoring, best-shoring, outsourcing, and insourcing, along with the combination and variants within these scenarios.
13. The evaluation of the best practice framework was done by an expert review team, within various industries, but limited to the IT functions of those industries. The evaluation of the framework should be expanded to more experts, and other experts within other functional areas (non-IT).

14. The best practice framework should be tested against live projects for the entire duration of the projects, to compile evaluation feedback from live running projects to be able to determine its true value and its relevance, usefulness, practicality and applicability.
15. The best practice framework which has been produced into a tool using the MS-Excel spreadsheet file can be further developed into an application, as a standalone tool, or embedded into other existing tools, to produce a more effective project administration and management experience.

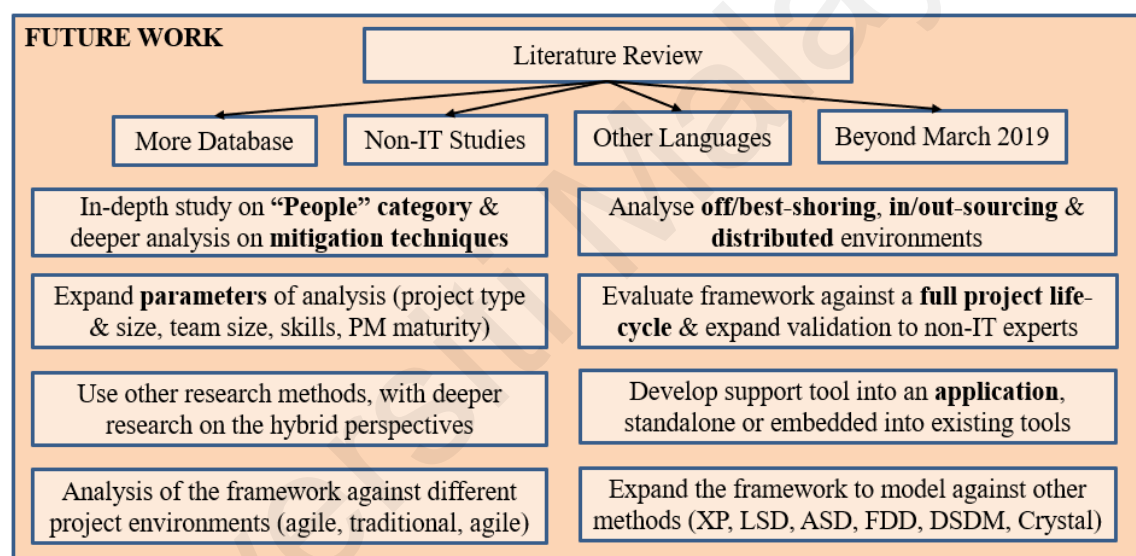


Figure 10.8: Proposed areas of Future Research Work

10.7 Summary

This chapter summarises the entire study undertaken by this research, which has met and fulfilled the proposed “purpose of study” (Section 1.4) and ROs (Section 1.5) as described in Chapter 1. A preliminary literature review was undertaken on the issues and challenges in APs to take a deep dive into existing literature on the factors which may affect the industry practitioners as they may not have realised those factors. The intention was to compile a comprehensive list of issues and challenges and obtain rankings from the

practitioners on each of the factors, to identify if they have been impacted by these factors, and to what extent have they been affected by them. Based on the ranking results, the factors, and its corresponding impact towards the management of APs were identified. Based on the discrepancies and open issues identified above, a more concise list of factors were included, which extended the research further to identify which of the studies addresses the additional factors, after which a trending analysis was performed to identify the key factors against literature. An in-depth understanding of the factors were obtained, as well as the mitigation factors proposed by literature.

The researchers then embarked on an extension of the SLR research work, to validate the factors with the industry practitioners, using a GT approach. The rankings from the practitioners on each of the factors were obtained, along with information on the impact of these factors, and the extent to which they have been affected by the respective factors. Based on the ranking results, the level of impact of the factors towards the governance and management of APs were identified. Based on the discrepancies and open issues identified, a more concise list of factors was created and the research was extended to identify which of the studies address the additional factors, performing a trending analysis identifying the key factors by literature. An in-depth understanding of the factors were obtained, where they were combined to remove duplicates, to create a more concise list of factors. The factors were then tabulated against a four-dimensional framework, to produce the best practice framework (HAT-PMFv1.0), evaluated by an expert review team. Relevant feedback was compiled to fine-tune the framework, to produce an improvised best practice framework (HAT-PMFv2.0). A supporting toolkit was developed, to be used along with the formulated framework, to assist PMgmt professionals in the administration and management of APs, and to act as a reference

material for the project stakeholders in the successful governance and management of APs.

Advantages and disadvantages conferred by the various ITPM environments exists, in both traditional and agile methods. Migrating from one environment to another may appear beneficial, but is not encouraged, without first understanding its implications. PMgmt practitioners should be careful, as to not allow the wrong motivational element to influence the decision on the utilisation of a method, keeping in mind that there is no 'one method that serves all'. With the current drift on tremendous technological changes, huge demands for communications bandwidth, heavy quest for technology, unprecedented global economic conditions, outrageous pandemic outbreak, and the sense of plummeting expenditure, a balance need to be attained. People want the best for the least, organisations want everything for nothing, and it is important to always keep these in mind, before making any decisions on investments. By understanding the what (managing successful projects), the why (issues and challenges), the who (stakeholders), and the how (best practice), an informed decision can be made, which is the direction this research work traversed, to investigate the issues and challenges in APs, identifying the factors which impacts its performance, striving to harvest greater success for projects, its stakeholders, the organisation, and the entire enterprise of inter-related systems and processes. The researchers expect the best practice framework to at least provide this realisation, if not for any greater benefits it should rightfully yield, concluding this research work with the thoughts of taking this subject one level higher.

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