A COMPILATION OF FACTORS ASSOCIATED TO THE GOVERNANCE AND MANAGEMENT OF AGILE PROJECTS: A SYSTEMATIC LITERATURE REVIEW

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DOI: https://doi.org/10.22452/mjcs.vol34no3.4

ABSTRACT

The demand for project success is increasing, while the number of failed projects are still high. Whilst Project Management Offices help in the governance of Information Technology projects, the trending issues and challenges in Agile projects need a great deal of attention. More organisations are embracing the agile method due to its popularity and the benefits it yields. Literature discusses various issues and challenges, with an absence of a holistic review to determine its frequency, impact, and classification systematically. This study attempts to identify the factors addressed in literature over the last 2 decades, producing a list of factors and ranking them according to the most addressed and the frequency of reference. A systematic literature review was undertaken to identify the relevant literature using specific keywords search and filter, arriving at a final list of 175 selected studies for the analysis work, which was used to identify 37 prominent factors affecting agile project success. The highest number of studies and factors discussed were between years 2014 and 2016. Project Governance faired as the most addressed factor, while People related factors were widely discussed. Current trends are focused on attaining project governance with a sound understanding of the agile principles, by people with the right attitude, knowledge, skills, and the ability to work well with the team. Project governance with the careful implementation of the agile method and its processes in stages, with the right support tools and technology, is most important for project success. Competence of project stakeholders possessing the right attitude, with great collaboration and teamwork capabilities, and the ability to garner a close relationship with the customer and clearly articulate changing requirements is key to delivering successful agile projects. Future work will include the understanding and identification of critical challenges and crucial factors for ensuring agile project management success. It is proposed to expand the research further into the project governance and people-related area.

Keywords: ***Agile Project Management, Success Factors, Issues and Challenges, Project Governance***

1.0 INTRODUCTION

The rate of failed and challenged Information Technology (IT) projects are too high [46]. The issue of software projects being over budget, behind schedule, and not meeting stakeholder expectations have been addressed by several publications over the last few decades [18] [19] [32] [43] [45] [51]. This has traditionally been accorded to the three critical elements of Project Management (PMgmt); scope, cost, and time, popularly known as the Iron Triangle of success [5]. Software projects generally did not meet one or more of these 3 elements: cost or budget, time or schedule, and scope or requirements [46]. Between the years 2011 and 2015, on average, only 28.8% of projects recorded success, while 18.8% of projects failed, and the remaining 52.4% of projects were classified as challenged [47]. The high rate of failed or challenged projects can be mitigated by increasing the PMgmt maturity level in an organisation [18]. Many organisations have implemented Project Management Offices (PMOs) to improve PMgmt maturity and project success [35]. Ten (10) prominent project success factors were identified, which are Executive Sponsorship, Emotional Maturity, User Involvement, Optimisation, Skilled Resources, Standard Architecture, Agile Process, Modest Execution, PMgmt Expertise, and Clear Business Objectives [47].

Traditional PMgmt methods focus on comprehensive planning, reducing the need for changing requirements in the project whereas agile methods assume the inevitability of change and can therefore more easily tolerate changes [S118]. Agile Project Management (APM) methods focus more on customer interaction and working software supporting business strategy and less on detailed planning and documentation [S19] [S12]. No manual or guide can eliminate all the issues that may be faced in agile projects [32]. The critical requirement of staying successful is to find out and meet the challenges and success factors and concentrate on success factors [24]. The Agile Manifesto developed by a group of practitioners in 2001, based on twelve principles [7], provides a set of values and principles

on which agile methodologies are based but does not prescribe any specific methodology [32]. As the Agile Manifesto does not provide solutions for best practice and methods of managing and delivering successful projects by mitigating the issues and challenges, the existing issues must be analysed so that the success factors can be identified and employed to projects to achieve greater project success.

This study focuses on **Agile Projects (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 Agile Project (AP) practitioners to capture additional issues in the APM industry. The population for the research is targeted at Practitioners of PMgmt practices with an average of 5 to 10 years of experience in a PMgmt or PMO role, managing APs. The core of the study is around failing projects and mitigation techniques to reduce the number of failed projects, turning them around into successful projects. This study expands the research performed by Chow and Cao (2008) [S29] which identified nineteen issues and challenges in APs, by including 18 additional issues and challenges identified through a Systematic Literature Review (SLR). Combined, the 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 Project Manager (PM) and team members are seen to be key in attaining agile project 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, given the means to maintain a close relationship with the project stakeholders and customers with frequent 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.

2.0 BACKGROUND AND RELATED WORK

This section elaborates three key concepts involved in this research: PMgmt, PMO, and APM. The review concludes with the compilation of issues and challenges of APM from literature.

2.1 Project Management (PMgmt)

Too many Information Technology (IT) projects (which widely includes software projects) are not completed on schedule, on budget, and within scope, resulting in cost overruns, and missed business opportunities [46]. Despite significant efforts spent on projects, PMgmt did not evolve into a recognized discipline until the 20th century [40]. A significant development for the field of PMgmt was the establishment by the Project Management Institute (PMI) in 1969 [40], working to establish PMgmt standards across industries, documented in the Project Management Body of Knowledge (PMBOK) (2013) [36]. As organisations acquire greater awareness on the importance of PMgmt, a corresponding need for a systematic method of the implementation and support of PMgmt arises [9]. PMgmt has evolved, from the utilisation of tools and techniques on standalone projects to becoming organisational capabilities, integrated across multiple projects [14]. The popularity of PMgmt has led many American corporations to "projectize their operations" [29, pp.38]. Projects have become the method by which organisations make investments in IT that create valued business assets [29]. Ibbs and Reginato (2002) [22] observed that organisations with more mature PMgmt practices have improved project performance, including more predictable project schedules and cost performance.

The Standish Group (2015) [46] reported 10 factors of project success; Executive Sponsorship, Emotional Maturity, User Involvement, Optimisation, Skilled Resources, Standard Architecture, Agile Process, Modest Execution, PMgmt Expertise and Clear Business Objectives (described in Table 1).

Table 1: Project Success Factors as reported and described by the Standish Group (2015)

Success Factors	Description
Executive Sponsorship	Agreement from the executive or group of executives to provide both financial and emotional backing, encouraging and assisting in the successful completion of a project or multiple projects.
Emotional Maturity	A collection of basic behaviours of how people work together. In any group, organisation, or company, it is both the sum of their skills and the weakest link that determine the level of emotional maturity.
User Involvement	Takes place when users are involved in the project decision-making and information-gathering process. This also includes user feedback, requirements review, basic research, prototyping, and other consensus-building tools.
Optimisation	A structured means of improving business effectiveness and optimising a collection of many small projects or major requirements. Optimisation starts with managing the scope based on its relative business value.

Success Factors	Description
Skilled Resources	People who understand both, business and technology. A skilled staff is highly proficient in the execution of the project's requirements and delivery of the project or product.
Standard Architecture	The term used by the Standish Group is "Standard Architectural Management Environment (SAME)" and defines it as a consistent group of integrated practices, services, and products for developing, implementing, and operating software applications.
Agile Process	The level of skills and proficiency of the agile team and the product owner in the agile process. Agile proficiency is the difference between good and bad agile outcomes.
Modest Execution	Having a process with few moving parts, and those parts are automated and streamlined. Modest execution also means using PMgmt tools sparingly with minimal features.
PMgmt Expertise	The application of knowledge, skills, and techniques to project activities to meet or exceed stakeholder expectations and produce increased value for the organisation.
Clear Business Objectives	The understanding of all stakeholders and participants in the business purpose for executing the project. Clear Business Objectives could also mean the project is aligned with the organisation's goals and strategy.

2.2 Project Management Office (PMO)

In addition to acquiring project scheduling software and training employees on PMgmt, Block and Frame [9] recommended establishing a project office. The project office name evolved to become the PMO for a majority of organisations [21]. Dai (2001) [16] defined a PMO as "an organisational entity established to assist **PMs** and teams throughout the organisation in implementing PMgmt principles, practices, methodologies, tools, and techniques". A PMO can provide a framework for organisations to improve project success across multiple projects [23]. Dai (2001) [16] conducted research on the contributions PMOs made to PMgmt effectiveness and corresponding project success, recording a positive relationship between the presence of a PMO and reported project success. Many organisations have implemented PMOs to improve PMgmt maturity and project success [35]. Lee (2006) [30] studied IT PMOs and found that they have positive effects on all nine of the PMI® knowledge areas (time, cost, scope, quality, risk, communications, human resources, procurement, and integration). The official text of PMI, known as the PMBOK has evolved and included an additional knowledge area (stakeholder) in its 5th Edition [36], making it a total of 10 knowledge areas. These 10 Knowledge Areas described in the PMBOK (2013) [36] are listed in Table 2.

Table 2: PMgmt Knowledge Areas as described by PMI (2013) [36]

Knowledge Area	Description
Project Time Management	The management of time and maintenance of the project schedule to ensure adherence to the time element of the Iron Triangle.
Project Cost Management	The management of cost and budget for the project to ensure adherence to the cost element of the Iron Triangle.
Project Scope Management	The management of the scope of the project, including the detailed requirements describing the boundaries of the project to ensure adherence to the scope element of the Iron Triangle.
Project Quality Management	The management of the quality of the project to ensure the deliverables conform to the expected quality standards.
Project Risk Management	The identification and management of the existing and probable risks in the project to devise a means of mitigating them towards the best possible level.
Project Communications Management	The management of communications within the project team and between the project team and the other project stakeholders (i.e., end-users, testers, customers, departmental managers, leadership team, regulators, enforcement agencies, and any other stakeholders impacted by the project).
Project Human Resource Management	The management of personnel in the project, including the recruitment of project team members, providing the necessary induction, coaching, and training, and ensuring the proper level of motivation is fostered throughout the project.
Project Procurement Management	The management of procuring goods or services which are required for the project, including the proper negotiations to set-up the contracts according to the project charter, the goals and objectives of the organisation, and the expectations of the key stakeholders.
Project Integration Management	The management of the integration of the various elements of the project to ensure they align with the main objectives of the project and conform to the charter of the project.
Project Stakeholder Management	The management of project stakeholders, consisting of any party who has an interest in the project, including the project team members, sponsors, customers, users, vendors, contractors, and any other party who either have an interest in the project or is affected by the outcomes of the project.

PMOs help to improve PMgmt maturity in organisations by providing consulting, mentoring, training, reporting, methodologies, and standards for PMgmt [13]. Taylor (2006) [51] suggested five core functions of a PMO: practise management, infrastructure management, resource integration, technical support, and business alignment, further listing the activities of a PMO as shown in Table 3.

Table 3: PMO activities as described by Taylor (2006) [51]

PMO activities	Description
PMgmt Methodology	To establish policies and procedures, training and clearly defined operating expectations.
Project Governance	The governance in terms of consultative Vs controlling PMO.
Resource management	The resources required mainly for the "Controlling PMO" environment.
Mentoring	Coaching, communication, listening, and organisational knowledge.
Project Portfolio Management	Aligning the projects to fit the organisational goals and objectives.
PMgmt Tools	Evaluate and implement tools that add value, while practising caution not to change tools (especially software) just because new ones become available.
Assessment	Assess the project health, competencies, and capabilities.
Training and Education	Skills and knowledge required to extend the PMs' capabilities.
Planning support	Assist in requirements definition and developing technical approaches.
Customer relationship	Interface with the customer.
Standards and Metrics	To issue consistency in the quality of projects.
Organisation and Structure	To choose the PMO model in the organisation which best suites the organisational objectives, goals, mission, and vision.
Career Development	Helping PMs and team members on a suitable and appropriate career path.
Project Auditing	An attempt to determine the true health of the project.
Vendor/Contractor Relationships	Managing subcontracts and the relationship with the contract holders, partners, and external organisations.
Project Knowledge Management	Required due to the mobility of the workforce, evolution of the global business structure, and the lack of amount of time to acquire knowledge.
Facilities and Equipment Support	Supplying facilities and equipment, shared by various projects to maximise usage and minimise idle time.
Team Development	Formation of a project team and the team dynamics within the project team.
Project Recovery	A separate experienced team to assist troubled projects.
Business Performance	Monitoring project viability.

2.3 Agile Project Management (APM)

APM has gained wide public attention lately, with considerations of being the most appropriate PMgmt approach for today's projects, compared to traditional PMgmt approaches, applied in practice in the form of PMgmt methodologies which are often tailored to specific organisational needs of managing and executing projects [43]. Agile methods are regarded as a set of umbrella terms for a set of approaches that are interactive, incremental and collaborative [52], having the ability to gracefully adapt to changes [S12]. The "Agile Manifesto" was written in 2001 by practitioners who proposed many of the Agile development methods. The manifesto states that Agile development should focus on the following four core values [7] [18]:

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

Highsmith (2004) [20] defines agility as the ability to create and respond to changes to create value in a turbulent business environment. Agility, as endeavoured by most research, is based on several business principles like continuous innovation, product adaptation, shortening delivery times, adjustment of people and processes, and reliable results [20]. In a more generic term, Chin (2004) [12] defined the "agile environment" as a habitat that contains a certain amount of uncertainty and requires specific knowledge of the entourage, stressing the need to deliver projects as soon as possible.

2.4 APM Methods

Dybå & Dingsøyr (2008) [S52] conducted an empirical study on seven agile development methods, classifying them as main agile development methods, summarised in Table 4. For this study, which is focusing on the issues and challenges in agile projects, and not precisely on the agile methods, other agile methods will not be described.

Table 4: PMO activities as described by Taylor (2006) [51]

Methodology	Description
Crystal methodology	Designed by Cockburn (2002) [15]. "The core Crystal philosophy" is that software development is usefully viewed as a cooperative game of invention and communication, with a primary goal of delivering useful, working software and a secondary goal of setting up for the next game [15]. Since the software projects are different in nature, scope, and size, Crystal methods present a set of methodologies from which project teams can pick a starting point and then adjust the selected methodology further to fit their needs [19]. The framework for Crystal methods includes three factors that influence methodology selection/design: communications load (dependent on staff size), system criticality, and project priorities.
Dynamic Systems Development Method (DSDM)	Stapleton (2003) [47] described nine principles underlying the DSDM methodology, which are User Involvement, Empowering the Project Team, Frequent Delivery, Addressing Current Business Needs, Iterative and Incremental Development, Allow for Reversing Changes, High-Level Scope baselined before the Start of Project, Testing throughout the Lifecycle, and Efficient and Effective Communication. According to Koch (2005) [26] Dynamic Systems Development Method (DSDM) is a generic project development method, and not prescribed specifically to software development, so there is not much emphasis on programming. The DSDM methodology divides projects into three phases: the pre-project phase (before), the project life-cycle phase (during), and the post-project phase (after).
Feature-Driven Development (FDD)	FDD combines both methods, model-driven and agile development, with the emphasis on the initial object model, division of features into multiple works, and the iterative design for each feature. According to Palmer and Felsing (2001) [33], FDD is defined by its eight practices, which are Domain Object Modelling, Developing by Feature, Class ownership, Feature teams, Inspections, Regular build schedule, Configuration Management, and Reporting/Visibility of results. FDD is unique among Agile methods because it emphasises upfront design and planning, unlike the traditional methods [26]. However, it is very much classified as an agile method due to its nature of development which involves iterations of incremental building of identified features, and in the way the changes in the features list and plans are accommodated.
Adaptive Software Development (ASD)	Highsmith (2002) [19] defines Adaptive Software Development (ASD) as a complex adaptive system composed of 3 elements: agents (team members and stakeholders), environments (processes, organisations, technologies), and emergent outcome (product). The ASD life cycle model consists of three components: Speculate (i.e., plan), Collaborate (i.e., build), and Learn (i.e., review). These three components entail five steps, the first step being the "Project Initiation", executed at the start of the project. The last step is the "Final Q/A & Release" step, executed at the end. The first and last steps are executed only once, while the three steps in between, constituting the "Learning Loop" (Adaptive Cycle Planning, Concurrent Feature Development, and Quality Review), are executed multiple times [26]. The 6 ASD life cycle characteristics are Mission-focused, Feature-based, Iterative, Time-boxed, Risk-driven, and Change-tolerant [19].
Lean Software Development (LSD)	Lean Software Development (LSD) is a set of principles and tools that software development projects can utilise to be lean, characterised by seven lean principles that encompass 22 Lean Software Development tools, as described by Poppendieck et al. (2003) [37]. The seven lean principles are: Eliminate Waste, Amplify Learning, Decide as Late as Possible, Deliver as Fast as Possible, Empower the Team, Build Integrity, and See the Whole [37]. The Toyota production system, within the software development unit, adapted the principles from lean production and recorded significant improvements to its production system.
Scrum	Scrum is a popular agile software development method that has been used to manage regular product development projects. According to Koch (2005) [26], the word "Scrum" originated from the game of Rugby, referring to a particular strategy of getting the ball back into play (in Rugby). 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. As described by Schwaber & Beedle (2002) [39], Scrum focuses on PMgmt in situations where it is difficult to pre-plan, where feedback loops constitute the core element. In the software industry, the software program is developed by a self-organising team in increments (called ''sprints"), starting with planning and ending with a review. The system implementation features are registered in a backlog, and the product owner decides which backlog items should be developed in the next occurring sprint. Team members coordinate their work in a daily stand-up meeting. The Scrum Master, who is also a team member, is in charge of solving problems that stop the team from working effectively [39].
Extreme Programming (XP)	Extreme Programming (XP) is a very popular agile software development method discussed in many agile literatures and has come to embody the Agile methodology itself to many practitioners. XP focuses on best practice for development, and it consists of twelve elements of practices: The Planning Game, Small Releases, Metaphor, Simple Design, Testing, Refactoring, Pair Programming, Collective Ownership, Continuous Integration, 40-Hour Week, On-site Customer, and Coding Standards [4]. The revised ''XP2" consists of 13 primary practices: sit together, whole team, informative workspace, energized 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" [6] [8].

While the methods described in Table 4 have their peculiarities, they all share the same principles as envisioned by their advocates. The Agile Alliance (2001) [2] published 12 principles of agile practices, describing the basis of methods towards the governance and management of agile projects. Customer satisfaction is classified as the highest

priority for agile practitioners, which should be achieved through the frequent and timely delivery of working solutions through sustainable development. Welcoming changing requirements throughout the development process helps deliver usable and valid solutions, as developers are expected to work closely with the business stakeholders frequently throughout the project, via face to face conversations. The Agile Alliance (2001) [2] dictates that motivated project team members, given the required level of support and trust, is expected to produce a self-organising team, with continuous attention to technical excellence and the capability to produce the best architecture, requirements and design. This team is expected to adopt simplicity and regularly reflect on past behaviour and experience to foster an agile-tuned behaviour.

2.5 Issues and Challenges of APM

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 by Boehm & Turner (2005) [S21]. Eighteen significant issues were identified, as shown in Table 5.

Table 5: Significant Issues in the implementation of Agile Processes (2005) [S21]

Significant issues in the implementation of Agile methods	
1. Resource loading, slack, timekeeping, capital evaluation	2. Required colocation, customer access
3. Non-functional requirements	4. Documentation
5. Critical design reviews (milestones)	6. Contractual and source selection issues
7. Interfacing/integration with other methodologies/disciplines	8. Predictability, perfect knowledge
9. Statutory/regulatory constraints	10. HR policies and processes
11. System interface control	12. Roles, responsibilities, and skills
13. Agile work on legacy systems	14. Formal requirements
15. System engineering V-process model	16. Maturity assessments
17. Traditional engineering measurements	18. Cost estimation

Boehm & Turner (2005) [S21] identified **people issues** as most critical in improving the management of project personnel, particularly the engineering and development personnel, which is vital for the adaptation and integration of agile methods and practices into the existing processes. People issues are at the heart of the agile movement, and much of the paradigm change is aimed at empowering individuals by supporting reasonable goals, shorter feedback cycles, ownership, and flexibility [S21]. Boehm & Turner (2005) [S21] indicated that **management attitude** contributes to the next most critical issue, mentioning that migrating from traditional to agile management attitudes can be difficult, where managers tend to associate employees with specific roles that might cause difficulty in the multitasking characteristics of agile team members. PMs in most agile methods play two primary roles: protector and coach [S21], and act as a barrier between the organisation and the team to minimize unnecessary perturbation during a sprint or development cycle and provide experienced technical help when necessary [S21]. While many traditional managers fill these functions, agile methods particularly focus on them [S21]. The third most critical issue described by Boehm & Turner (2005) [S21] is the **logistical issue** which directly affects 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 & Turner (2005) [S21] due to organisational resentment that surfaces when something new appears in the existing culture. Concerns of inadequacy or desuetude surface, jealousy about assignments and business appurtenances is aroused, and defence mechanisms rapidly deployed, which can result in several destructive behaviours, including the cultural victimisation of change agents or early adopters and the deliberate sabotage of projects through direct or indirect methods [S21]. 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 smooth and seamless transitions [S21].

2.6 Related Work

According to Kaur & Singh (2016) [24], most projects do not fail due to technology, but due to social and organisational deficits, and the lack of effective communication, making it more likely for larger projects to fail than small projects. As described by Miller (2013) [32], issues, challenges, and problems are usually unique and occur due to differences and peculiarities in the organisation, the people, the execution of the practices, or other factors. No manual or guide can eliminate all the issues that may be faced in agile projects [32]. The critical requirement of staying successful is to identify the issues and challenges while concentrating on success factors [24]. The Agile Manifesto does not prescribe any specific methodology, it provides a set of values and principles on which agile methodologies are based [32]. 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 [32]. The existing issues must be analysed so that the success factors can be identified and employed for projects to achieve project success.

Carrillo et al. [10] asserted that it is important to establish real factors that are in accordance with the characteristics of the key stakeholders of the project (project practitioners/manager/team), to adopt a methodology. An agile methodology should be implemented in a manner in which it must apply to any projects, with automation and the utilisation of tools to promote data compilation and reporting, while providing the ability to work seamlessly with the management team directly responsible for the project outcomes [10]. Thence, 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 to identify mitigation methods to (minimise project failures and) achieve project success.

Pazderka et al. [S125] commented that those working with virtual teams are faced with challenges in the context of PMgmt maturity models, establishing a strategy to extend these models to address the challenges, further identifying a set of best practices for virtual team collaboration that can be integrated into existing maturity models. However, there was an absence of a thorough analysis of the project challenge areas to refine them into mitigations steps to formulate best practices for PMgmt maturity models, as per the proposed future work [S125]. This research will analyse the issues and challenges amongst the practitioners in a global environment, mostly working in virtual teams across a geographically disbursed team, to deliver a set of common objectives for the customer.

Chow and Cao's [S29] study was not able 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. Research carried out by Stankovic et al. (2013) [S148] was limited to a particular country (Yugoslavia) and the survey respondents were mixed, and were not specifically related to agile projects, or were themselves agile practitioners, proposing research targeted specifically at agile practitioners in a global setting (and not confined to any particular country).

A more recent study by Hoda et al. [S75] 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, the role of the managers in providing an optimum level of guidance and support, customer demand for unsystematic requirements changes, 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. [S65] to identify the challenges faced by agile practitioners, to further strengthen existing studies, was conducted against a limited group of audience in three cities in Europe (London. Manchester and Rome) and face to face style interactions 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 varied data collection methods (interviews, workshops, round-table discussion, focus-groups) to be able to arrive at more comprehensive findings.

3.0 RESEARCH METHOD

A systematic literature review (SLR) is conducted to identify, select, evaluate, and interpret the relevant research available in literature which provides answers to a particular topic, area of interest, phenomenon, or to some prescribed research questions [25]. The method is appropriate for summarising existing research, to identify gaps in the existing literature, and to provide a background for the positioning of new research [25]. An SLR should be achieved by employing a rigorous search method, encompassing a strategy or plan which must be fair and non-biased, to ensure completeness of the search to arrive towards a reasonable level of assessment. When this study was conducted, there was no systematic study compiling and analysing the issues and challenges of agile project management, and there was no trending analysis done to determine the frequency of reference to the factors which affect the governance and management of agile projects. We aimed to fill this gap by conducting an SLR, adapting Kitchenham's methodology [25].

This study presents the results of an SLR of issues and challenges in the governance and management of agile projects. The review is positioned in the field of software engineering and utilises literature from PMgmt in IT. This SLR process comprises several steps, performed in a systematic and disciplined manner, including the establishment of a literature search and review protocol, conducting the SLR, analysing the results, reporting the findings, and discussing the outcomes of the findings. This study utilises part of the findings from the study done by Chow and Cao (2008) [S29] on APM, which generated nineteen issues and challenges. These challenges, along with the categories pointed out by Miller (2013) [32] were discussed with the industry experts (senior agile practitioners), further capturing eighteen additional issues and challenges, deriving a total of thirty-seven issues and challenges, as listed in Table 11 (Section 4.2).

3.1 Research Questions

The research questions (RQ) for this study are as follows:
RQ1: What are the reported issues and challenges associated with the governance and management of agile projects?
RQ2: What agile project (success) factors are addressed or discussed in the literature?
RQ3: How frequently are these (success) factors addressed in literature over the last 2 decades?
RQ4: What is the yearly trending of these factors over the last 2 decades?

The topic of general PMgmt could provide an exhaustive list of (success) factors, and provide a wider arena of research questions. However, we chose these four questions as they are likely to trigger future research based on grounded work to identify how these issues and challenges impact the practitioners in the industry. The research questions are not intended to overlap each other, but complement each other in gradually formulating the intended results to act as a supporting artefact for future study by the authors.

3.2 Search Strategy

The study utilised eight online databases: ACM, EBSCOhost, IEEExplore, Open Access Library, PMO Journals, ProQuest Journals, SAGE Journals and ScienceDirect. To determine which studies should be included, and which studies shouldn't be included, the inclusion and exclusion criteria were defined, as shown in Table 6.

Table 6: Inclusion and Exclusion Criteria employed by this study

Inclusion Criteria		Exclusion Criteria	
1	Studies published between 2001 until March 2019 (The Agile Manifesto was defined and published in 2001.	1	The studies published before the year 2001 (before the Agile Manifesto was formulated) and after March 2019.
2	Studies produced in "English" language only.		
3	Studies available in full text and retrievable online.	2	Studies in other languages, apart from "English".
4	The subject was related to the governance and management of agile projects, within the topics of Agile, IT (including Software Development), Project Governance and PMgmt.	3	Studies not available in full text and non-retrievable online.
		4	Subjects not directly related to the governance and management of Agile Projects
5	Academic Journals, Conference Proceedings, Periodicals, Symposium proceedings and Workshop proceedings.	5	Studies not related to the IT or the Software Development industry
		6	Studies not addressing PMgmt related topics
		7	Duplicate studies

The search string defined was: ((“project” OR “PMO” OR “methodology” OR “methodologies”) AND (“management” OR “governance” OR “methodology” OR “methodologies” OR “agile” OR “agility” OR “lean” OR “scrum” OR “Kanban” OR “software process” OR “software method”). The initial search was executed in April 2016, which yielded a search result of 2,618 studies. The second search was executed in March 2019 with the primary intention of capturing the latest studies between 2016 and 2019, which was not captured during the initial search, which yielded an additional 569 studies, bringing it to a total of 3,187 studies identified.

3.3 Screening of Studies

For the 3,187 (2,618 + 569) combined number of studies, the title of the studies was first reviewed for relevance as the first filter to exclude studies that were not deemed relevant for this study. The remaining studies were then reviewed based on the abstract. Based on the relevance of both title and abstract of studies, a total of 191 studies were selected, with the remaining 2,996 studies excluded from this study. From the selected 191 studies, 3 studies were excluded further as they were duplicates, 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, thirteen studies were excluded based on irrelevance and the inability to contribute to the intended findings of this study, bringing the total number of selected studies down to 175. A summary of the method employed for the screening of studies is shown in Fig. 1.

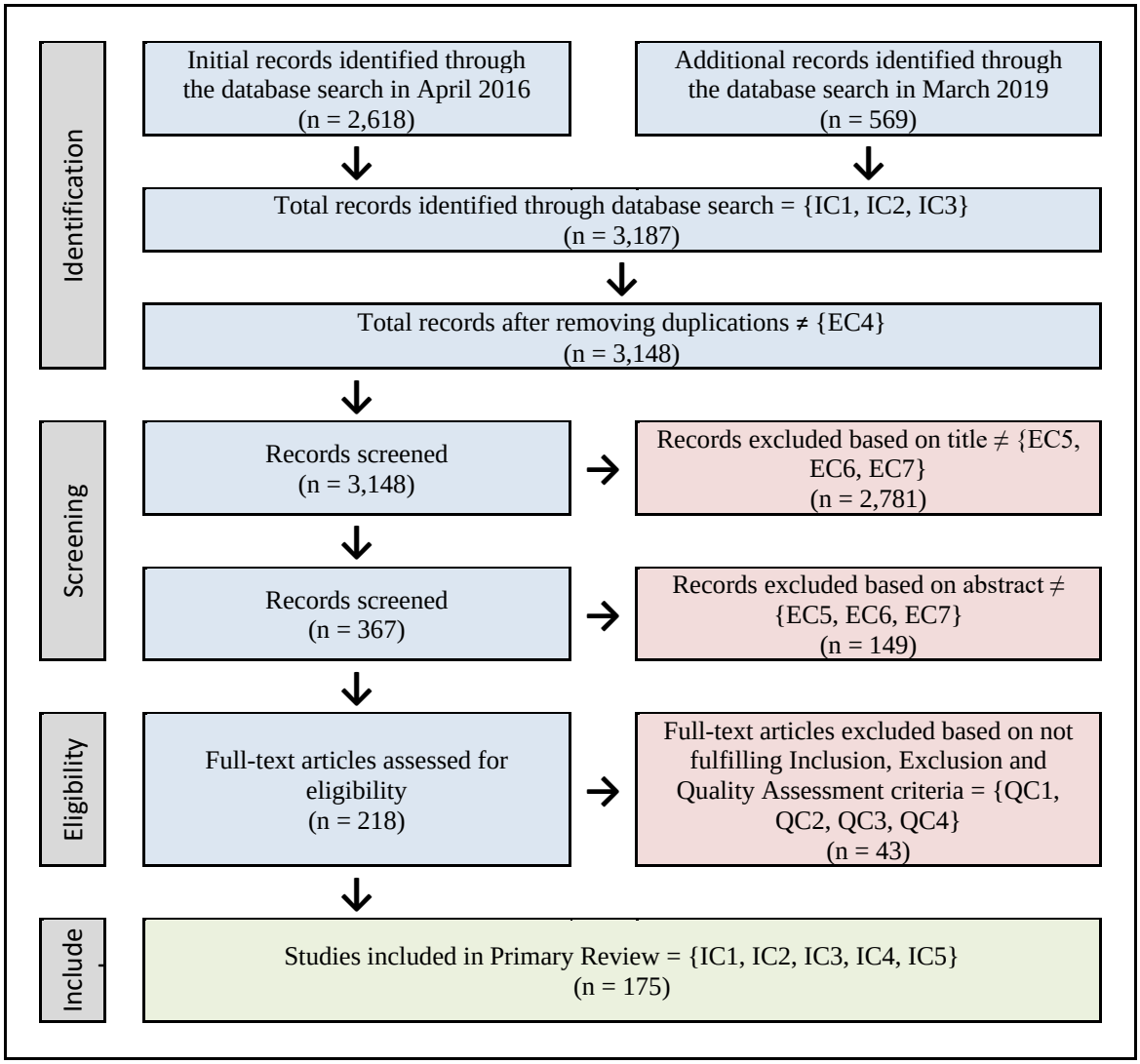

Fig. 1: Procedure employed for the selection of the studies

The number of selected journals from the eight respective online databases (ACM, EBSCOhost, IEEExplore, Open Access Library, PMO Journals, ProQuest Journals, SAGE Journals and ScienceDirect) have been tabulated in Table

7 and Fig. 2. The highest number of journals were extracted from ScienceDirect (62 studies or 35%) and IEEExplore (48 studies or 27%).

Table 7: Number of studies obtained from the respective Databases

Database	No. of	Percentage
ACM	22	12.5
EBSCOhost	23	13.1
IEEExplore	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**

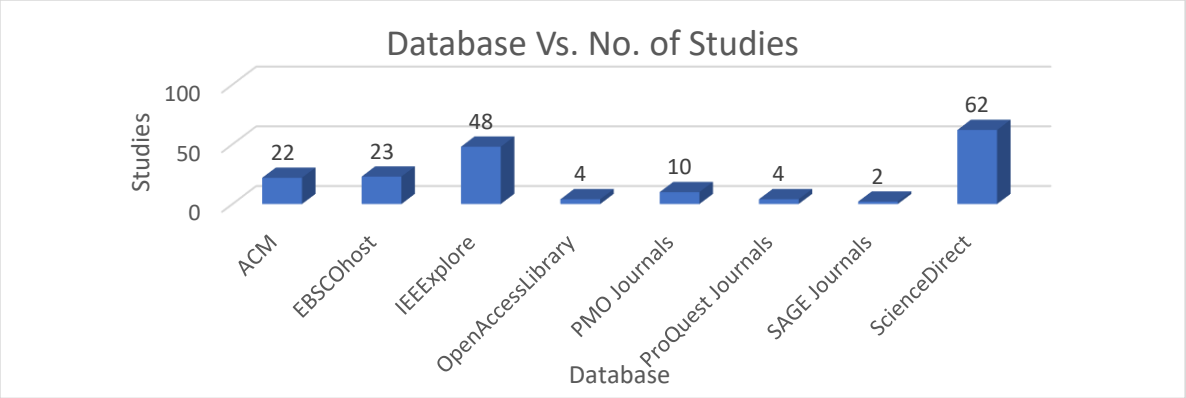

Fig. 2: Number of studies obtained from the respective Databases

Amongst the selected studies, there were five categories: Conference Proceedings, Journal, Periodicals, Symposium Proceeding and Workshop Proceeding. The highest number, 117 studies (66.9%) were from the Journal category. The second highest contribution, 42 studies (42%) were from Conference Proceedings. The other 3 categories (Periodicals, Symposium Proceeding and Workshop Proceeding) contributed to only a small percentage (5%, 1% and 3% respectively) as shown in Table 8.

Table 8: 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**

The number of studies for each of these categories have been described graphically in Fig. 3, which clearly shows that the biggest contribution of studies are from Journals, followed by Conference proceedings. Both of these categories make up 90.9% of the 175 selected studies.

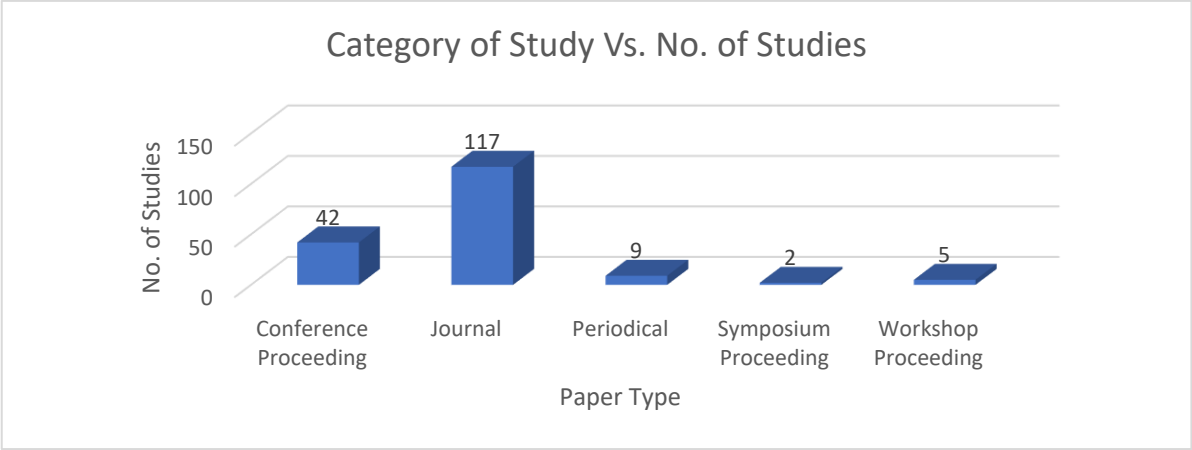

Fig. 3: Number of studies obtained against the category of studies

3.4 Data Extraction

The data extraction is done in 2 phases, as shown in Fig. 4. The first phase is the extraction of various factors that affect the successful governance and management of agile projects, from the 175 selected studies. Through the first phase, the researchers were able to identify the common issues in agile projects, providing them the ability to understand the broader perspectives of the factors and the ability to group them into the 4 broad categories of "Organisation", "People", "Process" and "Technical", where the researchers captured a total of 1,699 factors within these 4 categories, with 327, 688, 496 and 188 factors respectively. The researchers identified the relevant applicable factors from each of the studies and built a list of factors in an MS-Excel spreadsheet, tabulated against the respective studies they were extracted from. Upon completing the review of all 175 studies, the factors were combined to merge similar factors into a unique list of 37 common factors, tabulated into 4 separate tables based on the 4 broad categories. These factors are tabulated and described further in Table 11 (Section 4.2), in the "Results" section. In the second phase, the 175 selected studies were reviewed again to capture the respective studies addressing each of the 37 unique factors. The data was mapped into a matrix, and the frequency of reference to each of the factors in the selected studies was identified and tabulated to determine the frequency each of these factors were addressed. From a broad perspective, a study is deemed to have discussed the factor when the author(s) address the relevant factors in the respective studies. The factors are then listed from the most frequently addressed to the least frequently addressed, which are discussed in the following sections. The intention is to then translate these factors into probable issues and challenges for future research work, to be undertaken by the authors in the form of grounded research work.

The factors were combined using keywords, for example, "organisational culture, executive support, skillset, teamwork, communication, scope, requirements, project plan, etc.". When these keywords are found, the text in the studies were mapped against the 37 unique factors to record the resulting statistics. At this stage, the focus was to identify which of the 37 factors were addressed in each of the 175 studies. The details of the mapping process are elaborated in the "Results" section of this study. On one hand, the data extraction method employed by the researchers possibly entails the risk of biasness of the resulting data, as the extraction was based on past experiences and the abilities of the researchers to review and identify the factors, and the manner the subject matter is understood and comprehended. This presents a crucial limitation in this study, which can be bridged if similar studies are undertaken by different researchers, comparing them against the results of this study. As this method is qualitative, there can be different sets of results obtained if the research is done by different researchers, at a different time or setting, or with a different understanding and perspective of the subject matter. On the other hand, the style, setting, and manner in which the selected studies were written, its requirements, along with restrictions and limitations imposed by the publishers and editors of the studies is also deemed to have imposed biasness in the way they were written and presented, and how they were comprehended. These limitations will be described further in the "Discussion" section of this study.

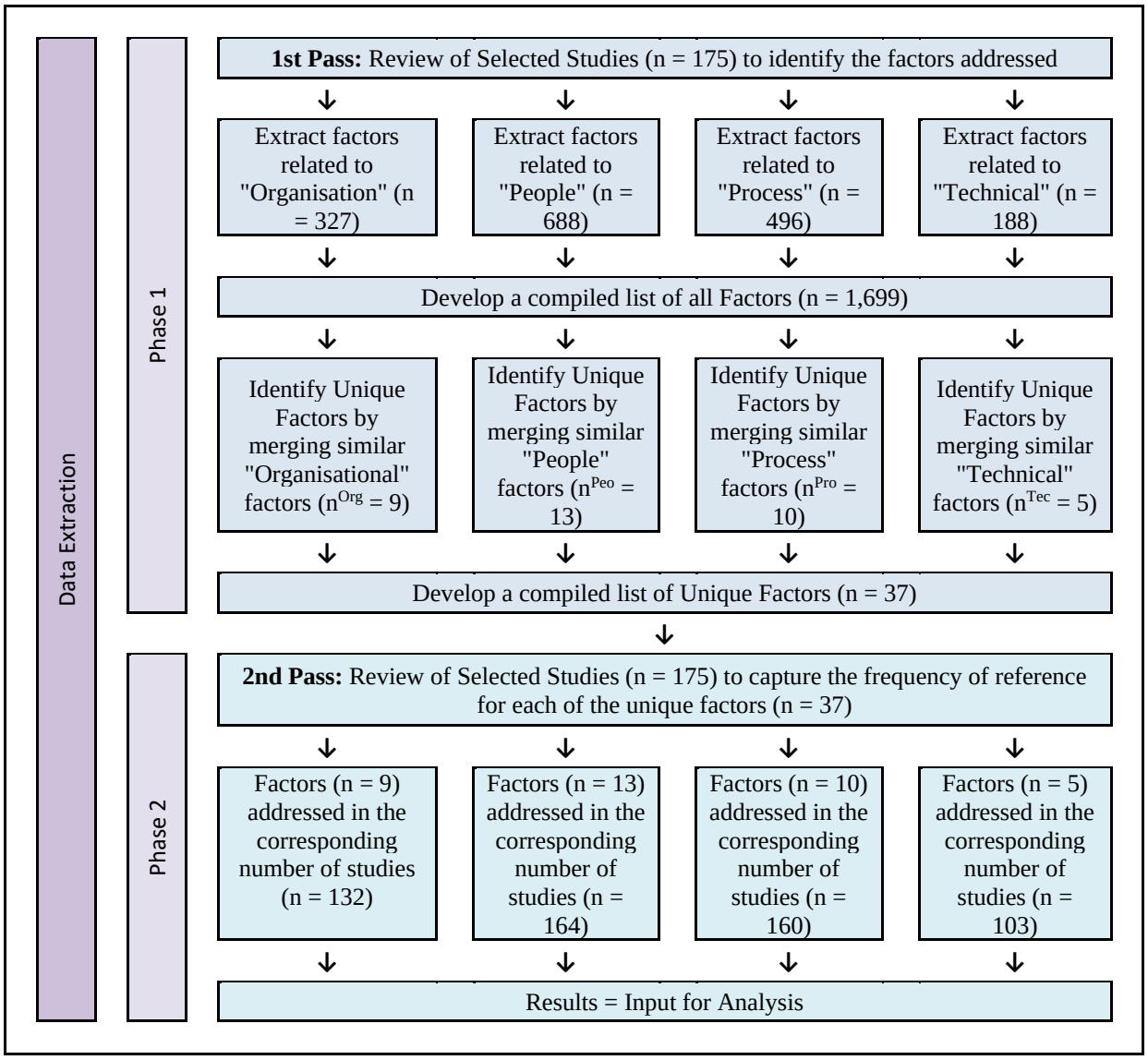

Fig. 4: Data extraction process employed in this study

4.0 RESULTS

This section will discuss the results obtained in the SLR, and further describe the method of identifying the factors impacting the successful governance and management of agile projects. A second pass was done to re-verify the identified factors against the selected studies to gauge the frequency these studies have addressed these factors. The results obtained are based on how they have been identified, reviewed, retrieved, and tabulated by the researchers. The restrictions of this study, along with the various possible biasness has also been described.

4.1 Identification of Issues and Challenges

Agile projects come with a set of challenges and problems that are different from those faced by projects following a traditional methodology [32]. These challenges and problems can be directly related to issues faced by agile projects. Chow and Cao (2008) [S29] generated nineteen issues and challenges based upon the research conducted on APM, derived from four categories: (1) Organisational, (2) People, (3) Process, and (4) Technical [S29], described in the following context.

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 below.

- Lack of executive sponsorship or management commitment: As agile methods call for a radical departure from the typical software development process, a loss of executive sponsorship [38] or lack of management commitment, or inappropriate management attitude [S21], as well as non-flexible management style [S118], would hinder the success of agile projects.
- Organisational culture too traditional or political: According to Nerur et al. (2005) [S118], "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 the decision-making processes, problem-solving strategies, innovative practices, information filtering, social negotiations, relationships, and planning and control mechanisms" [S118, pp. 75-76]. Thus, an organisational culture that is too traditional, which relies heavily on old ways of developing software and running IT in general, will have trouble in implementing agile projects [S21] [S118]. Two other areas that also fall under this category are politics [S33] and inappropriate performance measurement/reward system [S21] [S118] as the agile way is more conducive to teamwork reward, which may cause political frictions between and amongst groups and individual performers.
- 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, organisations with very large teams taking on an agile project, regardless of their division into smaller teams, may have problems communicating and synchronising [S21].
- Lack of agile logistical arrangements: Agile methods generally require collocation of team members and customer representatives, with specific facility arrangements; attempts of distributed development between distant geographical sites will not work [S33]. Lack of agile-oriented logistics does directly affect people in an agile environment, as "a 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" [S21].

People Factors

People factors are not only limited to employees (agile project team members), as it also includes the leadership team, management team, and customers, as described below.

- 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 [38], and this is especially true for agile projects where rigorous techniques such as pair programming, continuous testing, daily integration, etc. make this problem more profound [S33] [S21].
- Lack of PMgmt competence: Agile PMs need to be versatile to be successful, as they play the role of both coach and leader, so the lack of competence and knowledge on their part will create a more likely scenario for failure [S118]. Mistakes are sometimes made by ignoring best practices [38] or by micromanagement [S33].
- Lack of teamwork or cooperation: Teamwork is central in any software development project, and even more so in an agile world, so it is a critical point of failure if the agile project team doesn't work effectively as a team [S118]. The non-cooperative atmosphere may foster resistance against agile from groups or individuals [38] [S21] [S33]. Even one single dissenter in a team may render an agile software project ineffective [28].
- Bad customer relationship: As it is almost mandatory for agile projects to work closely with customer representatives throughout the project, customer relationship is paramount; it requires "commitment, knowledge, proximity, trust, and respect" [S118, pp.76]. As a result, any friction between the project team and the customer will jeopardize the project. Even a misunderstanding or a non-alignment between project leadership and customers will pose a problem to the entire team [28].

Process Factors

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

- Ill-defined project scope, requirements, and planning: The execution of a software development project may become problematic if the project scope is ill-defined [38]. As for the requirements, problems arise when they are too informal in many agile projects, which is rigid for software engineering validation/verification functions [S21]. In the planning arena, an unrealistic schedule [38] or following a predictive sequence of planning (instead of agile methods' adaptive planning) will cause problems as the project progresses [28].
- Lack of agile progress tracking mechanism: In agile projects, a manager cannot track progress in the same manner as it is done in plan-driven projects, where a manager simply checks if the necessary documents have been produced [S33]. Projects which do not have the Agile method's rapid-pace progress measurement techniques will encounter problems, as "traditional earned-value processes are difficult, if not impossible, to apply to agile work because of work breakdown structure inadequacies and the flexibility timeboxing requirements" [S21, pp.34].

- Lack of customer presence or Ill-defined customer role: Agile projects almost always require the availability of at least one full-time customer representative on-site; so, if an agile project does not include this customer role, it will fail [28]. For larger projects, an entire customer team may be required on-site; so even the assumption of a single customer representative being on-site can be flawed [28]. An ill-defined customer role (such as the customer having no decision-making authority or having no acceptance-test ownership) will also convey failure to a project [28].

Technical Factors

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

- Lack of complete set of correct agile practices: Larman (2004) [28] points out several "how to fail" mistakes in agile projects that have to do with technical aspects, such as no upfront unit test being designed; no refactoring being done; incorrect pair programming practices; lack of integrating Quality Assurance team; etc.
- The inappropriateness of technology and tools: A software development project must be able to avoid problems caused by technological changes [38]. Using inappropriate technology or tools will invite failure. For example, in agile projects, "companies that rely solely on mainframe technologies may find it difficult to assimilate agile methods, compared to those that use 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" [S118, pp.77].

4.2 Summary of Issues and Challenges

Table 9 summarises the nineteen issues and challenges as identified by Chow and Cao (2008) [S29].

Table 9: Agile project Issues and challenges as identified by Chow and Cao (2008) [S29]

Category	Issues and Challenges (Failure Factors)	
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 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 a complete set of correct agile practices	19. Inappropriateness of technology and tools

Based on the initial literature reviewed, eighteen additional issues and challenges were captured as described in the respective literature as important factors faced by agile practitioners in the industry, which are listed as follows:

1) Lack of understanding of the Agile method values (and principles) – Ebert et al. (2017) [S55] stressed that it is important for the project stakeholders to understand the values of the Agile methods. An example quoted was to ensure that everybody understands the reasons for change and why it's important from the start, as the lack of knowledge and communication about the change increases the resistance to change [S55].
2) Leadership Team reluctant to invest in Agile method – Yang et.al. (2016) [S172] 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 [S172].
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 [S96].
5) Lack of commitment – Drury et al. (2012) [S49] 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, etc.) for decisions. Lack of commitment to a decision was an issue raised by many [S49].
6) Inability to manage expectations from stakeholders – Lalsing et al. (2012) [S96] emphasises the differing levels of expectations from the various project stakeholders, and the need to manage these expectations. Software

development teams often fail to manage expectations, and this can cause issues between the teams and the customers [S96].

7) Resistance to change from stakeholders – As supported by Guerra (2010) [S67], 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 an agile 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 [S144]. A PM who lacks skills and knowledge will naturally be reluctant to participate actively in the agile process.
9) Lack of project managers with formal PM certification – Farashah et al. (2019) [S56] emphasised 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 (2012) [S113], 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. 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 (2012) [S113] asserts creativity as one of the core behavioural element 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 [S113].
12) Lack of regular and timely reporting – Tilk (2016) [S160] asserted that Agile projects 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 Agile project success [S160].
13) Lack of complete project visibility – Drury et al. (2012) [S49] stated that complete project visibility is a key factor in avoiding issues in projects. Providing visibility can help avoid situations (issues) in projects [S49].
14) Lack of project governance – Joslin et al. (2016) [S82] emphasised that project governance, which has grown exponentially in popularity since 2005, is an important factor in project success. Ambler (2009) [S7] asserts that a lean approach based on enablement, collaboration, and motivation are required to effectively govern agile teams.
15) Lack of customer (user) collaboration – Hochmüller et al. (2008) [S74] 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 such as tacit knowledge of colleagues, prioritisation of requirements, integration of different user views, expressing user stories, and so on [S74].
16) Lack of knowledge on tools – Nerur et al. (2005) [S118] mentioned that tools play a critical role in a methodology, and further support 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, refactoring, and other agile techniques [S118].
17) Lack of communication support tools – Lee et al. (2006) [S101] 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 [S101].
18) Lack of software (tool) to support Agile methods – Lloyd et al. (2017) [S106] identified gaps in managing requirements changes and keeping track of project status (especially in a distributed environment) and proposed automation in means of a tool to support these functions.

These additional eighteen issues and challenges have been summarised in Table 10, which have been organised into the 4 broad categories as proposed by Chow and Cao (2008). The researchers placed these additional factors into the most appropriate category upon a few rounds of discussion, verification and agreement amongst the researchers, which doesn't reflect the categorisation perspectives of the practitioner community at large.

Table 10: Additional Agile project Issues and challenges as identified from various literature

Category	Issues and Challenges (Failure Factors)	
Organisation	1. Lack of understanding of the Agile method values (and principles)	2. Leadership Team reluctant to invest in an 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 PM 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 Agile project governance	15. Lack of customer (user) collaboration
Technical	16. Lack of knowledge of tools	17. Lack of communication support tools
	18. Lack of software (tool) to support Agile methods	

The initial issues and challenges identified by Chow and Cao (2008) [S29] and the additional prominent issues and challenges identified from the various literature were combined to present a list of 37 issues and challenges. The description from the perspectives of agile project governance and management, as understood from the selected studies has been summarily described, as listed in Table 11.

Table 11: Combination of identified Agile project Issues and challenges from various literature

Cate-gory	Issues and Challenges (Failure Factors)	Brief Description
Organisational	1. Lack of executive sponsorship	The leadership team is either not supportive or not willing to endorse the agile program.
	2. Lack of management commitment	The management team is not committed and not in support of the implementation of the agile methods of working.
	3. Organisational culture too traditional	Traditional phase-gate thinking and practice in the organisation which hinders the progress of the agile practice.
	4. Organisational culture too political	Organisation culture is impacted by political agendas which affect decision-making and agile practices.
	5. Organisational size too large	The organisation is too large and widespread to be able to adapt the agile methods timely and with ease.
	6. Lack of agile logistical arrangement	Agile requires logistical arrangements to be able to support the method (i.e., proper office planning for colocation of the team, communication support for daily meetings, etc.).
	7. Lack of understanding of the Agile method values (and principles)	The value and principles of agile methods need to be well understood before embarking on implementing them, as it requires a different kind of mindset and process control
	8. Leadership Team reluctant to invest in the Agile method	The leadership team of the organisation is 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., reorganisation of office, travel expenses for face to face meetings, management time to understand and implement the method, etc.).
People	10. Lack of necessary skill-set	The lack of skills of the stakeholders of agile projects (i.e., Soft skills to be able to participate and contribute positively to the team, people skills to manage the team, technical skills for design and implementation, etc.).
	11. Lack of PMgmt competence	The lack of PM and PMgmt skills and competency to tactfully contribute to the successful management of agile projects.
	12. Lack of teamwork	Inability to work in a team and be a team player, to contribute effectively to the team.

Cate-gory	Issues and Challenges (Failure Factors)	Brief Description
	13. Resistance from groups or individuals	Certain groups (i.e., management, customer, product team, marketing team, user community, etc.) 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 an unfavourable communication protocol, which will be a hindrance to project progression.
	16. Lack of commitment	Unable to secure a 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 not being able to deliver what is expected.
	18. Resistance to change from stakeholders	The stakeholders (i.e., the project team, customers, testers, managers, other departments, etc.) are in their comfort zone and not able to accept and foster change, in a changing environment.
	19. Managers reluctant to participate	The Managers (departmental, leadership team representatives, etc.) are not willing to completely participate, which could be caused by their disability to believe in the agile methods.
	20. Lack of PM's with formal PM 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 delivering project outcomes.
Process	23. Ill-defined project scope	The project scope is not properly understood, introducing the inability to properly define them.
	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 the relevant inputs 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 the 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 capture 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 can do.
	29. Lack of regular and timely reporting	The project progress, and mainly the issues and challenges are not reported regularly, causing a lack of knowledge on the progress of the project, hindering the ability to determine if the project will attain success or 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 Agile project governance	Projects are 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 mainly be caused by

Cate-gory	Issues and Challenges (Failure Factors)	Brief Description
		the absence of a PMO, or the PMO not being able to control the projects or direct them in following the agile principles.
	32. Lack of customer (user) collaboration	The customers are not consulted or involved frequently enough in the projects; hence their feedback and cooperation are not solicited on a timely basis.
Technical	33. Lack of a 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. The inappropriateness of technology and tools	The technology and tools present and available in the organisation are limited or not appropriate in support of the agile model.
	35. Lack of knowledge of 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.
	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, automatic version control mechanism, tool to assist in capturing and maintaining requirements, software to guide the PM and team members in their daily tasks, etc.)

4.3 Factors of Success

The 37 combined issues and challenges were then converted to (success) factors that could impact the successful governance and management of agile projects. The (success) factors have been tabulated in Table 9 (Section 4.2), which are organised into the same 4 categories as proposed and presented by Chow and Cao (2008) [S29]. The four categories are "Organisation", "People", "Process" and "Technical". The authors discussed the eighteen additionally identified factors and, after a few rounds of discussion, the factors have been respectively categorised into these 4 broad areas. The darker shades in each of the categories denote the factors derived from the study by Chow and Cao (2008) [S29] (Table 9, Section 4.2), and the lighter shades denote the additional factors identified from literature based on various other studies by other authors as shown in Table 11 (Section 4.2).

The selected 175 studies were reviewed again to map them against the 37 identified factors. A table was created with the rows listing each of the 175 studies, and the columns listing each of the 37 factors, forming a study-factor matrix which was used as the basis for the evaluation. Each time a match was identified to be either addressed or discussed in the respective studies, a count was added in the study-factor matrix. When reviewing each study, at each instance any of the 37 factors were addressed or discussed, a "yes" was captured in the cells which correspond to the respective study and factor, forming a matrix of all the identified factors in all the corresponding studies. A snapshot of the matrix is shown in Table 12, which shows only the first 7 factors (columns) and only 10 randomly selected studies.

Table 12: Sample worksheet matrix for data collection

Article Title **Hidden columns (Database, Year, Publication, Category, Author, Citation, Date retrieved, etc.)**	**Executive Sponsor-ship**	**Manage-ment commit-ment**	**Traditional/ Agile Organisa-tional culture**	**Political Organisa-tional culture**	**Organisa-tional size**	**Agile logistical arrangement**	**Understan-ding of Agile method values (and Principles)**
Quintessence of Traditional and Agile Requirement Engineering			Yes			Yes	Yes
Agile approach in the PMgmt of the Czech companies	Yes		Yes		Yes		
PMgmt Offices in transition	Yes	Yes	Yes	Yes	Yes		Yes
Agile PMgmt: 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

For each column, the total number of times that factor has been addressed or discussed amongst the 175 studies was captured, and shown in the last column in Table 13, which totals to 1,699 counts of reference to the total combination of factors.

Table 13: Combination of (Success) Factors from various literature

Area	**Code**	**Agile Project Governance and Management (Success) Factors**	**Total count**
Organisation	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 & dedication (Motivation)	50
	Peo08	Managing stakeholder expectations	28
	Peo09	Stakeholders welcome (embrace) change	61
	Peo10	Managers' participation	26

Area	Code	Agile Project Governance and Management (Success) Factors	Total count
	Peo11	PM 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 of tools (technology)	34
	Tec04	Communication support tools	15
	Tec05	Software (tool) supporting Agile methods	17

The data extraction method employed by the researchers entails biasness, which can be classified as elements of risk imposed onto the results of this study, described as follows:

- Data extraction was generally conducted on existing databases contained in the search engine subscribed by the research institution of the researchers. Even if the number of databases searched was deemed elaborate and widespread, there is certainly a risk of missing out on some level of data, which may otherwise influence the results of this study.
- The researchers rely on their level of understanding of the subject, past experiences in the industry, and their level of comprehension and ability to decipher the studies to arrive at the resulting data, which is an important element of biasness in the study. However, this biasness positively creates the uniqueness of the results and discussion threads.
- The method used in this study, an SLR, being a true qualitative method, creates another set of biasness as it is done within a selected number of databases, within a stipulated period of published studies, limited to only one language and a selective group of search keywords.
- The findings of this study are perceived to be influenced by the way the 175 selected studies were written and presented, on the style, setting, breadth and depth of research, while striving to conform to requirements, restrictions, and limitations imposed by the publishers and editors of the studies.

This study was undertaken based on these known risks of biasness, to decipher the data obtained to produce the results and the corresponding discussions. It was performed in a manner deemed fit by the researchers, alleged to present them in a unique manner reflecting the thoughts and experiences of the researchers, which is not a representation of the industry or the practitioner community at large.

5.0 DISCUSSION

In this section, the answers to the research questions will first be discussed, followed by the discussion on general observations. After which we identify open issues and discrepancies in the literature. Finally, the limitations will be discussed, and the section will be concluded by identifying future research in this area.

5.1 Answers to Research Questions

In answering **RQ1:** "What are the reported issues and challenges associated with the governance and management of agile projects?", we identified 19 issues and challenges of managing agile projects based on the study presented by Chow and Cao (2008) [S29], as described in Section 4.1, with the summary of these 19 factors listed in Table 9 (Section 4.2).

In answering **RQ2:** "What agile project (success) factors are addressed or discussed in literature?", we identified 18 additional factors for the governance and management of agile projects from various other literature [S7] [S49] [S55] [S56] [S67] [S74] [S82] [S96] [S101] [S106] [S113] [S118] [S144] [S160] [S172], as shown in Table 10 (Section 4.2). We further simplified the original 19 issues and challenges presented by Chow and Cao (2008) [S29], as the basic factors for the successful governance of management of agile projects, which are classified as the original factors. We further combined the other 18 factors identified from various other literature, and created a combined list of 37 factors, which have been listed and briefly described in Table 11 (Section 4.2).

In answering **RQ3:** "How frequently are these (success) factors addressed in literature over the last 2 decades?", we discussed the factors and methods of reviewing the literature to obtain the answers in Section 4.2, and summarised the findings in Table 13 (Section 4.3) showing the frequency of each of these factors addressed or discussed in the literature, consisting of the 175 selected studies. An analysis of the results was performed against the findings of the literature review, which has been summarised in Fig. 5. The factor most addressed within 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 these factors are from the "People" area. 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. Just looking at the 5 highest factors referenced in the selected studies, 3 of them are from the "People" area, indicating importance on people, or the stakeholders of Agile projects, mainly the team members (skillset, teamwork, PMgmt competence). Various studies discuss the crucial role of people in the success of agile projects as these factors are seen to be critical elements when managing projects in an agile environment. Comparing with the study by Boehm & Turner (2005) [S21], people factors are still reported in the literature as a crucial category in sustaining project success, as there has been a lot of discussions surrounding them.

Ranking in the 6th and 7th position with a respective count of 81 and 76 studies are both from the "People" category, which is "Communication (for information sharing/decision making)" and "Cooperation from groups or individuals (testers)". Although the former (communication) has been widely discussed, they were not mostly addressed as many authors believe that communication skills and the ability to strategize the communication protocol are a given for agile projects. Without frequent communication, agile projects are at risk of not obtaining the required level of success. The latter (Cooperation from groups or individuals) is also seen as an important element in agile project 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, who are viewed as important stakeholders, to ensure that aggressive development and production of smaller chunks of deliverables for the customer are tested as quickly as possible.

Skillset and PMgmt competence have been viewed as highly discussed factors, but on the contrary, "PMgmt certification" from the "People" category scored the lowest (8 studies), indicating the least addressed factor. The authors concluded that PMs knowledge and experience are very important, but not necessarily required to be substantiated by a formal certification, indicating it as a non-mandatory requirement. "Budget to implement Agile methods" from the "Organisation" category is positioned as the second least discussed factor (9 studies). The authors feel that this factor is closely related to 2 other factors, which are "Executive Sponsorship" and "Support of Investment on Agile Method". If sponsorship and support are secured from the leadership team, a budget would have probably been allocated upfront, hence they were not discussed exclusively in the studies. Having the understanding that agile methods are supposed to reduce cost in the long run, upfront investments in implementing and adopting the methodology may be substituted by cost reduction efforts.

In the "Technical" area, only 1 factor stands out within the top 10 rankings, in the 8th position, which is "Appropriate technology and tools", discussed in 72 studies. We believe this factor is crucial as agile development mostly depends on technology and tools available for collaborative purposes and to assist in speeding up the process of development and delivery of the end products faster, and the ability to keep up with changing trends as the requirements evolve aggressively, as depicted by most studies. Ranking 9th and 10th positions, 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 in ensuring that the "Customers" participate in the process of gathering "Project Requirements", as requirements are expected to change according to the various demands, which could be 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 scenarios. 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 Fig. 5, which can be matched against Table 13 (Section 4.3).

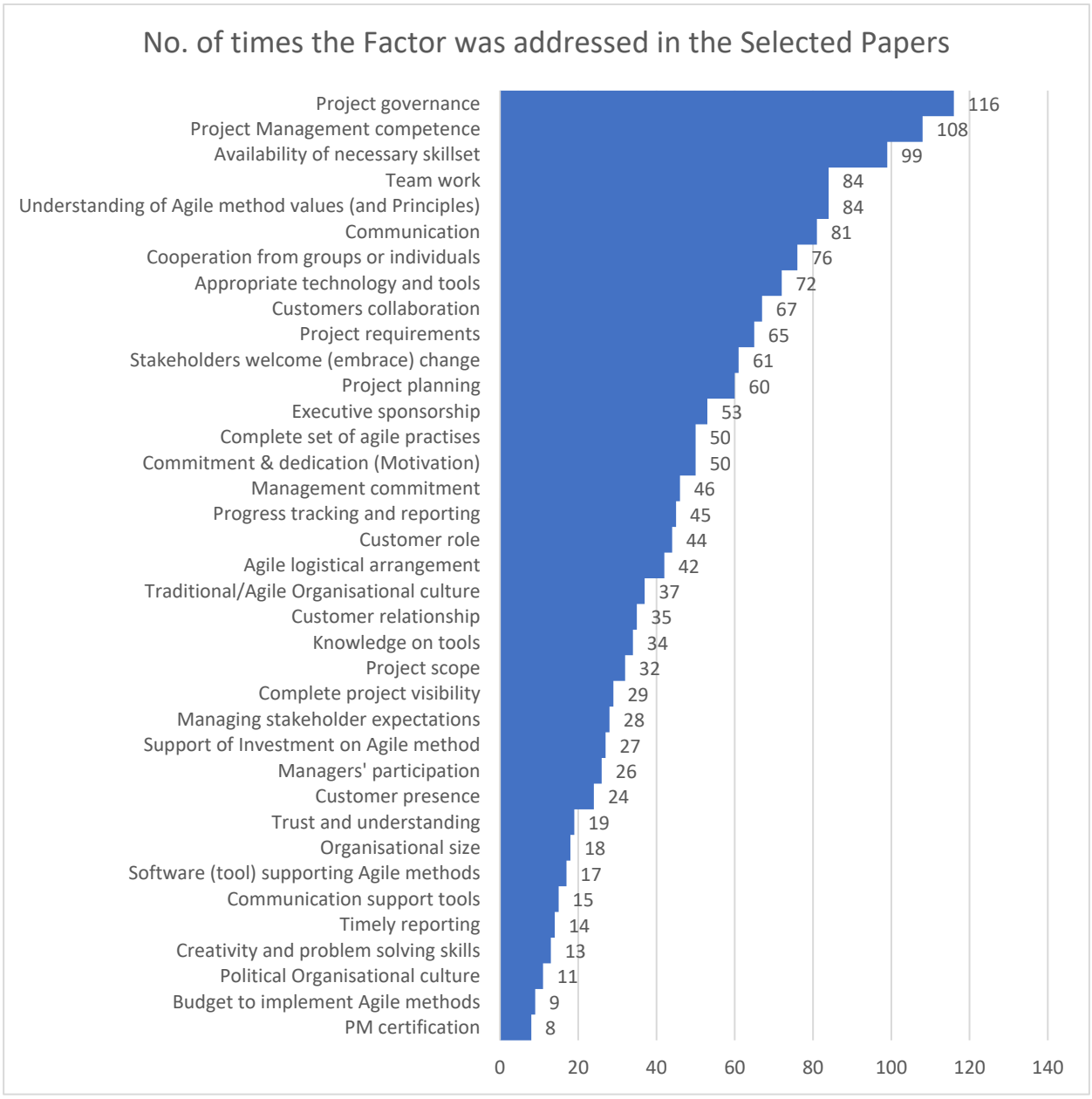

Fig. 5: Factors for (Successful) Governance and Management of Agile Projects

In answering **RQ4:** "What is the yearly trending of these factors over the last 2 decades?", we first counted the number of selected studies within each year from 2001 to 2019 for each factor, and tabulated the results of the count against each year. We then combined the factors identified from the selected studies within each year of publication and identified the trending of the factors from 2001 to 2019 (the last 2 decades). The number of studies selected from the years 2001 to 2007 was low and only contributed to about 14% of the total selected number of studies. In the year 2008, there was a spike in the number of relevant studies, where we observed that the agile topic discussions gained traction. The majority of the selected studies were obtained between the publication year 2014 and 2016 (total of 33% for these 3 years, or an average of 11% per year), which can be denoted as the period in which the discussions on APM was very popular and regular.

The concise number of selected studies and its percentage against the respective years from 2001 to 2019 (up to March) is tabulated in Table 14, and further graphically presented in Fig. 6. We can see an uptrend from 2001 onwards,

until 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 14: 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			

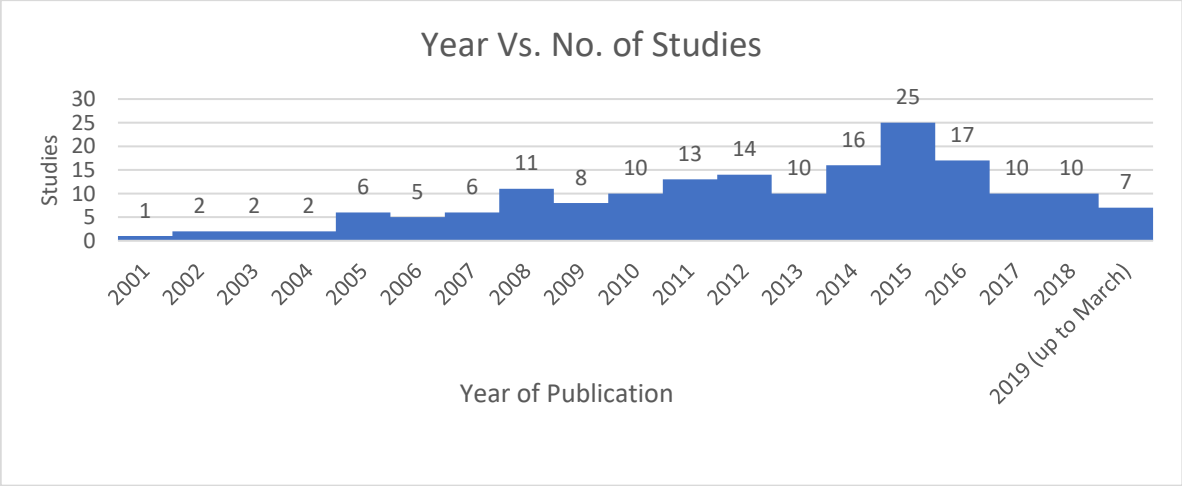

Fig. 6: Number of studies obtained against the year of publication

In conclusion, for RQ4, further analysis was done to identify the trending of factors obtained from the selected studies by the published year. The results are graphically represented in Fig. 7. It was observed that the highest number of factors were identified between the years 2008 and 2018 (total of 1,439 counts), with a spike in the number of factors in the year 2015 (282 counts). Although this is an interesting find, however, it could be directly related to the number of selected studies identified during the respective periods, which was also high.

Since the Agile Manifesto was only established in 2001 [1], formal and structured discussions surrounding the agile methods are seen to have picked up gradually thereon. The discussions surrounding the issues and challenges became rampant over 15 years (2001 to 2015), as more and more organisations started adopting agile methods to manage projects, with the belief that the agile way of managing projects will produce usable software and solutions, which in turn will be garnered and accepted by the end-user community or customers. Larger organisations developed interests in adopting agile methods and principles, creating a need for agile projects to be executed in large teams. During the same period, the IT industry achieved significant progress in globalisation as organisations were consolidating the IT function into offshore locations, attracting lower costs. Some organisations were outsourcing their IT function to concentrate on their core business, while allowing specialised IT service organisations to handle the IT function, expecting to reduce cost and technological complexities within their organisation. It was also during this time that the off-shoring and best shoring capabilities were maturing, resulting in the globalisation of IT operations, either within the organisation or via the outsourced vendor, introducing challenges in the communication protocol between the

project stakeholders, as they became geographically dispersed, imposing a challenge in the colocation of team members.

In recent years (2014 to 2019), many discussions were around the concerns of managing agile projects within large and geographically dispersed teams. As project teams span across different countries within different regions, different dimensions of barriers to managing projects were introduced as they became geographically dispersed, such as language, culture, time zone, belief system, legislation system, government policies, commercial regulations, reward systems, and many others. These barriers made it difficult to completely fulfil the Agile Manifesto (2001) [1] while trying to adopt the agile methods, which introduced discussions around hybrid methods consisting of a combination of stage-gate models and agile methods. We believe either this (discussions on agile and stage-gate hybrid methods), or the level of maturity of agile discussions itself, could have caused a drop in the frequency of discussions on the issues and challenges in the governance and management of agile projects.

The number of studies surrounding agile methods in the years 2014 to 2016 saw a temporary spike, looking like a bell-curve with 2015 as the peak, as shown in Fig. 7. During the same period, the number of factors addressed also experience the bell-curve effect. Further analysis of the factors and their trends over the last two decades are discussed in section 5.2 under the heading "Trending of Factors".

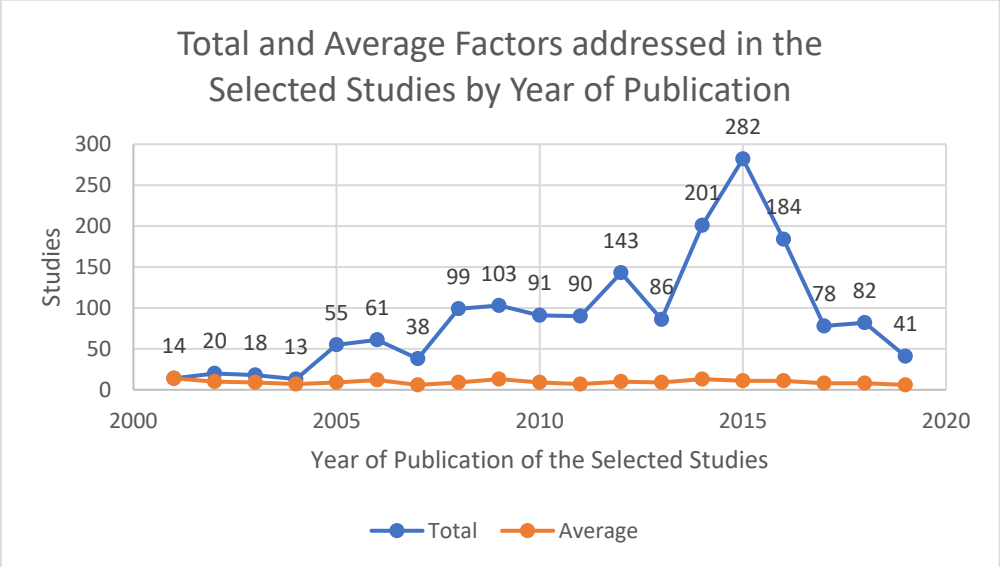

Fig. 7: Total number of Factors addressed by Year of Publication of the Selected Studies for the Governance and Management of Agile Projects

5.2 Trending of Factors

The median of the highest score (116) and the lowest score (8) is calculated as 62, resulting in 10 factors fairing under the upper median category, while the remaining 27 factors falling under the lower median category. The authors chose to discuss only the 10 factors which were classified under the upper median category, which are listed in Table 15.

Table 15: Ranking of the top 10 factors mostly addressed/discussed within the 175 selected studies

Rank	Area	Cate-gory	Agile Project 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 Fig. 8. Years 2005 to 2007 saw a spike in the number of factors discussed, even when the number of studies was quite consistent. A consistent increase in both studies and factors was seen between the years 2008 and 2013, except for the year 2012 which recorded a spike in the number of factors which was not directly proportionate to the increase in the number of selected studies. The years 2017 and 2018 saw a similar trend (with years 2008 to 2013) of studies and factors. However, there was a large increase for the years 2014, 2015, and 2016 for both the number of selected studies and the number of factors addressed in these studies. From the time the Agile Manifesto (2001) [1] was established, the popularity of agile discussions was seen to be increasing gradually year on year, with two notable spikes in years 2012 and 2015 (comparing with the respective years before and after).

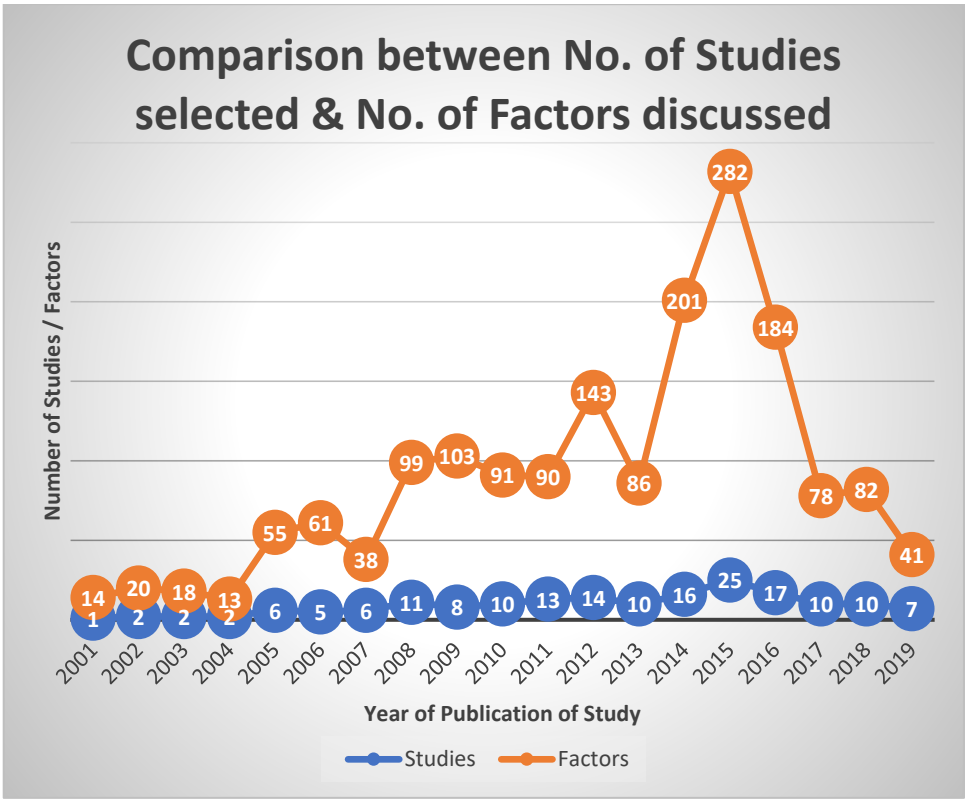

Fig. 8: Trending Analysis of the number of selected Studies against the number of Factors addressed by Year of Publication of the Selected Studies

The authors conclude that there has been a gradual increase in the usage of agile methods by organisations globally, with a sudden increase in the year 2005, and another sudden increase in the year 2008. As of late, there have been many discussions around the outsourcing of the IT and Software Development function, with sub-discussions around Offshore development initiatives. 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 stage-gate models) have also picked up as of late, resulting in organisations trying to mix and match the methods (agile and stage-gate) 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 globally disbursed organisations.

Large organisations with large project teams and with projects of long durations are seen to be embracing the agile philosophy in managing projects, as opposed to the traditional belief that agile projects are meant for small teams and projects with short durations. While project governance tops the records as the most widely addressed factor, the industry is seen to be in the need of a hybrid method that gives them the capability to achieve agility in a distributed environment. Executive sponsorship is an important factor for the successful implementation of agile methods. When the leadership team in an organisation is willing to sponsor the implementation of agile methods, they will be able to attain the necessary level of support from the various management teams while finding the means to obtain the required budget to implement the method. This is classified as a "top-down" implementation drive, which will mostly be successful.

On the analysis on the frequency of factors discussed, "People" factors have gained traction recently with discussions around the attitude of people and the emotional intelligence, addressing the level of experience, knowledge, skills, and competencies of the project team members (and stakeholders) in their ability to partake in an agile project. Documentation in agile projects is expected to be at a bare minimum, making it important for the PM and the project team members to be highly competent, as they are empowered on the design and development of the solution while establishing close contact and maintaining frequent communication sessions with the customer. The industry is giving more emphasis on the attitude of people, and a general belief that the projects can attain success by employing and placing the right people with the right attitude in project roles. Although there has been a lot of emphasis on skills and competencies, acquiring and sustaining them will not be possible without the correct attitude of the people [49] [50]. While knowledge and skills are deemed as important factors, formal certification in those skills may not be an absolute requirement, as organisations believe that team members can pick up the required skills and knowledge as they gain exposure and experience by having the right attitude. Some organisations may expect project team members to acquire on-job training due to limited budget to recruit certified professionals, who would demand higher wages.

5.3 Discrepancies and Open Issues

The authors had initially identified the 19 issues and challenges in the study by Chow and Cao (2008) [S29], classifying them as the initial 19 factors extracted from 1 relevant study, and further combined other factors found in the detailed SLR [S7] [S49] [S55] [S56] [S67] [S74] [S82] [S96] [S101] [S106] [S113] [S118] [S144] [S160] [S172] to arrive at a list of 37 factors. These factors were then used as the basis of identifying the frequency these factors were discussed or addressed within the 175 selected studies, from which the authors identified more factors. These additional factors had not been added on, as 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, based on how they are analysed. We were careful not to keep adding factors as they were identified in the literature as it would then be necessary to conduct multiple rounds of review until we announce satisfaction and conclusion on the review work, which is not easily achievable in the context of analysing literature. Hence, we decided to restrict the factors to the 37 factors concluded from the initial literature review.

5.4 Mapping of factors into PMBOK

Mapping was done for the 37 factors identified and compiled in this study against the PMI's framework, as presented in Table 16. The respective factors were mapped against their most likely applicability, using a table, horizontally against the Process Groups and vertically against the Knowledge Areas. As the PMI process model is regarded as a traditional or Stage-Gate model, there may be contradictions with the agile method. This mapping could be more relevant to hybrid projects, appearing to deviate from the original intention of keeping to an agile framework, but the benefits of describing this mapping are seen to supersede the agile context. As such, the researchers proceeded to present this mapping for the greater benefit of a project governed and managed in a hybrid environment, which is becoming prudent in many organisations.

Table 16: Mapping of factors into the PMI Process Groups and Knowledge Areas

PMI Knowledge Areas	PMI Process Groups				
	Initiating	Planning	Executing	Monitoring	Closing
Integration Management		Pro03			
		Pro09			
	Tec01				
		Tec02, Tec05			
Scope Management		Peo09			
	Pro01				
		Pro02			
		Pro03			
			Pro08		
		Pro09			
	Tec01				
		Tec02, Tec05			
Schedule Management		Pro03			
		Pro04, Pro07			
			Pro08		
		Pro09			
	Tec01				
		Tec02, Tec05			
Cost Management	Org06				
		Pro03			
			Pro08		
		Pro09			
	Tec01				
		Tec02, Tec05			
Quality Management		Pro03			
		Pro09			
	Tec01				
		Tec02, Tec05			
Resource Management	Org06				
		Peo01, Peo02			
			Peo03, Peo07, Peo12, Peo13		
		Peo06			
		Peo11			
		Pro03			
		Pro09			
	Tec01				
		Tec02, Tec05			
Communication Management		Peo05			
	Peo06				
		Pro03			
		Pro07			
			Pro08		
		Pro09			
	Tec01				
		Tec02, Tec04, Tec05			
Risk Management	Org05				
	Org09				
		Pro03			
		Pro09			
	Tec01				
		Tec02, Tec05			
Procurement Management	Org06				
		Pro03			
		Pro09			
	Tec01				
		Tec02, Tec05			
Stakeholder Management	Org01				
	Org02				
	Org03, Org04				
	Org07, Org08				
			Peo04		
		Peo05, Peo09			
	Peo06				
	Peo08				
		Peo10			
		Pro03			
		Pro05, Pro06, Pro07			
		Pro09			
		Pro10			
	Tec01				
		Tec02, Tec03, Tec04			

The 37 factors influencing the PMI's 5 Process Groups and 10 Knowledge Areas are briefly described as follows:

1. **Org01**: **Executive sponsorship** should be acquired at the project initiation phase, involving the key stakeholder and sponsors, as a key activity in the stakeholder management area. This is paramount to agile project success.
2. **Org02**: The project should acquire **management commitment** throughout all phases of the project, managed within the stakeholder management area, and regarded as paramount to project success.
3. **Org03**: The **organisational culture** should be studied and understood by the project team as early as possible in the project phase to determine the method of PMgmt employed, which could be **agile or traditional**, or a mix of both methods (hybrid), preferably during the initiation and planning stages, managed as part of the stakeholder management area.
4. **Org04**: The **political** influence on the **organisational culture** should also be analysed and understood upfront to avoid any unpleasant experiences from any sector of the stakeholders, especially from the leadership and management levels. Team empowerment, an important trait in agile projects, may have political repercussions.
5. **Org05**: **Organisational size** should be duly considered in the beginning stages of the project and managed as a risk element. Although the agile method dictates small teams executed in smaller organisations, larger organisations are adopting the agile method with recorded success.
6. **Org06**: **Agile logistical arrangement** will most likely impact the project budget and cost elements. It would also impact the resources planning and procurement activities. Resources should be well managed from the start of the project, and at least up to the execution phase.
7. **Org07**: Proper **understanding of the Agile method values and principles** should be acquired at the beginning of the project, at the initiation phase, and managed under the stakeholder management area.
8. **Org08**: **Support of Investment on Agile method** should also be acquired from the stakeholders at the project initiation phase. Investment decisions dictate project success to a great extent.
9. **Org09**: The necessary **budget to implement Agile methods** should be acquired upfront, and managed as a risk item at the beginning of the project. There should be due consideration on variation to budgets, which is a standard practise in organisations when confronted with challenging financial positions, causing administrative functions (agile method implementation) to be impacted by forceful reduced budgets.
10. **Peo01**: The **availability of necessary skillset** should be secured at the planning and execution phases of the project, and managed carefully under the resource management area. Having the right level of skills and experience is important in agile projects.
11. **Peo02**: **PMgmt competence,** especially of the PM and the project team should be ascertained to garner a successful project. It is important that the team recruited is qualified and has the necessary PMgmt skills, especially during the planning and executing phases of the project. Greater importance should be given to agile specific skillsets.
12. **Peo03**: Good **teamwork** should be fostered during the execution phase of the project, managed within the resource management area. A seamless working relationship is important in agile projects, especially within the project team and with the customers.
13. **Peo04**: **Cooperation from groups or individuals**, especially the **testers**, is required during the project execution phase to prevent or minimise conflicts and misunderstanding. A matured working environment should be garnered in an agile environment.
14. **Peo05**: **Customer relationship** should be planned and managed within the communication and stakeholder areas, to be performed during the planning and execution phases, which is crucial in agile projects.
15. **Peo06**: The necessary level of **communication (for information sharing/decision making)** should be carried out to the stakeholders, to be included as part of the communication, resource and stakeholder management areas. The planning activity should be done throughout the project lifecycle, with frequent communication to the stakeholders commencing from the initiation phase, and from the planning phase onwards for the resources. Agile projects call for frequent and informal communication requirements.
16. **Peo07**: The (project) resources are expected to give the project their **commitment & dedication (Motivation)**, most importantly during the execution phase.
17. **Peo08**: **Managing stakeholder expectations** starts as early as the initiation phase, and carried out throughout the project **life cycle**, up to the monitoring phase.
18. **Peo09**: **Stakeholders welcoming (embrace) change** is a trait expected throughout the planning and execution phase, managed in the scope and stakeholder management knowledge areas. This is an important element in the agile environment.
19. **Peo10**: An expected level of **managers' participation** is required for project success, managed within the stakeholder management area, from the planning stage onwards, until project closure.
20. **Peo11**: **PM certification** is not crucial, but deemed as an important aspect to promote conformance and good governance. This requirement should be determined at the planning stage, before recruiting project resources, based on organisational, project, and budgetary needs. The cost of recruiting certified resources is expected to be higher, especially agile certified resources.

21. **Peo12**: **Trust and understanding (amongst team members/stakeholders)** should be an important element to manage, especially within the project team, more importantly within an agile environment.
22. **Peo13**: It is fair to expect **creativity and problem-solving skills** as one of the crucial traits amongst the project resources, especially when we expect the projects to be self-managed with minimal supervision, most appropriate for an agile environment.
23. **Pro01**: The **project scope** is managed within the scope management knowledge area, and during the initiation, planning, and execution phases. The scope is expected to deviate during the progress of agile projects, so the team needs to be prepared to handle the frequently changing scope.
24. **Pro02**: The **project requirements** are expected to be managed during the planning and execution phases; within the scope management area as well. The team should also be prepared to accept and manage changing requirements, to effectively factor them into the project's schedule for efficient delivery of the project outcomes.
25. **Pro03**: **Project planning** is mostly done during the planning stage, throughout all knowledge areas, with subsidiary planning done at other stages on a need-be basis, more for agile projects.
26. **Pro04**: **Progress tracking and reporting** are done during the planning and execution phases, as projects are expected to progress during these phases, managed within the schedule management knowledge area.
27. **Pro05**: **Customer presence** is required for agile projects throughout the planning and execution phases, to be managed within the stakeholder management area. The expectations need to be communicated to the identified customers, and their commitment need to be sought upfront.
28. **Pro06**: The **customer role** should be well defined in the early stages of the project (planning) to avoid any conflicts, managed within the stakeholder management area. The roles should be re-affirmed during the execution phase to ensure continuous support from them during the crucial development stages of the project.
29. **Pro07**: **Timely reporting** should be fostered within the planning and execution phases, and managed within the schedule, communication, and stakeholder management knowledge areas.
30. **Pro08**: There should be **complete project visibility** during the execution phase, monitored closely within the scope, schedule, cost, and communication knowledge areas. With visibility, the scope, requirements, project timelines, and expenditures can be properly administered, controlled, and monitored.
31. **Pro09**: **Project governance** is a very important factor that is managed in all knowledge areas, and administered from the planning stage onwards, until the end of the project.
32. **Pro10**: **Customers collaboration (agreement/expertise/ability to dictate requirements)** is expected during the planning and execution phases, managed within the stakeholder management knowledge area, as the customer is classified as an important and key stakeholder.
33. **Tec01**: A **complete set of agile practices** are required for projects executed using the agile method, and should be implemented at the beginning stages (initiating and planning) of the project. In some cases, a hybrid method could be opted for, which should also be defined at the beginning stages of the project. If the method is altered during the execution phase, the team may get confused, and the delivery of the project may be adversely impacted. This factor should be included in all knowledge areas.
34. **Tec02**: The **appropriate technology and tools** should be secured early in the project, usually from the planning stage onwards, until the completion of the project (project closure phase). Different projects may have different technological requirements, which should be addressed promptly to efficiently manage projects.
35. **Tec03**: The stakeholders are expected to possess **knowledge of tools (and technology)** that are required and deemed necessary for the successful management of the respective projects. Each project may require the knowledge of different sets of tools and technology.
36. **Tec04**: **Communication support tools** should be carefully managed within the stakeholder and communication areas, and rightfully made available, especially for agile projects which demands frequent and a varied mode of communication,
37. **Tec05**: **Software (tool) supporting Agile methods** should be employed at all knowledge areas from the planning phase onwards, until the project completion stage, to efficiently monitor and control scope creep, and to speed up project delivery, while increasing project success.

The mapping is presented based on the perspective and understanding of the researchers, and may not represent a holistic model for the industry, or the research community at large. The perspectives of understanding of the above mappings will also be highly dependent on the type of method employed to manage projects, introducing a varied level of adoption.

5.5 Limitations

The type of research we embarked on is unique as we couldn't identify this type of work in the selected studies. We conducted this research with the following known limitations:

1) The research was done on selected databases that have been subscribed to by the research organisation, and available in full text and in the English language.
2) The studies reviewed are only until March 2019, and should be extended beyond this date as there were many interesting studies in the later years as more and more emphasis is placed on agile methods and more people are embracing agile principles.
3) Non-IT studies were excluded from this research due to time constraints and scope of work, nevertheless, the authors feel that this area could yield interesting results.
4) The identification of factors and merging them into unique factors are based on the perceptions of the researchers, which may not be a holistic representation of the research community at large.
5) The data extraction method employed by the researchers introduces biasness of the resulting data, as the extraction was based on past experiences and the abilities of the researchers and the manner the subject matter is understood and comprehended.
6) The style, setting, and manner in which the selected studies were written, the requirements, along with restrictions and limitations imposed by the publishers and editors of the studies are also expected to impose biasness in the way they were written, presented, and understood.

5.6 Future Research

The researchers have embarked on an extension of this research work to validate the factors with the industry practitioners, using a grounded theory approach [42]. The intention is to obtain rankings from the practitioners on each of the factors, on whether they have been impacted by these factors, and to what extent they are affected. Based on the results, we intend to identify the factors based on rankings and their impact on the governance and management of agile projects. Based on the discrepancies and open issues identified above, we also intend to include a more concise list of factors and extend the research to identify which of the studies address the additional factors and to perform a trending analysis to identify the key factors by literature. While doing this, we intend to obtain an in-depth understanding of the factors, and further combine relevant factors to create a more concise list of factors for the grounded work.

Based on the limitations identified above, we propose future research work to be undertaken in the following areas:

1) Similar studies to be undertaken by different researchers, at a different timeframe and setting, entailing a different understanding and perspective of the subject matter, and to compare them against the results of this study.
2) To perform grounded research against the list of factors to identify the extent of its impact in the various industries.
3) 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 the English language.
4) 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.
5) Non-IT studies could be included to identify similar factors impacting inter-industry projects, which could yield interesting and curiously unexpected results.
6) 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 agile projects.
7) To include more parameters to the analysis of studies, such as the type of projects, size of projects, size of the organisation, level of PM and PMO maturity, type of method(s) implemented, the extend of method utilisation, project outsourcing indicator, offshore development indicator, and other indicators which would produce interesting results for further analysis.
8) 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 current organisational needs.
9) To analyse the governance and management of agile projects from the angle of offshoring, best-shoring, outsourcing, and insourcing, along with the combination and variants within these scenarios.

6.0 CONCLUSION

An SLR study was conducted, identifying 1,699 relevant studies and analysing the issues and challenges in the governance and management of agile projects. Upon scrutiny of the identified studies, 175 studies were selected for the detailed analysis, developing a list of 37 factors addressed or discussed in the selected studies. These factors can influence the impact on the successful governance and management of agile projects. We analysed the factors against the year of publication and identified that the factors were most discussed in the studies published between the years 2014 and 2016, recording 2015 as the peak year. It is concluded that the discussions and research work around APM

were picking up steadily from the time of inception of the agile principles in 2001, up to 2013, which resulted in a sudden spike in academicians addressing this topic from 2014 onwards, recording the peak of awareness in 2015. The discussions tapered down in 2016 and gradually reduced to a similar trend in the years before 2014. However, with the current discussions revolving around the adoption of agile methods in large, distributed environments, and the proposal of using a tailored model combining agile and stage-gate models to create a hybrid model, we expect more academicians to embark on this area in the current setting.

The most addressed factor, ranking number 1 was "Project Governance" from the "Process" category, along with another 2 factors from the same category, "Customer collaboration" and "Project requirements", but ranking number 9 and 10 respectively. The factors most addressed amongst the top ten rankings are from the "People" category, which includes "PMgmt competence", "Availability of necessary skillset", "Teamwork", "Communication" and "Cooperation from groups or individuals", which are in the 2nd, 3rd, 5th, 6th and 7th placings respectively. The "Organisation" and "Technical" categories had 1 factor each in the top 10 rankings, which are "Understanding of Agile method values" and "Appropriate technology and tools" respectively, which are in the 4th and 8th positions respectively. The indication we get is that a formal PM certification is not as important as possessing relevant PM skills and knowledge on the agile principles. We also conclude that an allocation of budget to implement the agile method is not a critical factor as many organisations understand the need for agile methods and support its implementation, hence the cost of implementation is not deemed as a crucial factor. The organisational politics is also not seen as a barrier to the implementation of agile methods. Most of the other "Process" related factors such as scoping, planning, scheduling, progress tracking, visibility, timely reporting, stakeholder relationship and knowledge on tools and technology are anticipated traits in agile projects and are considered to be a regular expectation.

As future research areas, we suggest expanding the database of studies, language of studies, to include non-IT based studies, and to research the most recent studies published. We also suggest researching the "People" category in greater depth as it is seen to be an important category in the management and governance of agile projects. Another area for future work is to identify the issues and challenges on the implementation of agile methods and how it will be governed in a distributed project environment, and in environments where large organisations implement a hybrid method. This will create greater value in understanding the agile fit into the various environments. Different perspectives of findings and discussions from researchers with variable background in PMgmt will definitely add value to the results of this study. We hope that this study will benefit the audience, both researchers and practitioners, with reasonable contributions to the industry.

APPENDIX A: STUDIES INCLUDED IN THE REVIEW

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