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IMPACT OF AGILE METHODOLOGY USE ON PROJECT SUCCESS, MEDIATING ROLE OF PROJECT COMPLEXITY

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ABSTRACT

This paper explores the effects of the Implementation of the Agile methodology on the success of a project and the project complexity as a mediating variable in the construction industry in the UK. The research study adopted a quantitative survey method drawing on a positivist philosophy and deductive approach to the study. The participants of the research (100 respondents) were surveyed with the help of structured online questionnaire where validated scales were used to measure the use of Agile methodology, the success of the project implemented, and the complexity of this project. The results were analysed statistically based on the SPSS 21 and the PROCESS macro by Preacher and Hayes (2008). The findings showed that Agile approach has a strong positive influence on the project success although project intricacy moderates the connection between the two aspects. These results demonstrate the significance of adapting Agile practices to the complicated project circumstances and imply that managers ought to consider the provisions of complexity to maximize the results. The research paper will add value in both elucidating theory and empirical practice on the Agile topic in dynamic industries.

Keywords: Agile methodology, project success, project complexity, mediation, UK construction industry

I. INTRODUCTION

The world of project management continues to evolve and become more intricate and thereby it has become difficult to determine project success. Nevertheless, with the influence of digital transformation and the changes of customer requirements, the issues of traditional project management are too rigid and resistant to adapt to changes on one hand, (Ciric et al., 2019), On the other hand, there is a very much broader acceptance of Agile methodology due to its flexibility in form of an iteration model that allows the project teams to manage uncertainties and dynamism of project requirements efficiently (Butler et al., 2020). Being a methodology that is focused in collaboration, customer satisfaction and improvement, Agile provides a structure identify to achieve the best results in conditions of high uncertainty. Agile methodology was introduced in software development field in early 2000 to provide solution to the client needs' changes which are not addressed by the conventional approach like Waterfall (Islam and Ferworn, 2020, Atawneh, 2019). Due to the nature of the Agile approach, it breaks down a project plan into small, easily manageable segments; this permits iterative reviews and the correction of activities against stakeholder expectations (Franklin, 2021). This methodology emphasizes delivering working software frequently and continuously, collaborating with the customers instead of negotiating with the contract, and managing the change instead of performing as per the plan which is mentioned in the Agile Manifesto (Nuottila and Nystén-Haarala, 2019).

The use of Agile methodology in project management has revolutionized the way projects are executed, fostering flexibility, collaboration, and customer satisfaction. Originally derived from the software development industry, Agile's principles and practices have spread across various sectors due to their adaptability and effectiveness in dealing with project uncertainties (ÇUBUKCU, 2020). The core tenets of Agile—such as iterative development, self-organizing teams, and regular reflection on how to become more effective—offer a stark contrast to the traditional, plan-driven approaches (Korpivaara, 2020). Despite its widespread adoption, the impact of Agile methodology on project success is not uniform and can be influenced

by several factors, including project complexity. Project complexity, characterized by various dimensions such as technological uncertainty, scope, and team dynamics, can significantly affect the implementation and outcomes of Agile methodologies (Butler et al., 2020). The mediating role of project complexity in the relationship between Agile methodology use and project success is critical yet underexplored. Understanding this relationship can provide valuable insights into how Agile practices can be tailored or adapted to complex project environments to enhance their success rate (Kaller and Söderqvist, 2020).

Agile methodologies emphasise customer involvement, regular delivery, iterative development, and easy adaptation to change (Khan et al., 2021). According to (Ekechi et al., 2024) agile teams foster innovation and iterative steps, leading to increased productivity and product quality. The construction industry has in the past worked with conventional project management frameworks including Waterfall that focus on stages of project planning, designing, and implementation. But in the recent past, the Agile methodologies have been adopted in the sector since they offer the opportunity to adopt flexibility and flexibility in managing complex and dynamic projects (Arefazar et al., 2022). Although Agile practices were designed for the software industry, they consist of the principles of development in an iterative manner, interacting with the customers, and being adaptive to change, which are particularly important for construction projects due to various uncertainties in design, regulations, and stakeholders' demands (Omotayo et al., 2024). The use of Scrum and Lean has been applied to part of the construction projects mainly in the design and pre-construction stages where there is considerable focus on feedbacks and incremental enhancements (Jethva and Skibniewski, 2022). The life cycle nature of Agile makes it easy to incorporate changes and improve the construction teams' ability to adapt to changes in client requirements or environmental factors. Nevertheless, the implementation of Agile on a more extensive scale in the construction industry is problematic due to the focus of the sector on strict contracts as well as the applicable legislation (Burton et al., 2021). However, the use of Agile in construction has the possibility of enhancing the project delivery due to enhanced collaboration, flexibility and creativity.

Project success can be defined as process, project, or organisation success (Ika and Pinto, 2022). Castro et al. (2021) defines project success as stakeholder satisfaction, organisational benefit, product success, and team development. Project success is often attributed to the methods utilized to complete it. Alotaibi (2019) suggests that success should not only be measured by time, cost, and quality, but also by reevaluating the methods used to achieve them. According to (Malik et al., 2020), project success is not solely determined by schedule, budget, and quality, but also by managing complexity. According to (Shao et al., 2019), complexity might motivate individuals to work harder and think creatively to achieve goals. When project aspects are complex, many team members are needed to assist, leading to increased cooperation. The initiative will succeed. However, the success of Agile projects is not automatic and depends on some factors one of which is project size (Tam et al., 2020). Measures of project characteristics are next defined by Project complexity, which can be defined as the level of integration of activities, participation of stakeholders, technical risks, and environmental risks affecting a project as posited by (Matu, 2020). Multitailed projects, especially those with more participants or when they require the application of different technologies, are rather difficult for managers since they are characterized by greater risks and uncertainties (Alanazi, 2021). In such cases, agility is a double-edged sword where Agile either aids the project team and pushes all the more for complexity or hinders the team and relapses into complexity at a moment's notice.

Project complexity has significant moderating role for the impact of Agile methodology on success of projects which is an area of further research. Maqsood (2021) have supported the idea that although Agile incorporates the betterment of the project performance at its core value of collaboration and flexibility, the success of the project really does not vary on the Agile implementation. More complex initiatives may require extra prescriptive governance, communication, and risk management tactics to make sure that Agile's repetitive nature does not expand the scope of the project and deviate from the strategic course as suggested by (Diem, 2021). Therefore, it is important for the project managers to know how project complexity affects Agile to enhance project performance. Complexity has become a critical aspect in project management literature due to the continuous demands and technological advancements (Nicholas and Steyn, 2020). Each project is unique, containing uncertainties and complexities that contribute to its unpredictability. Project complexity is a term used to describe the difficulty in understanding, predicting, and controlling its overall behavior, even with complete information about the project system (Kerzner, 2022). Factors related to project size, variety, interdependence, and context contribute to its complexity. Complexity is a prominent feature of projectized organizations, as it is defined as interdependency between different assignments and co-dependency between tasks (Zaib, 2019). Effective management of project complexity is essential to prevent difficulties in working on the project and ensure the team's success. Assessment of project complexity is essential for effective project management. Complexity refers to the execution of a complex process with various parts working together to achieve desired results within time, cost, and quality. It is a challenge in implementing planned objectives

(McGraw and Harbison, 2020). Understanding complexity can help identify root causes of problems, increasing project success. It is a vital element of projects and is discussed during discussions (Darty-Baah, 2022).

Furthermore, the current literature indicates that Agile methodology is not universally effective for managing all types of projects (da Costa Filho et al., 2022). In a situation where technical solutions are complex, a number of stakeholders are involved or if the environment is considered uncertain then Agile may have to be adapted or even combined with more traditional approaches (Hybrid Agile) known to deal with such complexities (Gemino et al., 2021). This has underlined the need for the identification of other factors moderating the relationship between Agile methodology use and project success cumulative evidence and project complexity ranked highest. In fact, Agile methodology has been regarded as effective in improving success rates of projects but the assumption made by successful implementation of Agile, some aspects need to be explored further such as its relationship between it and the project complexity. The purpose of this research, therefore, is to investigate how such practices affect project success and the role of project complexity.

Agile success is a key component of project management because it tackles and provides a fresh, practical approach to all of the ineffective techniques and procedures that were previously used to ensure project success (Avlijaš, 2020). It remains unclear whether projects—those using the most recent agile technique or those using conventional methods—have the highest success rates. Agile methodologies are often regarded as the most effective; nevertheless, this notion is not substantiated by scientific evidence and is accompanied by several overlooked facets. The purpose of the current study is to assist project managers in effectively implementing the agile methodology. The objective of this research endeavor is to ascertain the influence of agile technique on the achievement of projects, a domain that is presently inadequately investigated and mostly disregarded in scholarly works. Additionally, it aims to validate the mediated mechanism by project complexity. In the haste to investigate this subject, many studies fail to consider the way project complexity impacts the implementation of agile methodology. The research concludes by investigating the moderating effect of manager support on the relationship between project complexity and project success to fill a gap in the literature.

This study aims to explore the influence of Agile methodology on project success, with a particular focus on how project complexity mediates this relationship. The primary goal is to provide insights into effectively tailoring Agile practices to suit complex project environments, thereby enhancing both theoretical understanding and practical applications in project management. The research seeks to evaluate the impact of Agile methodology on project success while distinguishing between projects of varying complexity levels, and to investigate the mediating role of project complexity in shaping the relationship between Agile methodology usage and project success. Guided by these objectives, the study will address two central research questions: how the impact of Agile methodology on project success differs between projects with different levels of complexity, and what role project complexity plays in mediating the relationship between Agile methodology adoption and project success metrics.

The significance of this research lies in its potential to enhance both theoretical and practical knowledge of project management by examining the interplay between Agile approaches, project complexity, and project success. Agile methodologies have gained widespread adoption over the last two decades, particularly in software development and dynamic, fast-changing environments (Alqudah et al., 2019). However, existing literature remains inconclusive regarding the generalizability of Agile methods to highly complex projects (Beetseh, 2023). This study addresses this gap by analysing how project complexity mediates the relationship between Agile methodology and project success. From a theoretical standpoint, the research enriches the discourse on Agile project management by moving beyond the primary effects of Agile practices—such as improved flexibility, enhanced communication, and faster delivery (Ozorhon et al., 2022)—to examine their operation in environments characterized by interdependent variables and dynamic systems (Masili et al., 2024). This deeper investigation will identify conditions under which Agile methods are most effective and when they may require adaptation or integration with traditional project management approaches, as suggested by Ciric Lalic et al. (2022).

Furthermore, the study will help clarify whether Agile is more effective in small or moderately complex projects and how complexity factors—such as multi-party involvement, high technical uncertainty, and inter-task dependencies—affect outcomes. By shedding light on these dynamics, the research will contribute to the ongoing theoretical debate regarding the limitations of Agile in complex contexts and the potential value of hybrid approaches. From a practical perspective, the findings will be valuable to project managers, organizations, and decision-makers, providing evidence-based guidance on adopting suitable Agile methodologies and understanding how complexity influences outcomes. This understanding will

enable better resource allocation, strategy formulation, and governance structures, ultimately increase the likelihood of successful project completion while avoid risks such as scope creep or misalignment with organizational goals.

II. LITERATURE REVIEW

AGILE METHOD

Agile project management emphasizes flexibility, cooperation, and the customer during development. It was developed in the early 2000s in software development to address the disadvantages of Waterfall (Thesing et al., 2021). The 2001 Agile Manifesto prioritized people and communications over structures and documentation, working software over comprehensive documentation, customer collaboration over contract-based project definition, and flexibility over following a plan. Agile is an incremental and cyclical project management process that addresses changing needs and the pressure to deliver to consumers. Scrum, Kanban, and Lean are Agile frameworks. One of the most popular Agile frameworks, Scrum, uses sprints to divide and finish work in short periods (Dixit & Bhushan, 2019). Kanban is another Agile method that emphasizes visualizing work and keeping it under control to maintain delivery (Zayat & Senvar, 2020). Lean, originating from manufacturing, was implemented in Agile to reduce waste and increase process value (Rodríguez et al., 2019). Each framework offers a unique approach to introducing Agile, allowing firms to tailor their practices to their needs. Agile can accommodate variable project dynamics, improve team cooperation, and speed up project results. The project can adjust to fresh information and input to meet stakeholder expectations (Urbinati et al., 2021). It also promotes team collaboration, which increases transparency and reduces misunderstandings. Leveraging Agile has drawbacks like any other strategy. Sometimes its strength is also its drawback since it causes project scope to expand without sufficient planning (Nicholas & Steyn, 2020). Agile may also lose direction and timelines, which might distract from the strategic objective (Miller, 2022).

PROJECT SUCCESS

Project success is one of the most important ideas in project management over the last 30 years, and its definition has altered (Kerzner, 2022). Project success was traditionally determined by the ‘iron triangle’ of project management—time, money, and quality (Hussain & Uddi, 2022). A project was measured by its capacity to be delivered on time, within budget, and of sufficient quality. Many industries employed such criteria to evaluate work results (Kamble et al., 2020). In addition to the iron triangle, stakeholder satisfaction and long-term project value have become other criteria for project success (Zid et al., 2020). This shift recognizes that a project can meet the success criteria of time, scope, and cost but not give much value to stakeholders or could have delivered significant value to key stakeholders despite time and cost differences. Project success definition and realization have altered with agile methodology (Ciric et al., 2019). Agile's emphasis on incrementalism, smaller cycles, regular feedback, and customer interaction aligns with modern, customer-centric success criteria (Eboh, 2024). Agile initiatives serve consumer needs because they are adaptable and often altered to stakeholder expectations, creating a significant risk of delivering a market-unsatisfactory result (Singh, 2021). Agile approaches improve collaboration and adaptability among project team members, which speeds up problem-solving and directly affects project outcomes (Zhang et al., 2021). Agile's flexibility can collide with success norms. For instance, Agile projects may satisfy stakeholders and help achieve long-term organizational goals, but the cyclic nature of development may cause the Agile process to fail in meeting time and cost requirements. This suggests that Agile project success may depend on stakeholder value and flexibility rather than conventional measurements (Radhakrishnan et al., 2022).

PROJECT COMPLEXITY

Project complexity—the business of project management—has fascinated project management scholars. Chipulu et al. (2019) list technical, environmental, and stakeholder dimensions. The technology, systems, and procedures employed in a technical project may be complex or require technical skill to coordinate (Roehrich et al., 2019). External elements including legislation, market, and geopolitical forces might impact the project's outcome, making them environmental complexity. Stakeholder configuration—the quantity and kind of stakeholders, their interests, power, and expected communication—makes it hard for the organisation to align its goals with its stakeholders (Erkul et al., 2020). Complexities, alone or together, create ambiguity and increase project drift. Project complexity is a crucial factor in project management since it often hinders schedule, cost, and quality management (Butler et al., 2020). Because many project components are interdependent, Haq et al. (2019) say simpler projects are easier to design, execute, and control. For instance, changes in one element of the project can affect others, making it difficult to set and implement a project direction (Englund & Graham, 2019). Project managers

employ modular design, risk management, and good communication to handle complexity. These tactics aim to split the project into tiny, manageable pieces, identify potential hazards, and keep stakeholders informed and updated (de Rezende et al., 2022). Complexity management is another key to project success when many aspects are unpredictable and continually changing (Nicholas & Steyn, 2020). Flexibility, short development cycles, and stakeholder feedback make agile better at project complexity (Alqudah et al., 2019). Since Scrum or Kanban are flexible, project teams feel little uncertainty. Agile cycles evaluate and adjust project goals, enabling progress despite technology and stakeholder complexity. The research suggests that Agile's value for complex tasks may be limited if applied incorrectly. Beecham et al. (2021) suggest that Agile may need other governance or risk management frameworks in large projects to avoid scope explosion or strategic focus loss during iterative development. If project complexity is addressed, agile can manage it.

HYPOTHESIS DEVELOPMENT

Agile Methodology Usage and Project Success

Over three decades of this research in software development projects but the recent years are indicated that agile methodology of software development is a key, ruling, and the dominant methodology that is being used and seen out to be successful in the performance of the excellence of the project (Palopak and Huang, 2022, Akinbaleye, 2021). Research pointed out that there is a gap in terms of work and data analysis with the use of development agility concept along with the factors and conditions that are associated with the project success (Radhakrishnan et al., 2022, Hajli et al., 2020). While working through the process of analysis and data gathering it emerged that organizational culture and empowerment of the project team is the key factor to project success referred by (Nauman et al., 2022). Industry is moving toward the agile methods because the nature of the project industry is moving toward more customer focused, there is the possibility of well-structured problems which are having clear objectives which are to be solved but there comes a problem with uncertain user requirements (Sithambaram et al., 2021). Agile approaches have developed to address the risks associated with projects and adapt to market shifts, resulting in the project's success. Analyzing the effective completion of agile software development projects necessitates the use of comparable quantifiable tests (Srivastava et al., 2020). Similarly, it was discovered that managers learn about a specific project-related aspect in order to make better decisions because it is discovered that people, systems, and processes are all related to the project's successful execution (Sajja, 2021).

According to Albuquerque et al. (2020), agile approach is extensively utilized in software development and other industries since it is a transition from waterfall project management, which is important for complicated project implementation. Based on these findings, agile methodology helps projects succeed. The sector mainly uses agile project management, which promotes information sharing and client collaboration (Daraojimba et al., 2024). Most software development projects are responsive and customer-focused; thus, companies must use this technique. Agile teams communicate with clients and alter plans based on their requirements (Ciric et al., 2019). Effective agile approach deployment requires code reviews. Agile techniques emphasize client involvement and project success goals (Moloto et al., 2020). Agile methodology's iterative nature allows customer collaboration and demand fulfillment.

Counterarguments claim that large parallel teams cannot employ agile methodologies like scrum (Whiteley et al., 2021). Traditional project management methods are used since most large-scale initiatives fail. It works well in small agile practices (Mishra et al., 2021). Similar stories demonstrate how difficult agile software projects are. To secure project succession, the organisation should carefully implement agile and standard project management approaches (Sithambaram et al., 2021). Agile can also be used in other industries. The initiatives are too inventive and complex for the outdated agile methodology methods; doing so will hurt their success. Examine potential in the sector to successfully adopt agile methodology for project delivery (Žužek et al., 2020). Agile improves client and team satisfaction in the project sector. Although unrelated to project performance, this practice speeds up project start (Chathuranga et al., 2023). If the project industry cannot describe the procedures needed to understand agile methodology, a project will fail (Canlas, 2022). From another perspective, agile and traditional project management companies are similar. The success percentage and project delivery time are same in both situations since the failure rate is similar (Merrow, 2024). The literature rejects the connection between the use of agile methodology and project success, or posits that due to the inconclusive findings in previous studies, we want to empirically examine this link in the current situation (Malik et al., 2021). This study will analyse the success of agile approach in the software industry, highlighting the differing opinions already documented in the literature. Based on the aforementioned research, we may propose that

H1: Agile methodology usage is positively and significantly associated with project success.

Agile Methodology Usage and Project Complexity

To analyze complexity drivers and their impact on organisational resources for each project activity, a resource-oriented process cost calculation method has been developed (Jambor, 2022). Uncertainties about complexity and complexity tolerance are examined (Schuh & Zeller, 2020). A project's success depends on its complexity, which increases when performance and task execution are poorly managed, especially for near-term operations. Technical and management issues complicate the project (Ma & Fu, 2020). Technology complexity includes the number of technologies, team familiarity, and technological interfaces. Project staffing, managerial issues, and external influences might affect project progress and operations. Project complexity includes the function, amount, and number of interrelated items, tasks, or specialists, as well as intrinsic complexity (Butler et al., 2020). Agile methods require consumer interaction to meet project goals and get stakeholder feedback. Continuous project improvement requires this feedback. Agile approaches enable frequent and simple stakeholder interactions (Al-Saqqa et al., 2020). Agile techniques involve planning and distribution throughout project development, where information is collected at various stages (Islam & Ferworn, 2020). The present project's success rate suggests that agile project management approaches are becoming more popular in situations with constant change in tasks, requirements, budgets, and schedules (Nguyen et al., 2024). He said that two companies—one using agile approaches and the other not—achieved schedule and budget goals similarly and had identical failure reasons. Over time, companies adapt new methods and procedures for project implementation, objective achievement, and meeting project needs (Ershadi et al., 2020). Managing project complexity and achieving schedule, money, and performance objectives is key to project success (Bilikwa, 2022). Project success is strongly connected with efficiency (Gemino et al., 2021). We can analyze the complexity of the two measuring choices using direct and indirect methods. The former uses a quantifiable value to represent complexity, whereas the latter analyses its economic effects (Brandl, 2023).

Assessing the project's complexity involves examining historical data of similar projects, analyzing them in relation to actual conditions, and aligning them with the fundamental principles of understanding and addressing the project's needs and requirements while integrating agile methodology and project complexity according to the project's nature. Recent developments are more sophisticated (Cantarelli, 2022). According to research, agile software development can reduce uncertainty, complexity, and fluctuations in IT projects (Binboga & Gumussoy, 2024; Maqsood, 2021). Consumer feedback is needed to guarantee software development projects meet their needs. Agile helps teams understand consumer needs. Rapid feedback from agile can shorten software project development (Al-Saqqa et al., 2020). Software project complexity is a major hurdle to success, hence Agile offers methods to reduce it. Agile approaches are entering the software sector, which may simplify complex issues. Deconstructing and distributing tasks helps solve problems (Griebenouw, 2021). Agile methods reduce software development project complexity (Mishra et al., 2021). These tactics are particularly well-suited for managing complicated project scenarios, since (Maqsood, 2021) assert that the agile method is one of the most effective approaches for mitigating project complexities. Literature demonstrates that complexity can be mitigated by the application of agile approach techniques. Consequently, the following hypothesis might be formulated based on the prior research.

H2: Agile methodology is positively related to project complexity

PROJECT COMPLEXITY AND PROJECT SUCCESS

Complex systems are challenging to comprehend and manage. The majority of information technology initiatives fail owing to the intricate nature of their complexity and technological criteria, which are difficult to comprehend (Wimelius et al., 2021). The majority of projects have failed due to their complexity. The complexity of a project is inversely related to its success (Dartey-Baah, 2022). It is essential to address the factors that may complicate the project and consequently result in its failure. Complex projects are characterized by uncertainty in project goals, implementation strategies, and other factors, making them challenging to comprehend. These complexities often contribute to project failure (Mamédio and Meyer, 2020). Addressing the underlying causes of project complexity can enhance the likelihood of project success. Effective governance is essential not only for the implementation and execution of the project but also requires top managers and executives to comprehend the project's complexities (Mamédio and Meyer, 2020). This understanding enables the team to grasp their tasks, and if project managers can navigate these complexities, they are more likely to achieve success (Ika and Pinto, 2022). Therefore, it is imperative to address and mitigate complexity in every feasible manner. Complex situations are the hardest part of projects for project managers. Project dimensions increase this complexity; addressing it can lead to success. The

characteristics of project complexity improve success (Xia & Lee, 2004). Complex and new project aspects must be addressed to meet project goals. Individual project goals can be measured by evaluating employees' technical achievements by allowing them to confront both novelty and complexity, which, if done effectively, leads to project success (Tatikonda & Rosenthal, 2000).

Complexity is the major emphasis because it generates project bottlenecks, says research. No precise answer existed for project complexity, thus it was neglected or presumed to be subjectively overcome. Thus, project complexity must be neglected to meet schedule, cost, and market demands. Complexity can affect project success (Gidado, 1996). Because modern creative and innovative initiatives are complex, conceptually, project complexity negatively impacts project performance and success. Complexity increases competitiveness and complication even in small project phases, especially when controlling transaction-related expenses to control project complexity. Complexity also affects project outcomes in the organisational network by encouraging collaboration (Moore, Payne, Autry, & Griffis, 2016). Researchers have also found that project complexity can have integrated consequences through direction, communication, and control, which are commonly used to manage the project management process but negatively impact the project goals. Therefore, in order to understand the upper and lower levels of complexity, effectiveness and efficiency of the project manager are required. Project complexity is a critical issue because it is closely related to the performance parameters of the project team in a project management process, which in turn affects the process of achieving project success (Abdou, Yong, & Othman, 2016). Thus, it is hypothesis that based on the discussion above

H3: Decrease in project complexity is positively associated with the success of the project.

PROJECT COMPLEXITY MEDIATES THE RELATIONSHIP BETWEEN AGILE METHODOLOGY USE AND PROJECT SUCCESS

"A project's complexity is the attribute that, even with reasonably comprehensive knowledge about the project system, makes it challenging to comprehend, anticipate, and manage the project's overall behaviour." (Edmonds, 1999; Marle, 2002; Austin et al., 2002; Vidal et al., 2008; Baccarini, 1996). The project complexity is the most crucial factor to consider while planning and executing a project (Baccarini, 1996). According to Jones (1996), there is a startlingly high failure rate for intricate IT initiatives, and the intricacy of these projects is a major reason why many software development projects fail. The most effective method to manage that complexity is to manage and comprehend user requirements, enabling projects to be implemented in response to client needs and succeeding in the process. Poor management of the user requirements is the main reason behind the failure of most software development initiatives (Standish, 1994).

Project complexity has been shown to have a detrimental effect on project outcomes in a number of studies, including Baccarini's (1996) study. Complex projects are challenging to manage and accomplish project goals. In 1995, Meyer and Utterback conducted research on the positive correlation between the integration of many technologies and the rise of project complexity. Similar to prior studies, Larson and Gobeli's (1989) research demonstrated that there is no connection between project complexity and project performance, or success, or quality. According to Dvir and Lechler (2003), a complex project has a negative impact on effective project planning, which in turn affects the success of the project. Complex projects negatively mediate between strategic planning and project success. Aitken & Crawford (2007) found that project complexity makes innovative projects harder to manage and requires formalized methods like agile methodology to succeed. Agile can satisfy users (Paetsch, Eberlein & Maurer, 2003). The iterative method is best for complex scenarios with difficult goals and customer criteria since it constantly meets user needs. Agile methodology is being used in the software business to satisfy client goals and ensure project success (Elssamadisy, 2008). Projects succeed when agile methodology addresses project complexity. However, some companies don't comprehend agile technique, which can cause project failure.

Project complexity is the most important aspect in planning and execution (Baccarini, 1996). According to Jones (1996), complex IT projects fail at an alarming rate, and many software development projects fail because of their complexity. Managing and understanding user requirements is the best way to manage complexity and accomplish projects that meet client objectives. Most software development projects fail due to poor user requirements management (Standish, 1994). The Agile approach can be used to successfully meet user needs (Paetsch, Eberlein & Maurer, 2003). The iterative technique is most appropriate in complicated situations with challenging goals and customer specifications since it helps to continually touch and meet user requirements. The software industry is seeing a rise in the use of agile methodology to meet client objectives; effectively implementing agile methodology contributes to project success (Elssamadisy, 2008). Agile

methodology is used to meet the complexities of projects, and its application results in project success. However, some firms do not understand how to adopt agile methodology, which can lead to project failure. Thus, based on the discussion above, the hypothesis is:

H4: Project complexity mediates the relationship between agile methodology usage and project success.

Supporting theory

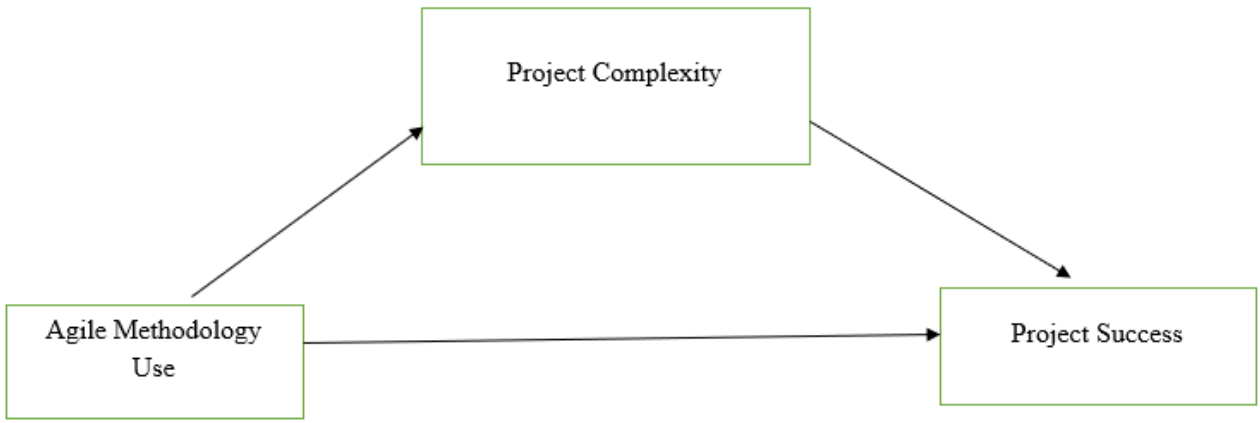
The agile governance theory, agile theory of general relativity, theory of constraints, and archives are some of the underlying theories that underlie the paradigm of this research article. Game theory, chaos theory, and theory of coordination in agile software projects. Game theory, which addresses every variable this research study examines, fits this research model the best.

Game Theory

The cooperation and interaction of the many elements is a general theme of game theory, which was introduced by Neumann in 1928.According to Myerson (1991), game theory is primarily applied in the fields of logic, computer science, biology, political science, psychology, and human interactions and behaviour. The application of agile methodology is also linked to prompt consumer participation; timely customer interaction is essential to the project's success. The project could be significantly developed utilizing the agile technique if the management supports it and the developers cooperate with one another. In order to handle complex interactions and respond to clients, game theory offers tools. Agile approach has been utilized for many years to comprehend difficult circumstances. In the last few years, it has also been used to communications networks. Understanding the various adaptations and intricate situations is beneficial (Srivastava et al. 2005). Game theory is used to tackle network issues with power control, cooperation, and channel access. According to Min (2008), a project can succeed if there is ongoing cooperation and power control, which can be attained with management support, particularly in software development projects. The majority of software projects are constrained by intricate software networking and customer communication. To address this complex networking, game theory is employed, since game theory fosters collaboration by sharing in any direction (Andrews & Dinitz, 2009). Thus, this theory addresses every facet of the relationship between the use of agile methodology and project success, emphasizing how management support and teamwork can lessen project complexity and lead to project success.

THEORETICAL FRAMEWORK

Figure 1: conceptual model



HYPOTHESIS

This study is aimed as to how using agile methodology affects project success and how project complexity plays a mediating role. This inquiry is based on the following four hypotheses:

H1: Using the agile method is highly and positively associated to project success.

H2: There is a positive significant relationship between the complexity of the project and the agile methodology.

H3: Decrease in project complexity is positively associated with the success of the project.

H4: The relationship between agile methodology implementation and project success is mediated by project complexity.

III. METHODOLOGY

A Research Onion framework used by Saunders et al. (2019) was applied to contribute to methodological rigor and transparency, helping to design research philosophy, approach and strategy, and methods. They assumed a positivist philosophy because the research aimed at objectively and empirically testing the hypotheses about the correlation between Agile methodology and project complexity as well as project success in the UK construction sector. The study took a deductive research pattern where the hypotheses used were based on the earlier literature and tested by subjecting it to statistically acceptable evidence in attaining the direction of attaining the theoretical consistency with the empirical evidence. The study implemented a quantitative mono-method, structured questionnaires consisted of closed-ending items based on the Likert-scale kind of questions, when constructs could be measured objectively and could be statistically verified. The survey design has enabled the retrieval of standardized data in the most efficient way, keeping costs down by administering the survey online or, through other forms of administering in a face-to-face manner, among UK construction companies, the inclusivity and external validity are achieved. A cross-sectional time frame was applied to conduct the study by measuring only once and collecting the data after four months' time frame in order to observe the prevailing circumstances of the industry without causal relationship being established but having the ability to test correlation and mediation. There were employees in the UK construction business such as engineers, project managers, laborers, and the administrative staff as the population and a representative sample of 100 respondents was selected through an appropriate sampling strategy in circumstances of limited time. The use of data was guaranteed to be confidential and only academic purposes in order to receive credible answers. In the analysis of the data, SPSS 21 was used along with the PROCESS macro by Preacher and Hayes (2008) to help in the analysis of the direct, indirect, and mediating relationships. The demographic information was summarized using descriptive statistics and Cronbach Alpha reliability test was conducted to test internal consistency of measurement scales. The bivariate relationships were measured by correlation analysis, whereas the regression method tested the effectiveness of Agile methodology on project success and project complexity. Lastly, the mediation analysis was done by utilising PROCESS Macro Model 4, which uses a bootstrapping process of 5,000 resamples at 95 percent confidence level to ascertain the mediating role of a project complexity.

INSTRUMENTATION AND MEASUREMENTS

This study's data was assessed and evaluated utilizing an adapted questionnaire from earlier, important research on the use of agile methodology, project complexity, and project success. Employees and supervisors who played significant roles in software projects and implied the use of Agile technique for their projects answered out the questionnaire. Unless otherwise specified, the questionnaire's response options ranged from 1 (strongly disagree) to 5 (strongly agree). A 5-point Likert scale was used to assess all the characteristics, and further demographic studies were conducted to measure the respondents' gender, age, qualifications, and experience. Utilizing a questionnaire that was borrowed from earlier, important research on the topics of project complexity, project success, and agile methodology use, data was assessed for this investigation. Employees and supervisors who were playing major roles in software projects and indicated that their projects will use the Agile approach filled out the questionnaire. Unless otherwise indicated, responses to the questionnaire were recorded on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Every variable question was examined using a 5-point Likert scale, and further demographic research was conducted to gauge the respondents' gender, age, education, and experience.

- Agile Methodology Use

A 10-item scale designed by was used to measure this (Maruping et al., 2009). To quantify and operationalize the concept and examine the effects of using agile methodology, they created a scale in 2009. The replies will be assessed on a 5-point Likert scale, with Strongly Disagree to Strongly Agree being the range of responses.

- Project Success

The three-item questionnaire that (Tiwana and McLean, 2005) suggested was utilized to examine Project Success. The responses will be gathered using a five-point Likert scale, with 1 denoting strongly disagree and 5 denoting strongly agree.

- Project Complexity

A 10-item scale was developed by Project Complexity (Xia and Lee, 2005) for analytical reasons. To gather the replies, a five-point Likert scale will be used, where 1 represents strongly disagree and 5 represents strongly agree.

IV. MODELING AND ANALYSIS

This study examines the influence of Agile Methodology on project success, mediated by team skills. The table presents a detailed analysis of the participants in a study investigating the influence of Agile Methodology on project success, with team skills serving as a mediating factor. The gender distribution indicates that 61% of respondents are male and 39% are female. Regarding qualifications, 28% hold a bachelor's degree, 20% possess a master's degree, 33% have a Master of Science, and 19% hold a Doctor of Philosophy. The age distribution indicates that 69% of respondents are between 26 and 33 years old, while 31% are aged 34 to 41 years. The predominant group of participants (41%) possesses 5-10 years of experience, succeeded by 28% with 1-5 years, 12% with 11-15 years, and 19% with 16-20 years of expertise. The demographics offer a comprehensive overview of the sample, showing diversity in gender, education, age, and professional experience, so enhancing the depth and trustworthiness of the study's investigation. The influence of Agile Methodology on project success, mediated by team skills.

Table 1: Descriptive Analysis

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	61	61.0	61.0	61.0
Female	39	39.0	39.0	100.0
Qualification				
Bachelors	28	28.0	28.0	28.0
Masters	20	20.0	20.0	48.0
MS	33	33.0	33.0	81.0
PhD	19	19.0	19.0	100.0
Age				
26-33	69	69.0	69.0	69.0
34-41	31	31.0	31.0	100.0
Experience				
1-5 years	28	28.0	28.0	28.0
5-10 years	41	41.0	41.0	69.0
11-15 years	12	12.0	12.0	81.0
16-20 years	19	19.0	19.0	100.0
Total	100	100.0	100.0	

REGRESSION ANALYSIS

To examine the effect of the independent variable on the dependent variable, regression analysis was conducted. to determine whether the hypothesis of a relationship among any of the model variables may be valid within the proposed model. To verify the direct association between the variables, we conducted a statistical analysis and generated a Table No 2 for the Linear Regression Analysis.

Table 2: Regression analysis

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig
Agile → PC	.168	.031	.476	5.361	.000
Agile → PS	.861	.039	.914	2.245	.000

PC → PS	.138	.031	.414	4.497	.000

a. Dependent Variable: Agile

The results of the regression analysis bring out the great impacts of Agile Methodology over project complexity and project success. The results show that Agile exerts a significant and positive influence on project complexity (B = 0.168, beta = 0.476, p = 0.000), which means that the implementation of Agile practices has a positive impact on the perceived complexity of projects owing to their being iterative, frequent feedbacks and the need to adapt. Nonetheless, Agile has a direct and large effect on project success (B = 0.861, 0.914, p = 0.000) and supports the idea of Agile practices improving project performance via increased adaptive flexibility, integration and reaction to change. What is more, the complexity of a project also plays a strong positive role (project success; B = 0.138, B = 0.414, p = 0.000) suggesting that effective management of a complex project can lead to innovation, problems solving, and better coordination among team members, which inform a positive influence on the results. The model accounts globally 17.1% of the variance in the success of the projects (R 2 = 0.171) which shows Agile influences project success not only directly but also indirectly since it facilitates reinforcements of the projects outcomes by impacting project complexity. All these findings combine in highlighting the quality of Agile as a contemporary project management methodology that turns complexity into a force behind better project outcomes. These results suggest that while Agile Methodology directly enhances project success and team competencies, the development of team skills plays a central role in ensuring successful project outcomes, particularly when supported by Agile Methodology practices.

RELIABILITY ANALYSIS

Table 3 presents the reliability values of the current study. All the Cronbach values range between ** and ***. This signifies the substantial trustworthiness of the variable data. The number fluctuates between 0.971 and 0.836.

Table 3: Cronbach Alpha Values of Research Model

Variable	***Cronbach's Alpha***	***No of items***
Agile Methodology	.951	10
Project Success	.971	3
team skills.	.836	4

The table presents Cronbach's Alpha values for the principal variables of the study, indicating the reliability of the utilized data. Cronbach's Alpha quantifies internal consistency, with values approaching 1 indicating more reliability. The "Agile Methodology" variable exhibits a Cronbach's Alpha of 0.951 over 10 items, indicating exceptional reliability. "Project Success" demonstrates exceptional dependability with a Cronbach's Alpha of 0.971 derived from three items, signifying highly consistent measurement. The "team skills" variable, comprising four items, exhibits a Cronbach's Alpha of 0.836, indicating strong reliability.

CORRELATIONS

To determine if the variables have a significant relationship with one another, correlation analysis was performed.

Table 4: Descriptive statistics, reliability, and correlation analysis

		Mean	***SD***	***1***	***2***	***3***	***4***
1	**Agile Methodology**	36.9100	6.93854	1			

2	***Project Success***	12.8900	2.30894	.414**	1	
3	***Team Skills.***	18.0700	2.45054	.476**	.914**	1

** Correlation is significant at 0.01 Level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

The correlation analysis reveals strong and statistically significant relationships among Agile Methodology, project success, and team skills, confirming the study's hypotheses. Agile Methodology shows a positive and significant association with project success ($r = 0.414^{**}$, $p < 0.01$), indicating that greater implementation of Agile Methodology practices contributes to improved project outcomes, thereby supporting H1. Similarly, Agile Methodology is positively linked with team skills ($r = 0.476^{**}$, $p < 0.01$), suggesting that projects with higher levels of Agile Methodology foster stronger team competencies, thus validating H2. The most substantial relationship is observed between team skills and project success ($r = 0.914^{**}$, $p < 0.01$), signifying that enhanced team skills lead to significantly better project outcomes, further strengthened under Agile Methodology, which confirms H3. These findings demonstrate that Agile Methodology not only directly influences project success but also indirectly improves outcomes by enhancing team skills, with all correlations significant at the 0.01 level, highlighting the robustness and reliability of these associations.

MEDIATION ANALYSIS

The PROCESS macro was employed to conduct the moderation analysis using SPSS-21. The bootstrapping method, utilized in the macro-PROCESS by Preacher and Hayes (2008), is employed. The mediation strategy utilizes five thousand resamples and a confidence interval of 95%. It is posited that mediation exists between two variables in the absence of a null effect, typically indicating a substantial indirect influence. Mediation Analysis is predicated on Model 4. Several optimal properties of mediation are as follows.

Table 5: Mediation Analysis (SL-TS-PS)

The total effect of Agile methodology uses towards Project Success					
Effect	**SE**	**t**	**p**	**LLCI**	**ULCI**
.1376	**.0306**	**4.4973**	**.0000**	**.0769**	**.1984**
The Direct effect of Agile Methodology use towards Project Success					
Effect	**SE**	**t**	**p**	**LLCI**	**ULCI**
.0092	**.0156**	**.5926**	**.000**	**-.0402**	**.0217**
The Indirect Effect of Team Skills					
Effect		**Boot SE**	**Boot LLCI**	**Boot ULCI**	
.1469		**.0334**	**.0803**	**.2115**	

Note: Bootstrap sample size 100.

LL = Lower limit; CI = confidence interval; UL = upper limit

The mediation analysis results demonstrate the total, direct, and indirect effects of Agile Methodology on project success, with team skills acting as a mediator. The total effect of Agile Methodology on project success is significant, with an effect size of 0.1376 ($p = 0.000$), a t-value of 4.4973, and a confidence interval (LLCI = 0.0769, ULCI = 0.1984) that does not include zero, indicating a strong positive influence. However, the direct effect of Agile Methodology on project success is not statistically significant, with an effect size of 0.0092, a t-value of 0.5926, a p-value of 0.5548, and a confidence interval (LLCI = -0.0402, ULCI = 0.0217) that includes zero. This suggests that Agile Methodology alone does not directly impact project success when team skills are considered. In contrast, the indirect effect through team skills is both substantial and significant, with an effect size of 0.1469 ($p < 0.05$) and a bootstrapped confidence interval (Boot LLCI = 0.0803, Boot ULCI = 0.2115) that excludes zero, confirming the mediating role of team skills. These findings highlight that team skills significantly strengthen the relationship between Agile Methodology and project success, thereby supporting H4 and underscoring the crucial role of team competencies in translating Agile Methodology practices into successful project outcomes.

V. DISCUSSION

The findings of the current study may be extremely useful because the correlations between Agile Methodology team skills and their respective project success have been analysed and the mediating relationship between the team skills and project success has been established. The demographic demographics of the participants show a fifty-fifty balanced nature between the educational background, as well as the professional experience, which also helps the authenticity of the findings in that there is a variety of respondents and the exposure of respondents to a larger body of knowledge. The presence of 26-33 age bracket and the high proportion of participants having advanced degrees means that the sample is familiar with much of what goes on in project management with focus on the effective leadership approach like Agile Methodology. This increases the topicality of the findings to current settings of an organization.

As would be observed in the reliability analysis, all the constructs that include Agile Methodology, project success, and team skills acquired a high score of the Cronbach's Alpha figures (which are between 0.836 to 0.971). This means that internal consistency was high indicating that reliable constructs are used in measuring these constructs. The validity that there is no effect being measured due to measurement mistake is powerful since the further findings in correlation and regressions receive a high estimate of reliability. Through correlation, it has been found that there are significant and substantial relationships among the three variables. Agile Methodology shows a considerable positive correlation with project success ($r = 0.414$, $p < 0.01$), which means that the leader with a servant-focus in terms of his or her role whose primary portion of attention is focused on the contribution and empowerment of the team members along with their well-being can contribute positively to the entire process of a successful project being implemented. This is in tandem with the above study that asserts that servant leaders foster collaboration, trust and the creation of a positive environment at the workplace which is vital in achieving the objectives of a project. Similar confirmation is reflected in correlation between Agile Methodology and team skills ($r = 0.476$, $p < 0.01$), which legalizes the assumption that leadership style can have such a powerful impact on shaping the capacities of the project teams.

The relationship between skills of the team and project success has the greatest correlation coefficient ($r = 0.914$, $p < 0.01$). It is a very large statistic that also revisits the core message of these competencies that is, communication, problem-solving, technical and adaptability as the overbearing aspects of the successful delivery of any project incurred. Theoretically, irrespective of a good leadership, unless the team skills are developed, the likelihoods to conduct a successful project are much smaller. This fact is in line with the theory of human capital in which the increase in skills and knowledge guides performance. Regression analysis ascertains that these relations are also confirmed. This is important as: (a) glory of an Agile Methodology, in terms of how it describes the project success, is an amount of 17.1 per cent of the variation, and (b) glory of an Agile Methodology, in terms of how it describes the team skills, is a variance of 22.7 per cent. Nonetheless the measurable disparity between the project success taken as team skills is also larger by 83.5 percent implying that the executing factor is the dominant element in performance delivery though its route is provided by its leadership. It means that organizations keen at improving outcomes on the projects should not only consider investing in the leadership development but also constant skills training of the project teams.

The mediation analysis offers additional details of the mediation during which leadership will determine the outcomes. Agile Methodology does not directly relate to project success but rather all the relations are mediated when it is included. Such

transition can be termed as a full mediating effect i.e. being a servant leader has an impact on the success of any project simply by influencing their skills. Servant leaders therefore succeed in improving project outcomes by inciting organizational maturity, team work, and performance of their team members rather than taking a direct order or oversight. Indirect effect (0.1469, $p < 0.05$) has been proved to be statistically significant due to the fact that it does not have zero included in its confidence interval, and also result indicates that there is sense of it.

These are theoretical and operational findings. Theoretically, they assert the logic that the efficacy of leadership at the project contexts can be considered dependent on the aspect other than suggesting a direct cause and effect relationship with other factors that may exist as mediators such as human capital which includes skills. It is a supplement to the current leadership theories because they concentrate on developing the capability as one of the major avenues to performance. Practically, the fact that it is impossible to implement leadership development in organisations without assuring that there will be structure interventions to build team skills, must be mentioned. As an illustration, between agile project management, communication, and problem-solving, the education of Agile Methodology can be organized together with certain skills development plans. Also, the compatibility between agile practices and Agile Methodology is demonstrated in the results. Agile settings value power and autonomy, collaboration and persevering, all of which, servant leaders Favor as a matter of course. By nurturing these values, servant leaders will be in a position to create a scenario where the team members will be more engaged and better able to handle the challenges that might be brought about by the complexities of the project. This study has shown that Agile Methodology has positive effects on project success; however, it will strongly depend on how team skills are enhanced. The ramification of such practice is clear: leadership styles involving application of focus to team empowerment must be combined with sustained capacity building to have optimal project performance. This continues to affirm the strategic importance of leveraging leadership and skills development into project management frameworks applied at organizational level and to be in a position to inculcate both the ability of leaders and the team in reaction to the more complex and dynamic project environment.

VI. CONCLUSION

The purpose of this research study was to investigate the relationship among the variables of Agile Methodology and team skills and project success with the variable of team skills being the mediating variable. The findings are useful in concluding that Agile Methodology that has positive and significant influence on project success is the one that operates mainly by team skills construction and not necessarily leadership activities themselves. The outcome confirms the impression that besides the vision and plan on the part of the leader, the approach to properly address the projects is in the ability of creating the competent, flexible and coherent team. The results point out that Agile Methodology is associated strongly with project success and skills development within the team, and it is necessary to encourage a trusting, empowering, and collaborating environment. Application of servant-oriented practices by leaders will stand a better probability of introducing open communication, trust in the workforce, and inculcating a culture where individuals are willing to deliver their best. However, the research has confirmed the fact that a key ingredient to a successful project is the presence of effective team skills that entails problem solving capability, flexibility, and technical skill. Because, according to the mediation analysis, full mediation was identified, the positive effect of Agile Methodology on the project success using the first mediator, that is, the team skills enhancement which, in turn, will lead to the enhanced project performance, become evident. This suggests that the results achieved will not suffice to measure the performance of leadership in the project scenario but rather the ability to generate and nurture human capital that is present within a team should also be utilized to assess the performance of a leader. The implication is that, despite the good leadership, the appropriate outputs that are supposed to be optimum may not be emulated unless there is a slight conscious effort into development of the skills. In practice, these findings not only prove the necessity of the organization to establish a comprehensive vision of the project management, namely the symbiosis of leadership development and unceasing training of a team. Agile Methodology can be incorporated with current project leadership concepts, which are characterized by agile practices because they operate on ideas of empowerment, flexibility, and collaboration. With the formation of the qualities, organizations would have a chance to, on the one hand, not only improve their current project outputs, but also to establish resilience and the ability to handle future issues. In conclusion, the study demonstrates that the existing correlation between Agile Methodology and project success is facilitated by means of enhancing team skills. This brings in support of the argument that leadership should be viewed as capacity building rather than performance driver. Organizations capable of recognizing and reacting to such a relationship by ensuring that its leadership is developed to address the needs of the organization in the form of guidance, empowerment and training and

simultaneously investing in ensuring that leaders are developed through the skills they possess will find it easier to succeed in keeping the organization successful in the more complex and competitive project environments.

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Informed Consent: The participants provided their written informed consent to participate in this study.

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