



Integrated agile facility management model for improving performance in construction projects

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Abstract

Facilities management (FM) has many challenges related to facilities requirements, unique services, and a need for actions to achieve customer/end-user/clients' expectations. There is poor communication among stakeholders, weaknesses, inflexibility in business realities, and difficulty engaging decision-makers and other key partners. Adopting an agile philosophy in facilities management can improve the value and achieve quality and stakeholder satisfaction. The main objective of this article is to explore a guideline on applying agile philosophy in facilities management to achieve flexibility in management and improve performance. The papers published between 2000 and 2022 had been selected. Content analysis was used to complement the qualitative findings. This article focuses on academic articles including subject areas: engineering, decision-making, and operations. The conceptual model is supported by current theories, literature and previous empirical studies from facilities management, agile philosophy, service quality, and stakeholder satisfaction. The major finding is the disclosure of a framework for evaluating agile philosophy in organizations by linking the agile mindset to facilities management practices. The results also revealed a conceptual framework for using agile philosophy in facilities management to achieve value and stakeholder satisfaction. This study is a review of theories and empirical studies. However, the previous studies were very limited and affected access to information widely. Therefore, it is preferable to conduct research and experimental studies on the application of agile philosophy in facilities management. Ultimately, using an agile philosophy in facilities management helps to achieve value and stakeholder satisfaction.

Keywords Facility management · Agile philosophy · Collaboration · Performance · Model

Introduction

The field of facilities management (FM) has increased significantly since using the term in the 1970s. Although many practitioners worldwide in the field and a wide range of academic research support it, this type of management is still not well-known [1]. Effective facilities management strategies aim at the organization's ability to achieve its business objectives [2]. Organizational needs vary in the pursuit of long-term goals. In addition, stakeholders and employees have different perceptions of the design of the facility that stem from different but consistent needs and interests [2–4].

MARTIN PICKARD, an expert in facilities management, noted in 2010 that facilities management has the longest stakeholder list of any part of an organization and any part of the building lifecycle [5]. This will be the most challenging when applying the agile method. Therefore, the key to an effective facility management strategy is the need to understand and align stakeholder needs with the organization's culture and values [2, 3].

Several research studies (Nguyen et al. [6], Mashali et al. [7], Khodeir and Soliman [8], Othman et al. [9], Mohammed and Chambrelin [10]) agreed that there are weaknesses and lack of flexibility in the business reality and the ability to incorporate continuous feedback from internal and external stakeholders such as customers, designer, contractor, and end-users into the facility management processes.

The authors Khodeir and Ehab [11], Kumar and McArthur [12], Mohammed and Jasim [13], Paul and Eldhose [14], Streule et al. [15], Thesing et al. [16] stressed the need to conduct research on the importance of applying agile in

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the construction industry and how to use it. Using agile management enhances communication, teamwork, collaboration, and organizational change improves the adoption of higher-value products during the preliminary stages [17]. According to Kumara [18], agile methods have not been widely understood when they originated, their goals, and whether they have further applications.

Agile philosophy background

Recently, agile philosophy has been gaining a lot of momentum, and it is a new popular management approach to combat ambiguity and uncertainty in the project [19]. The operation phase is the longest in the project life cycle and involves multiple stakeholders. Facility management services often did not meet the expectations of stakeholders [20, 21]. This requires new management models, and this is what will be done by evaluating the agile philosophy in facility management. “Agile is about delivering business value quickly—quicker than needs change in business and market cycles—and about being adaptive and responsive to evolving customer needs and business circumstances” [22]. Agile is not only limited to the field of information technology/information systems but can include other industries and can be applied in construction projects and can include the entire organization [10, 19, 23].

Agile core values (Agile Manifesto)

Group 17, (who, in 2001, gathered in a resort setting in Snowbird, Utah, with a mission to find common ground among competing and untraditional methods to formally define Agile project management.), has created a statement on the development of the agile methodology referred to as (Agile Manifesto), which aims to achieve value, under the auspices of agile alliance (Fig. 1) [22, 24]:

1. Individual and interactions over processes and tools.
 - Individual and interactions are most important.
 - Processes and tools will be needed on projects.
 - Projects are completed by people, not processes and tools.
 - Agile projects are people-driven.
 - Focus on people first.
2. Working software (may called services) over comprehensive documentation.
 - Agile projects need to deliver value.
 - Value is about the purpose or business need the project aims to deliver.
 - Documentation is barely sufficient.

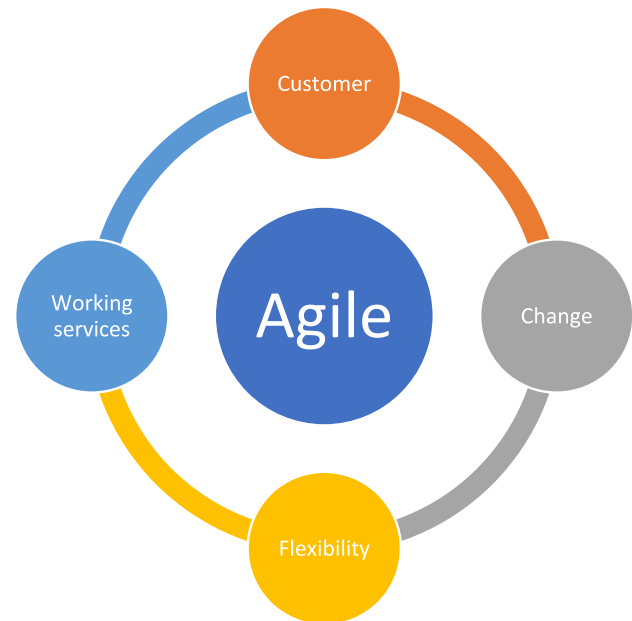


Fig. 1 Agile values

- Documentation is done just in time – as the last responsible moment.
- Documentation might also be just because (Industry requirement – Organizational requirements)
- 3. Customer collaboration over contract negotiation.
 - Agile is flexible, accommodating, and willing to change.
 - Contracts are often rigid and uncooperative.
 - Agile contracts must accommodate change.
 - Difference between being right and doing the right thing.
- 4. Responding to change over following a plan.
 - Agile welcomes change.
 - Predictive projects plan everything in advance.
 - Agile projects have lots and lots of changes.
 - Agile projects have uncertainty upfront.

Agile principles and the relation with facility management

After the Agile Manifesto was published by Group 17, the group continued communicating to support teams transitioning to agile methods. During this period, they developed 12 principles. These principles are used to achieve an Agile Manifesto (Fig. 2) [22, 24].

Research methodology

Selection of database, search strategy and eligibility

The papers published between 2000 and 2022 were searched with the help of titles, keywords, and abstracts using

Fig. 2 Agile principle



manual searches in databases of papers. These databases include: Web of Science, Science Direct, ResearchGate, and Scopus database. The keywords used for searching in the database are ‘‘FM’’, ‘‘Facility management’’, ‘‘Facilities management’’, ‘‘Construction’’, ‘‘operations’’, ‘‘Agile’’ and ‘‘Agility’’. After the search process, the identified papers were chosen based on the following criteria:

- (A) The papers were published between 2000 and 2022.
- (B) Availability of papers were online.
- (C) Written in English.
- (D) Title & abstract screening.

Content analysis

Content analysis was employed to examine the studies identified within the chosen documents. Content analysis entails a structured approach for evaluating written or recorded textual data, aiming to draw accurate deductions or conclusions based on its content [25]. This offered comprehensive and detailed elucidations of the concepts outlined in the literature review, in line with the consensus found in existing studies.

A detailed literature review was carried out regarding integrated agile in facility management. The relevant publications were chosen based on previous criteria, and their

content was submitted to a critical analysis to extract the factors for applying agile philosophy in FM and a conceptual model of implementing agile in FM through linking agile value with FM value (Fig. 3).

There is little independent scientific research on the benefits of agile and its applicability in the building sector [26, 27]. A literature summary (Study purpose, Methodology, Building sector, KPIs, and Findings) is followed. By exploring the literature in the field of agile project management in operations (facility management), the extent to which this new methodology can be applied has been identified, and the obstacles to its implementation [10–13, 23, 26–40].

Findings

Operations phase (Facility management)

Among all the previous studies, there is a paucity of studies that examined the impact of agile in facilities management, due to the lack of awareness among professionals about the possibility of implementing agile in any industry other than the information industry [29]. Employing agile management facilitates better communication, teamwork, collaboration, and organizational adaptability, leading to increased

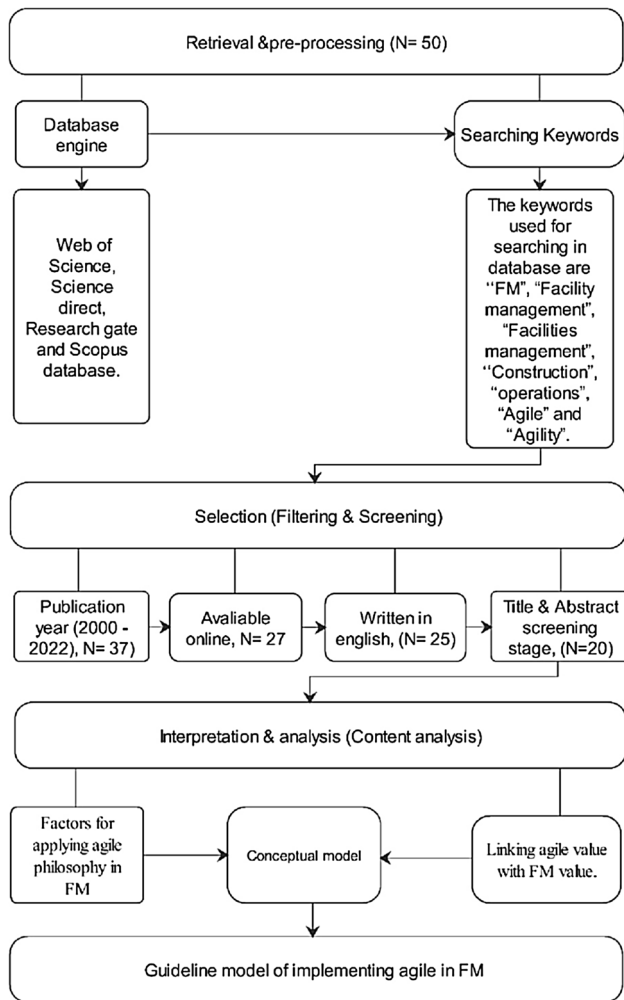


Fig. 3 Research methodology flowchart

acceptance of more valuable products both in the initial phases and throughout the project's duration [34].

In a study conducted by Thenuwara and Sandanayake [28], the integration of agile with facility maintenance was investigated with the aim of proposing an agile integrated facilities maintenance (AFM) approach. The research confirmed that because of the unpredictable nature of maintenance operations and processes, there is a significant level of unpredictability. Therefore, the study concludes that the concept of agile and facility maintenance can be integrated in an effective way. However, industry practitioners do not apply the agile idea.

The research conducted by Ling and Tam [30], a recent study purpose to investigate the agility of facilities

management during the Corona pandemic, examine successful strategies and extract lessons learned in order to manage the facility in the event of a pandemic. The study finds that agile can be combined with facility management to maximize value. The strategies that succeeded in managing the facility were as follows:

- Responsiveness.
- Flexibility.
- Velocity.
- Collaboration.
- Visibility.
- Competence.

Lessons learned for FM to manage future pandemics were crystallized:

- Reducing reliance on manpower.
- Boosting technology adoption.
- Personalized employee engagement.

This agile approach has a conceptual structure consisting of five steps:

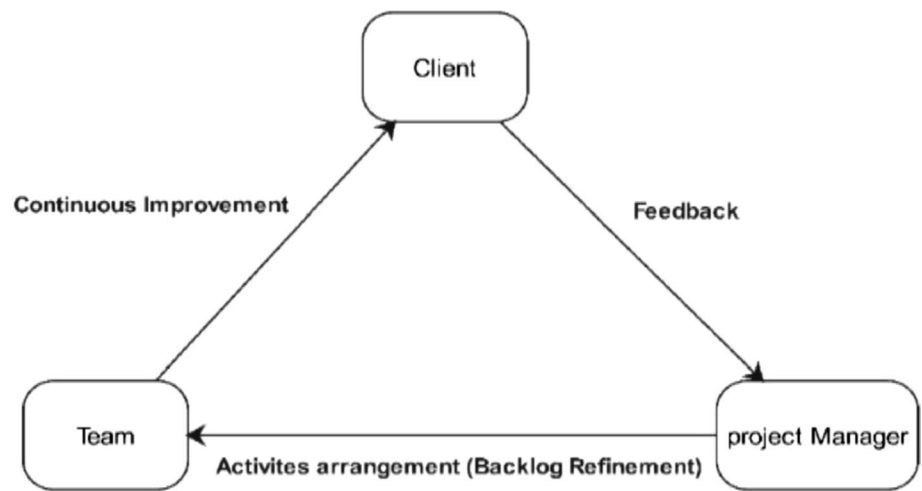
1. Define project requirements and scopes.
2. Integrate inputs and test the intermediate results.
3. Invite and process feedback.
4. Plan-do-check-act PDCA process.
5. Record, and go through the cycle again

However, while certain construction projects have begun to adopt agile principles and practices to some extent, the utilization of agile philosophy in building adaptation remains a developing area [33].

Agile framework, tools, technique

The agile philosophy combines many practices and frameworks and provides guidance for creating agility in its application, and each framework is applied to a specific area. Agile frameworks can work under unclear changes, requirements, and strategies which can help the team reach clear goals through alliteration and innovation [35]. The basis of the agile methodology is the elimination of bureaucracy in processes and the involvement of all parties in the shaping of the final product or service to achieve maximum value [23]. Agile approaches are based on the interactions between

Fig. 4 Agile basics in responding to change



the parties involved in the shaping of the final product or services, as shown in (Fig. 4).

Each framework has a specific goal to use: the goal of scrum is management, XP is technical, Kanban is visualization, and crystal is coordination. It turns out that all frameworks were derived from the Agile Manifesto and practices. As a result, several frameworks can be combined into a single work environment depending on their needs. However, for its application in facilities management, the SCRUM system proved effective since it is considered a "management tool" and therefore can be easily used in any other industries outside of information systems [10, 26, 29].

Factors for applying agile philosophy in FM model

The factors are based on the strategic importance of the application of agile facilities management. The stage is taken by deriving KPIs from the literature review and then combining them with an agile mindset to form the factors for applying agile philosophy in FM (Table 1).

Discussion

Thenuwara and Sandanayake [28], Ling and Tam [30], Chia et al. [32] noticed that a breakthrough in agile philosophy is still pending in the construction industry and facilities management. Nazali Mohd Noor and Pitt [43] stated that "FM is capable of contributing towards organizational success if it is given the opportunity to exploit new ideas and perform innovative activities". The main objective of facility management is to support primary business processes by

aligning physical resources (Supply) with organizational strategies (Demand) in order to add value to the organization and contribute to organizational performance [44].

To determine the opportunities of agile facility management, a good start is to identify the similarities between agile values and facility management. Guizzi et al. [45], Van Sprang and Drion [46] presented the most important basic pillars of facilities management according to their definition, which are summarized in 4 basic values, and they are professionals & multiple disciplines, workplace (service leadership), customer-oriented (customer intimacy), and process (operational excellence). Figure 5 shows the common goals between agile and FM, which aim to enhance organization value, increase interaction between stakeholders, and achieve satisfaction.

Guideline model of implementing agile in FM

The authors pinpointed primary agile practices that the information technology sector has embraced. These practices are detailed alongside their respective sources (Table 2).

Figure 6 provided an example of a modified agile approach for facility management. Finally, this study is a literature review that introduced the concept of integrated agile facility management as theoretical conceptual framework. Continuous dialog, more studies, refinement, and more validation of the framework are necessary to approach adequate representation for integrating agile facility management.

Effective participation of stakeholders and users achieve maximizing the enterprise’s performance. However, the concept of stakeholder and stakeholder analysis is crucial if one

Table 1 Synthesis agile values, agile principles and tasks

	Tasks (practices)	Reference
Individual and interactions	<i>Motivated individuals</i>	
	Contribute to a safe and trustful team environment	[28–30, 41]
	performance-based incentive systems	
	Create employee accessible performance feedback system	
	motivating FM staff regularly	
	Employee reward system for problem-solving	
	<i>Face-to-face conversation</i>	
	Encourage team members to share knowledge	[28–30, 41]
	Establish flexible workshops and close collaboration between multidisciplinary team	
	Working closely with the owner of the facility	
	<i>Self-organizing teams</i>	
	Encourage emergent leadership within the team	[19, 23, 27–30, 41]
	Providing trainings for employees	
Working software (may be called services)	<i>Deliver working software frequently</i>	
	Set objectives	[28, 29]
	Prioritize the work scope	
	Facility working as intended and with minimal to no operating startup issues	
	<i>Primary measure of progress</i>	
	Practice visualization (information radiators, Checklist, audit inspections & on time monitoring)	[23, 27–30, 41]
	Provision of essential FM services	
	Boost performance through group accountability for results and shared Responsibility for team effectiveness	
	<i>Simplicity</i>	
	Use of schedule & action plan	[28, 30]
	Regularly review business continuity plans	
	Build flexible supply chain with service providers	
	Customer collaboration	<i>Satisfy the customer</i>
Deliver reliable results by engaging customers in frequent interactions and shared ownership		[23, 26–29, 42]
Establish user complaint handling system		
Continuous feedback loops from stakeholder		
Client's future information needs should be prioritized right from the outset of a project		
Identifying the actual stakeholders and strengthening relations between them		
<i>Sustainable development</i>		
Improve effectiveness and reliability through situationally specific strategies, processes and practices		[23, 26]
Interpret common data set in facilities management, user surveys, occupancy levels, retail sales data periodically		

Table 1 (continued)

	Tasks (practices)	Reference
Responding to change	Constant monitoring and evaluating the project’s progress and should be able to maintain a constant pace <i>People and developers must work together daily</i>	
	Create effective communication channels between project areas and project team members (FM)	[23, 28, 29, 42]
	Regular meetings with other supportive departments Daily discussion between engineering, construction, and operations representatives	
	Sharing firm’s objectives with suppliers Share best practices & expert teams	
	Obtaining the requirements throughout the lifecycle in the project <i>Welcome changing requirements</i>	
	Support change at the system or organization level such as: House FM staff in different locations to prevent cross infection	[19, 26, 28–30]
	Rapid response to unpredictable failures of plant, equipment, components and quality issues immediately	
	Expect uncertainty and manage for it through iterations, anticipation, and adaptation	
	Be aware on (production requirement change, Adapt agile maintenance policies and procedures, changes in legal requirement, price changes in spare parts, new service providers, etc.) <i>Technical excellence</i>	
	Ensure that everyone has a common understanding of the values and principles of agile	[19, 23, 26, 28–30]
	Enhance creativity by recognizing that individuals are the ultimate source of value, and creating an environment where they can make a difference	
	Follow PDCA cycle, facility condition assessment, and Continuous improvement	
	Digitalization of FM supervision, checks and approvals such as use of IT integrated	
	<i>Become more effective</i>	
	Making continuous flow of value our focus	[23, 26, 28–30]
	Define core & non-core maintenance activities	
	Continuous learning sessions, Use of troubleshooting guidelines	

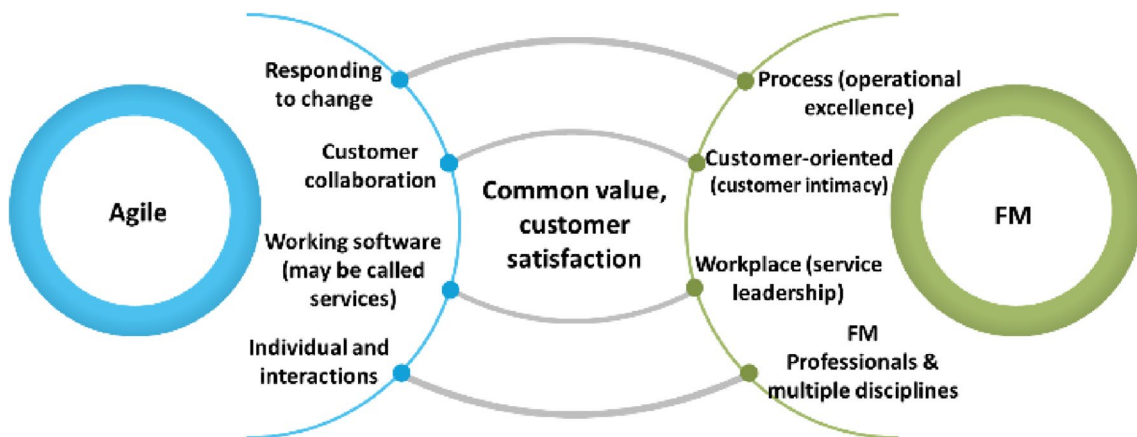


Fig. 5 Common goals between Agile and FM framework

Table 2 Agile philosophy that could be suitable for facility management

Practices	Description	References
Continuous integration	The act of frequently combining elements of a project created by various teams to prevent any single component from becoming isolated to enhance the efficiency of the delivery process and mitigate conflicts in the project's later stages	[30, 36, 37]
Iterative and incremental development	The development process is divided into small, manageable segments known as iterations or sprints. Each iteration entails delivering a functional piece of process, which is then iteratively enhanced in subsequent cycles. This methodology enables stakeholders to provide feedback early and frequently, resulting in more effective and efficient development	[26, 29, 37–39]
Backlogs	The backlog outlines the features and tasks planned for the project. Team members are matched with tasks that align with their skills for execution during sprints, which are short periods of intense work. Initially, the backlog may lack detailed tasks, but as the project advances, it is crucial for the team to regularly groom and update it	[33, 34, 37–39]
Running sprints	A sprint is a short-term endeavor, typically lasting a few days or weeks, akin to a micro-project. The expectation is that all scope items assigned to the sprint from the backlog will be completed within this timebox	[19, 24, 30, 38]
Sprint retrospective	are a vital aspect of agile project management, emphasizing consistent reflection and ongoing enhancement. These sessions usually occur at the conclusion of each iteration or predefined time period, enabling the team to review their work, procedures, and teamwork, and pinpoint areas for advancement. Through regular retrospectives, teams can detect and tackle issues promptly, fostering continuous improvement in processes and collaboration, ultimately leading to the delivery of top-notch products that satisfy stakeholder requirements	[30, 32, 36, 40]

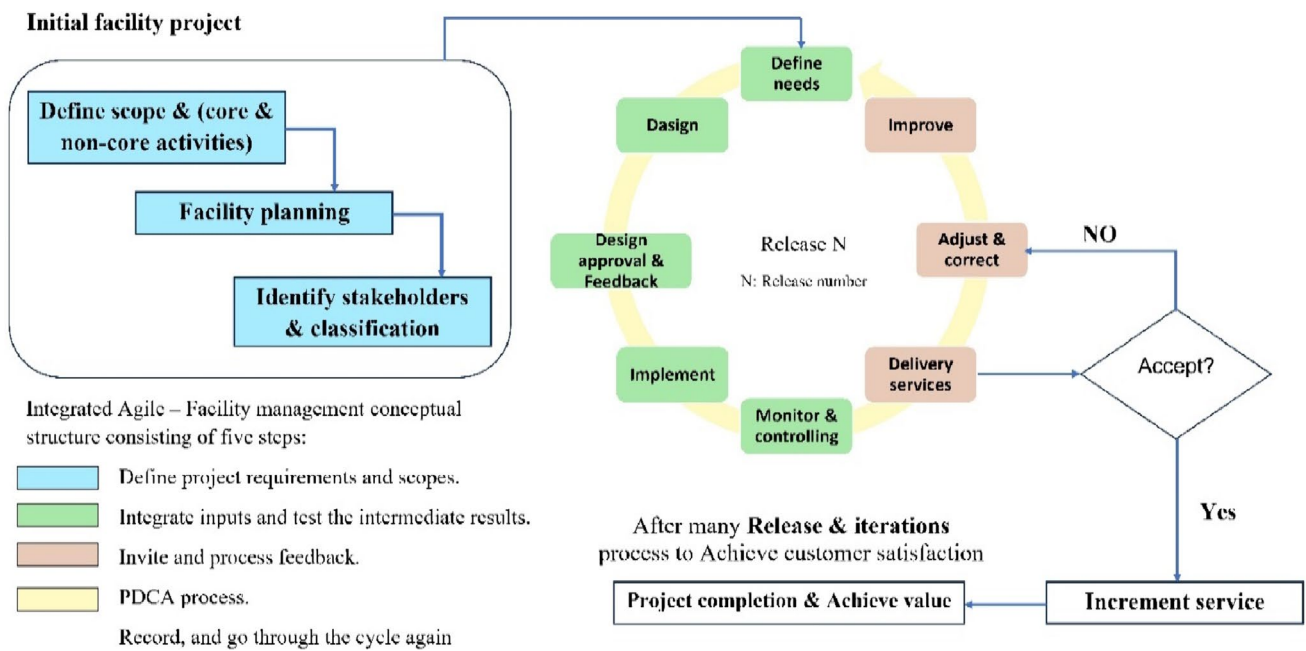


Fig. 6 A conceptual model of implementing agile in FM

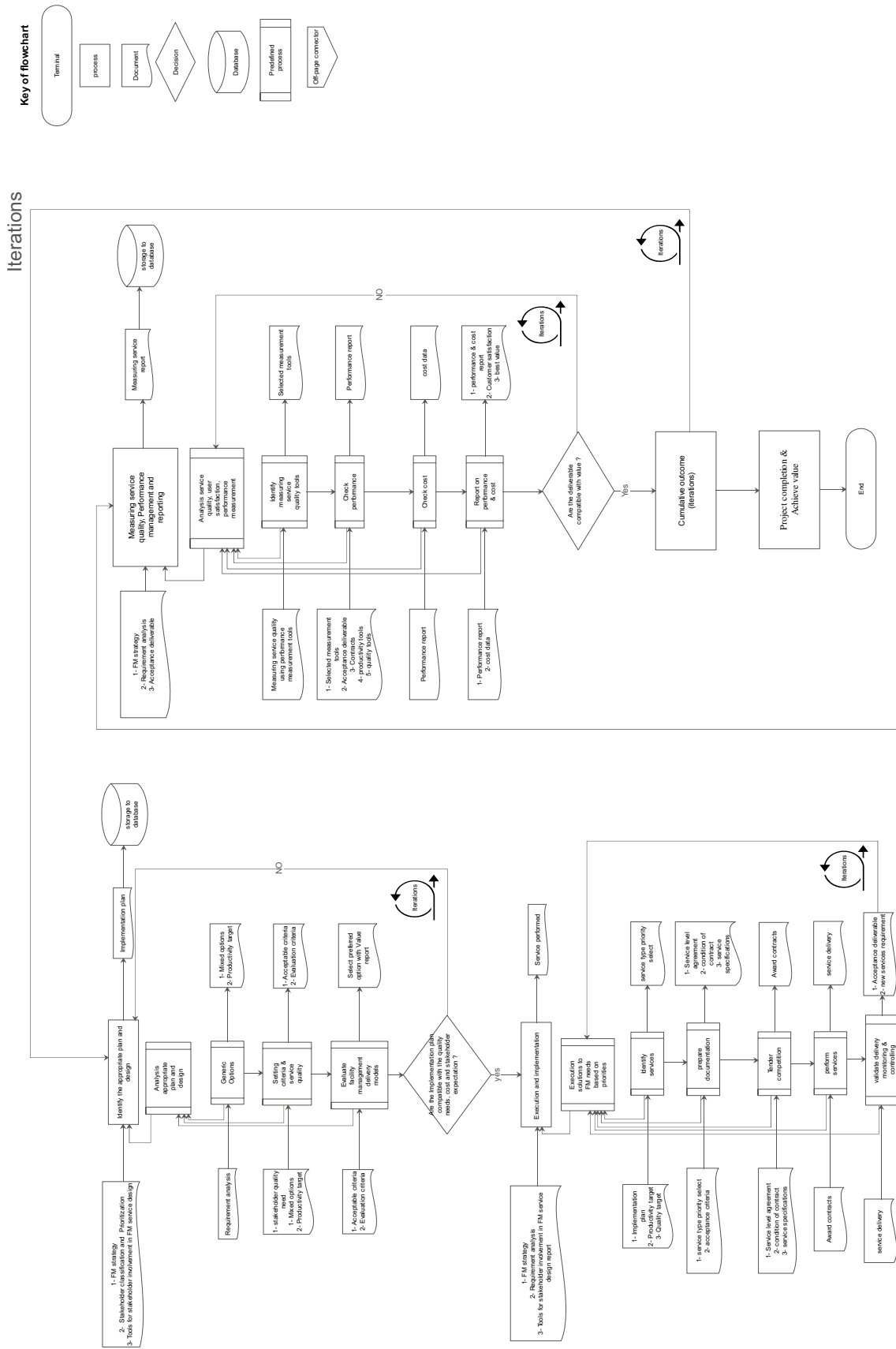


Fig. 7 Agile philosophy in facility management flowchart

seeks to establish how stakeholder communication affects project quality. Agile philosophy are more flexible and responsive to change than Lean methods. In addition, agile philosophy can be applied effectively in facility management because of the unpredictable nature of maintenance operations and processes, there is a significant level of unpredictability (Fig. 7).

Conclusion

This study determines the basic factors for applying agile in facility management and finds the best methods to achieve maximum value and performance for the facility. This study proposes how to apply the agile philosophy in facilities management to achieve improving performance in construction projects. This research presents a comprehensive literature review that addresses the findings of agile application in the construction sector. In addition, the research presents ideas and methods on how to apply agile philosophy in facilities management.

Agile management is not a methodology, but it is a philosophy or a style of project management. The agile process is iterative and puts more responsibility on a client than a traditional approach. Flexibility and responsiveness to change are a core strength of agile philosophy and the foundation for the philosophy's success. For agile to be successful, there must be mutual trust among all parties involved. Many frameworks can be created as long as they adhere to the mindset and values of the agile manifesto principles. On the other hand, organizations may not fully implement the agile mindset, as individuals may tailor them according to their needs and desires.

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Declarations

Competing interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent For this type of study, formal consent is not required.

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