Sustaining Agile Usage: Role of Management Support in Shaping Agile Mindsets in Development Teams

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Abstract - *Agile methodologies have acquired prominence in the modern landscape of software development. Regardless of development teams shifting to such methodologies, they experience obstacles in their sustained usage. Research implies these originate from shortcomings in the agile mindset of team members, considering the role of management support in fostering the same. However, they struggle to properly address the impact of management support on sustained agile usage. This study solidifies the impact of management support on the sustained usage of agile methodologies, exploring the mediating role of the agile mindset. A questionnaire was administered to select a group of 100 agile software development team members. A quantitative research approach was employed, with cross-sectional data gathering. Partial Least Squares Structural Equation Modelling was applied to analyse the relationships between variables, finding that the management support provided by an agile software development firm has a significant positive impact on the agile software development team's sustained agile usage. Furthermore, the management support by the firm cultivates an individual's agile mindset. An individual's agile mindset has a positive correlation with sustained agile usage of the team as well, thereby establishing a partial mediation between management support and sustained agile usage. Interestingly, the findings assert the importance of management support while demonstrating their responsibility for the achievement of the ultimate goal of establishing a culture of agility by fostering individuals' agile mindsets in an SD firm. Furthermore, it furnishes practitioners with the knowledge to develop effective interventions to foster an agile mindset among team members, thereby ensuring the long-term success of agile methodologies.*

Keywords: Agile Mindset, Agile Software Development, Agility, Management Support, Post Adoption Usage, Senior Management Support, Sustained Agile Usage, Top Management Support

I. INTRODUCTION

Software development (SD) firms confront a multitude of challenges daily as they strive to compete and thrive in the contemporary volatile, uncertain, complex, and ambiguous (VUCA) technological landscape. In response to this, an increasing number of SD organisations are embracing agile approaches, and there is also a noticeable trend towards the adoption of hybrid methodologies that integrate agile practices with traditional methods (Alt et al., 2020; Eilers et al., 2022; Nerur et al., 2005). Moreover, it is important to emphasize that there are added advantages to be obtained from the adoption of agile methodologies within an organisation. Such advantages encompass a higher level of stakeholder satisfaction due to the increased focus on meeting their needs and expectations, a notable improvement in the overall efficiency of team processes stemming from the iterative and collaborative nature of agile practices, and a significant enhancement in employee wellbeing resulting from a more flexible and empowering work environment (Annosi et al., 2022; Cockburn & Highsmith, 2001; Nerur et al., 2005; Uraon et al., 2023). Abu Bakar and Dorasamy (2023) have contributed additional evidence and delved into the significance of Agile methodologies, consistently stressing that the foundation of 'Agile' lies in principles that foster adaptability, flexibility, and

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continuous improvement, supported by various frameworks such as Scrum, Kanban, Extreme Programming, and Lean (Estrada-Esponda et al., 2024). These frameworks have been proven to provide organisation and direction to methodical execution across a variety of operational settings. Adopting an 'Agile' approach to work allows the achievement of benefits such as speed of development, efficiency, quality, and customer satisfaction, giving Agile Software Development (ASD) teams the capacity to address the difficulties, thereby increasing their competitive edge.

However, discovering how to foster and preserve these rewards within teams via interventions remains a crucial topic for exploration. Despite the growing popularity of Agile practices, both practitioners and academics have paid insufficient focus to their following evolution, absorption, and adaptation inside teams, which is required to fully grasp the benefits stated earlier.

According to Gregory et al. (2016), SD teams that have entirely switched to Agile methodologies now face substantially more obstacles to sustaining them beyond adoption, i.e., adapting the methodologies to their operating settings to determine their full ability in optimising performance. The reason is that Sustained Agile Usage (SAU) necessitates an ongoing commitment to 'being Agile, rather than doing Agile' (Denning, 2015). What he said implies and emphasises how SAU requires a team culture based on Agile ideals, rather than just implementing methods as they are. This emphasises the significance of understanding and exploring the elements that impact SAU in context.

Likewise, according to scholarly research and expert practitioners, the success of Agile methodologies hinges more on human factors than on technical considerations. Collaboration and continuous learning are at the core of Agile methodologies, requiring a particular mindset of agility for success (Eilers et al., 2022; Ozkan et al., 2023; Sathe & Panse, 2023). Senapathi and Drury-Grogan (2017) have underscored the critical role of an Agile Mindset (AM) in sustaining the adoption of Agile methodologies. Interestingly, Horlach and Drechsler (2020) and Ozkan et al. (2022) stress the importance of good leadership and management mindset approaches to nurture employees' AM. Senapathi and Drury-Grogan (2017) qualitatively confirm the vital role of management support (MS) in establishing SAU, requiring more research to confirm the findings. However, no research has yet been conducted, to examine how MS and AM interact to contribute to SAU. This leads to the current study's research questions: 1) Does MS have a significant positive impact on SAU? 2) Does AM act as a mediator between MS and SAU?

The growing significance of sustaining Agile methodologies for SD teams in order to gain the rewards promised by them underscores the desire for teams to establish assimilation-focused interventions. Such initiatives have the potential to greatly enhance project results and team productivity, ultimately leading to a considerable competitive edge in the SD sector. Senapathi and Drury-Grogan (2017) qualitatively outline the significance of MS as an intervention for promoting SAU. However, an unexpected scarcity of adequate academic research on the influence of MS on SAU prevents a generalised knowledge of how teams might attempt to build it. Furthermore, teams have a barrier due to a lack of understanding of the function of the AM as a mediator between the two, which may result in inadequate and ineffective treatments. This is a key knowledge gap that, if not addressed, will significantly delay the realisation of the aforementioned advantages, eventually affecting SD team performance. The scenario significantly warrants the necessity for deeper research. In addition, examining the role of MS and AM in SAU has major managerial consequences since it influences strategy decisions such as personnel management, resource allocation, and training investment.

Therefore, the primary objective of this study is to investigate the influence of management support (MS) on promoting SAU, with a secondary objective of evaluating the mediating role of the AM in the relationship between the two. The study contributes to the existing literature on MS, AM, and SAU, improving academic and practitioner knowledge regarding the combination of the components crucial to the context for sustaining Agile within SD teams, consequently advancing the major theme of Agile assimilation.

II. LITERATURE REVIEW

A. Sustained Agile Usage (SAU)

In the current setting of ASD, organisations prefer Agile approaches over traditional software development methods for features such as reacting to rapid changes to suit dynamic market requirements (Senapathi & Srinivasan, 2013). This significant shift from "traditional to Agile" in the ASD sector necessitates an in-depth investigation of the word "SAU". Therefore, the study seeks to make a significant contribution to the existing knowledge gap on the sustainability of Agile methodologies in the ASD setup. This research examines SAU using Agile methodologies such as Scrum, XP, Kanban, and Lean, which have gained popularity in the field of ASD. Nonetheless, Senapathi (2015) stated that any methodologies developed by practitioners using customised methods can be used to assess SAU as long as they adhere to the Agile fundamentals and values stated in the "Agile Manifesto," which is regarded as the core foundation upon which the Agile concept is built. In support of the scenario, consider 'ScrumBan' (combining Kanban and Scrum practices) as an example; ASD teams conduct development on a sprint basis (shorter iterative periods) while using Kanban tools for visualisation and the management of the workflow. However, previous research on this subject has mostly focused on adoption and adaptation, without taking into account the post-adoption stage, where the primary goal should be. As a result, this study attempts to provide insights into the post-adoption phase when SAU appears in effect. Senapathi and Drury-Grogan, (2017) identify "SAU" as the "infusion of Agile methodologies" into the framework of ASD following acceptance and routinization.

The stages of innovation assimilation (adoption, adaption, acceptance, routinization, and infusion) served as the basis for this concept. The intent underlying the use of "innovation assimilation stages" in the development of the SAU definition is that practices that are deemed novel by their adopters are recognised as "process innovations" of SD teams. Agile practices can be classified as process innovations since users observe them as " novel " (Cooper & Zmud, 1990; Conboy et al., 2007; Wang et al., 2012). Thus, Cooper and Zmud (1990) argue that the sequential model of the innovation assimilation stage is ideally suited to demonstrating the magnitude of SAU. Aside from the innovation assimilation stages, the outer edges of SAU may be defined from various angles as well. On the other side, one might debate whether the process must move linearly towards the infusion step or not. To address this argument, Wang et al. (2012) suggests that some Agile methodologies may be infused into the adopting entity by the time it becomes fully routinised, which consolidates the argument that assimilation stages are not always required to develop through the stages.

Infusion, the final stage of innovation assimilation, will be extremely important for the study since SAU takes an impact at this stage (Senapathi & Drury-Grogan, 2017). Gallivan (2001) and Senapathi and Srinivasan (2012, 2013) define infusion as the rooted

and pervading Agile practices and ideals within the adopting organisation. As a result, this study seeks to provide an assessment of the SAU in ASD teams by exploring the Agile practices and values that it encompasses. Nonetheless, it is critical to understand that routinising Agile principles and ideals is insufficient if ASD fails to adopt such practices in greater depth (Wang et al., 2012). The exact distinction between "Routinization" and "Infusion" yet remains up for debate among experts. Wang et al. (2012) claimed that the infusion stage can be defined by using five facets. Extensive, integrated, emergent, intensive, and deeply customised usage. Extensive use is defined as the extent to which Agile practices are used for adapting an exhaustive set of work tasks. Integrated use refers to the application of Agile practices to integrate and enhance workflow linkages between work tasks. The term "emergent use" refers to the use of Agile practices outside their defined scope. The term "intensive use" describes how deeply and intensely adopting teams apply Agile practices exceeding the accepted level. Deeply customised use is described as deeply adapting Agile practices within the adopting organisation. These factors were utilised to create the indicators of the SAU. However, it is vital to note that Wang et al. (2012) have only considered Scrum/XP methodologies when defining the phases of innovation assimilation and the facets of the infusion, omitting all other Agile methodologies. As a result, this study utilised multiple Agile methods (including Scrum, XP, Kanban, Lean, and hybrid methods) when developing the measurement instrument for the five aspects of the infusion.

B. Management Support (MS)

In the landscape of ASD, management support does not merely depend on providing training, monetary assistance, and sponsorship, but further ongoing and active participation and devotion towards successful implementation and adoption of Agile methods and practices (Senapathi & Srinivasan, 2013; Senapathi and Drury-Grogan, 2017). To achieve this, Denning (2016) emphasises that the management needs to have an “enabling mindset” rather than a “controlling mindset” while strengthening trust in the talents and their abilities. Specially, Senapathi and Drury-Grogan (2017) concurred, stating that creating a supportive atmosphere that fosters a problem-solving culture and makes individuals feel valued and appreciated is also part of the spectrum of MS offered in the ASD context. Furthermore, Livermore (2008) indicates that MS for SD teams and Agile adoption of the SD company are significantly related. In the ASD environment, the customer liaison area is crucial since it is responsible for understanding the client's demands, turning them into concise requirements, and ensuring that the final product fulfils those expectations. Facilitating timely access to continuous customer engagement is an essential assistance that management should provide, which contributes to the success of Agile adoption (Farmer, 2004). In addition, Farmer (2004) emphasises that allowing autonomy in decision-making within the team leads to the success of Agile adoption.

Furthermore, Denning (2015) said that management decisions are made to foster an Agile culture within the organisation, which helps foster AM. Küpper et al. (2017) and Klünder et al. (2022) both said that MS smoothly facilitates the formation of an Agile culture, consequently influencing the AM. Thus, the study focuses on SD teams, the decisions made, the managerial actions executed when implementing Agile within the organisation, and how they have a direct influence on the forming AM of team members. However, the present literature fails to recognise the altering nature of management support. MS is not a fixed input but rather a variable that can alter due to changes in

leadership, strategic initiatives, or business challenges. This diversity might cause variations in how Agile methods are supported and maintained over time. As organisations experience leadership transfers or adjustments in strategic focus, the ongoing and active support required to retain Agile methods can be reduced. This research will examine how leadership and business strategies will impact Agile transformation attempts. Effective leadership, monitoring, redirection, and ongoing feedback from management are critical for developing the AM within the team. Furthermore, management's leadership style and attitude encourage AM (Ozkan et al., 2023). ASD teams, on the other hand, require the freedom to develop and adapt Agile practices based on their project requirements, while still relying on management for concise guidance, resources, and a supportive atmosphere. Balancing these factors can be difficult, and management's inability to do so can result in team misunderstanding and conflict, weakening the benefits of Agile methods.

Moreover, Senapathi and Drury-Grogan (2017) discovered MS as a factor influencing SAU within the organisational factor. SAU necessitates a break from formalised or standard SD approaches, as well as a positive response to "change". This continual shift will necessitate more MS (Senapathi & Drury-Grogan, 2017). MS supports all levels of innovation assimilation. This study focuses mostly on the post-adoptive period because SAU functioned throughout the infusion stage of innovation assimilation (Senapathi & Srinivasan, 2013; Senapathi & Drury-Grogan, 2017). However, management's approach to adopting support systems that contain Agile concepts frequently lacks customised adaptation to the specific cultural and operational contexts of different teams within the company. This study's approach to management support might not be well-fit for all departments or teams. Thus, in this study, organisational cultural factors and the working atmosphere will be considered when assessing management support for Agile advancements. Furthermore, Senapathi and Srinivasan (2012, 2014) have demonstrated that encouragement, help, and direct engagement from the MS are particularly beneficial when implementing Agile approaches. Managers are also interested in offering additional sources, such as external Agile coaches, to assist teams in maintaining agility and completing tasks with greater effectiveness (Senapathi and Srinivasan, 2013).

C. Agile Mindset (AM)

Ozkan et al. (2023) defines mindset as one of the vital factors that determine a person's decision-making ability, behaviours and actions. In the domain of ASD, the Agile Manifesto, which serves as the foundation for ASD methodologies, consists of four values: "Individuals and Interactions over Processes and Tools, Working Software over Comprehensive Documentation, Customer Collaboration over Contract Negotiation, Responding to Change over Following a Plan." "Individuals and Interactions over Processes and Tools" resembles the human component in which the AM operates (Eilers et al., 2022). Thus, AM can be described as attitudes formed of four attributes "Learning spirit, Collaborative Exchange, Empowered Self Guidance, and Customer Co-Creation" that members in ASD teams ought to possess (Eilers et al., 2022). Similarly, Mordi and Schoop (2020) identify AM as the most critical factor for achieving agility. This conceptualisation contains traits such as "trust, responsibility and ownership, continuous improvement, a willingness to learn, openness, and a willingness to continually adapt and grow," which are equivalent to Eilers et al. (2022)'s four key elements of "AM". Moreover, Ozkan et al. (2023) demonstrated that an effective commencement of Agile should begin

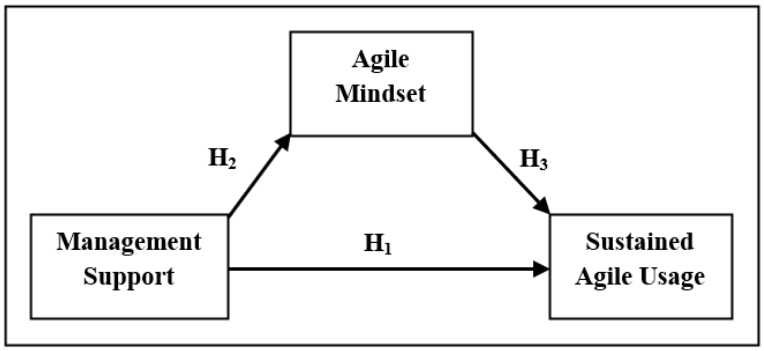
with the appropriate AM rather than directly implementing Agile approaches. Furthermore, Denning (2015) argued that AM is an essential part of being Agile, and this has been backed by Gregory et al. (2016), who acknowledges that "Agile is not just a set of practices applied by teams; it is a mindset, not a methodology." As asserted by Ozkan et al. (2023), AM lies in the heart of agility, which necessitates a shift in AM for ASD teams to accomplish their stated goals. Consequently, establishing an Agile mindset is extremely essential because of its inherent ability to adjust immediately within the dynamic setting in which ASD teams operate. As a result, the views presented in the literature highlight a key point, which is that adapting and executing Agile methodologies is insufficient if ASD team members are lacking AM. However, very limited research has shown how an AM impacts holistically at the ASD team member level, where our study is primarily focused.

This section will critically evaluate the relationships between the study's three variables. According to Senapathi and Srinivasan (2013), MS falls under the 'organisational factors' component and is one of the critical success factors in attaining the SAU. Furthermore, their most recent study included AM in the 'Agile team factors' component, which is also a critical success factor that drives SAU (Senapathi and Drury-Grogan, 2017). Interestingly, Ozkan et al. (2023) argue that employing correct leadership and management mindset techniques is critical in cultivating employees' AM. Moreover, based on Horlach and Drechsler (2020)'s study, Ozkan et al. (2023) systematically reviewed the emphasis on the elements of management support as critical success factors when developing employees' AM such as appropriate leadership approach, leadership manners boosting ASD teams' exploratory activities, an enabling environment in which ASD teams can openly share their perspectives, developing brand-new talents and aiding in routine workloads and timely communication while providing continual feedback, set outlined team goals and monitor their goal attainment while promoting innovative work conduct. Furthermore, Sathe and Panse (2023) argued that management should invest in training, forming, and evaluating their people's AM. According to Weinberg (1985), management has an important role in appropriately demonstrating Agile ideals, which aids in the development of the ASD team's AM. Considering all of these scholarly views discussed, it is proven that the relationships between these three factors warrant greater examination.

Therefore, this study focuses on testing the following hypothesis:
H1: Management support provided by an ASD firm has a significant positive impact on the SAU of an ASD team.
H2: Management support provided by an ASD firm has a significant positive impact on a team member's AM.
H3: Team member's AM has a significant positive impact on the SAU of the ASD team.
H4: Team member's AM mediates the relationship between MS and the SAU of the ASD team.

The conceptual framework shown in Figure 1 was developed based on earlier discussion. The MS provided by the ASD firm is displayed as the independent variable, while the ASD team member's AM acts as a mediating variable, and the ASD team's SAU is presented as the dependent variable, along with indications of the previously stated hypotheses.

Figure 1. Conceptual Framework



Source: Authors' compilation.

III. METHODOLOGY

A quantitative research approach was employed, with cross-sectional data used to evaluate the study's hypothesis.

A. Sampling and Data Collection

The study's population consists of Sri Lankan Agile software development team members who work for local and global SD organisations located in Sri Lanka. Accordingly, the unit of analysis in this study is defined as an 'ASD team member.'

However, due to the highly volatile nature of the ASD context, precisely determining the population size of ASD team members in Sri Lankan SD firms was a challenge, as most companies use Agile methodologies based on different projects at different times, and SD individuals switch between Agile and Non-Agile projects periodically. Taking these limitations into consideration, this study employed the multistage cluster sampling method to proceed with the data collection. Cluster sampling can be most beneficial when the population size is unknown, yet the hypothesis must be quantitatively evaluated.

Initially, a database of SD organisations was created utilising the websites of the Export Development Board (EDB) and the Sri Lanka Association for Software and Services Companies (SLASSCOM). The Agile status of SD organisations was updated by using several techniques, such as monitoring company websites, LinkedIn profiles, and contacting hotlines. After that, the identified ASD firms were categorized into three groups based on company size considering their employee count: small-scale (11-50 employees), medium-scale (51-200 employees), and large-scale (200+ employees) (Ministry of Industry and Commerce, 2014). Since ASD firms can be recognized as naturally occurring clusters, ASD firms were selected proportionately from the above three categories to enhance the generalizability of this study. Given the strict data security regulations and restrictions of SD organisations, data collection is centred mostly on the LinkedIn platform. Next, an anonymous online questionnaire was distributed to chosen LinkedIn profiles at previously identified ASD companies, carefully assessing the characteristics of their current company size, years of Agile work experience, and SD team member role. Furthermore, the questionnaire is mailed to the database's recognised ASD businesses, seeking approval for internal distribution from the company's end.

IV. DATA ANALYSIS AND DISCUSSION

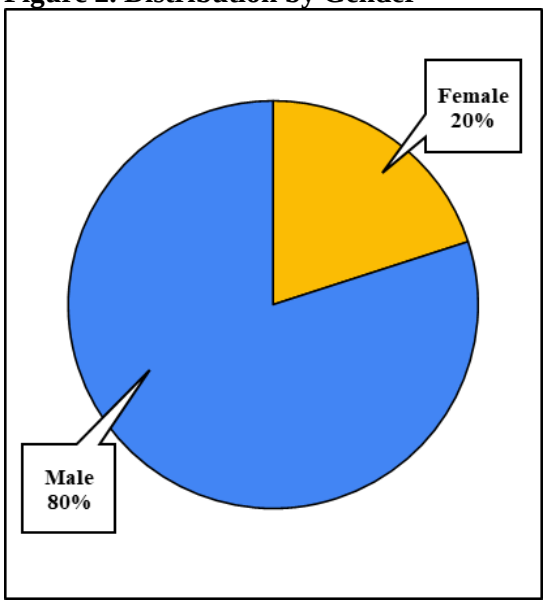
In this study, 'MS', the independent variable and 'SAU', the dependent variable were formed as lower-order-reflective constructs (Senapathi, 2015) while, 'AM', the mediator is formed as a higher-order-reflective construct which is a latent variable as well (Eilers et al., 2022). The Partial Least Square Structural Equation Modelling (PLS-SEM) technique was employed to analyse the gathered 100 data using Smart PLS4 software for the initial analysis. This technique is more applicable when the respective study consists of latent variables which cannot be directly measured, and complex variables (higher order, lower order, formative and reflective constructs, etc.) and causal pathways (multiple mediation and moderation effects) (Hair et al., 2019).

Furthermore, the employed technique is ideally suited to examining a theoretical framework from a prediction perspective. In addition, it is noteworthy that when deriving results from a limited sample size, PLS-SEM allows for more precise results due to its predictive capability (Hair et al., 2019).

A. Demographic Profile

The following pie and column charts provide a detailed and comprehensive overview of the respondents' demographics. This demographic profile of the 100 participants is based on five key attributes: gender, age range, agile experience level, the size of their company, and the agile methodologies employed by their current team.

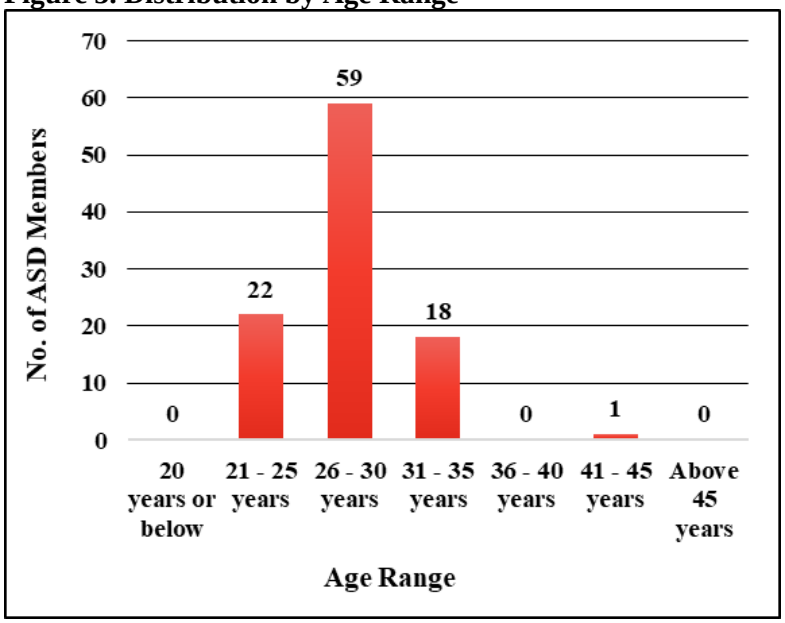
Figure 2. Distribution by Gender



Source: Authors' compilation based on survey data.

The above Figure 2. depicts a 4:1 (male vs. female) unequal gender distribution within this profile, which is a common characteristic related to the SD context.

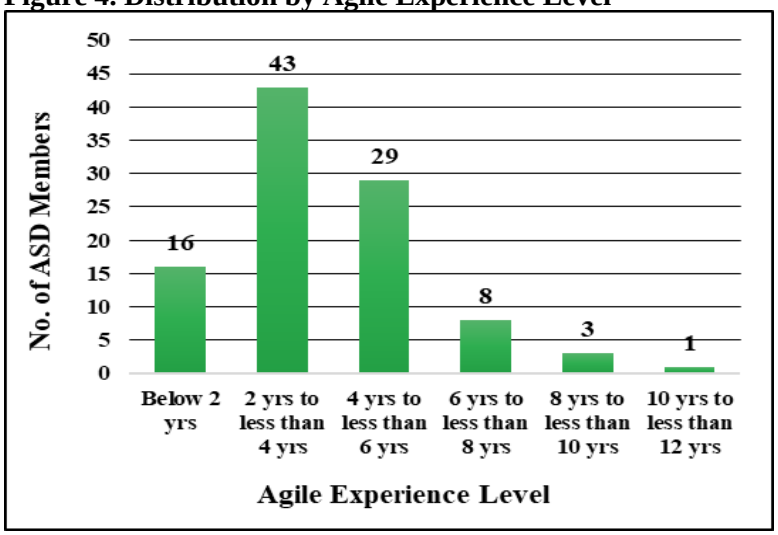
Figure 3. Distribution by Age Range



Source: Authors' compilation based on survey data.

When it comes to the distribution by age, the majority of data was spread between 21 years and 35 years, while 59% of the profile falls into the 26–30-year age category, which is skewed towards the young crowd as illustrated in Figure 3.

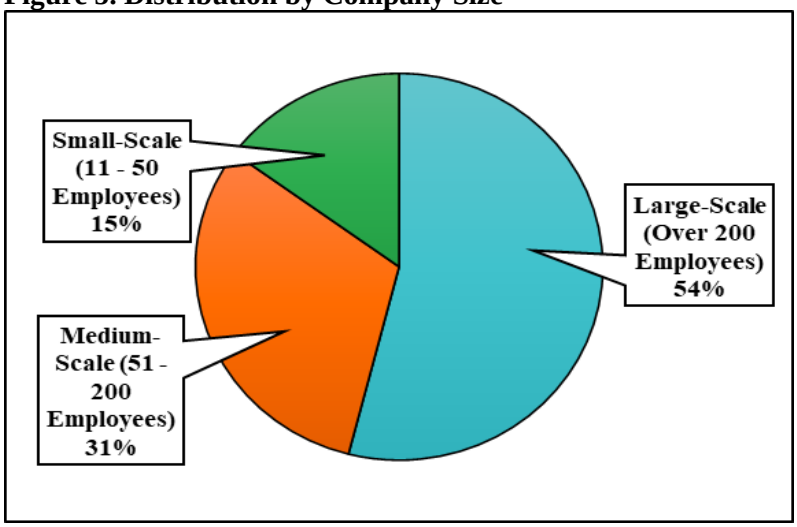
Figure 4. Distribution by Agile Experience Level



Source: Authors' compilation based on survey data.

The above Figure 4. represents the Agile experience level distribution in software development teams. The highest Agile experience level categories, respectively: 2 years to less than 4 years (43%), 4 years to less than 6 years (29%), and below 2 years (16%), which indicates a lack of above 8 years of Agile experienced people in the current ASD teams.

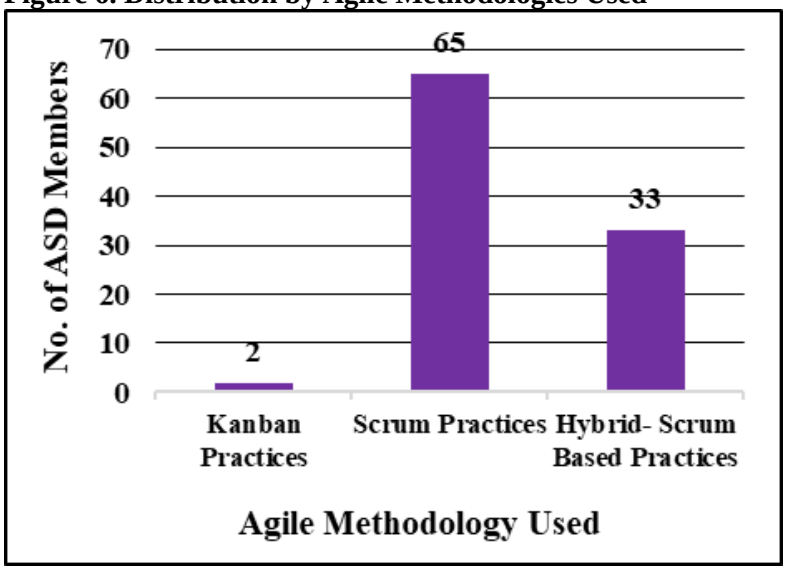
Figure 5. Distribution by Company Size



Source: Authors' compilation based on survey data.

Figure 5 depicts the proportionate distribution of the current company sizes of the sample; 54% of the sample works in large-scale companies, while medium-scale and small-scale are indicated as 31% and 15%, respectively.

Figure 6. Distribution by Agile Methodologies Used



Source: Authors' compilation based on survey data.

According to Figure 6, the most popular and widely used Agile methodology is scrum, with 98% of the sample consisting solely of scrum practices and scrum-based hybrid methodologies.

B. Measurement Model Assessment

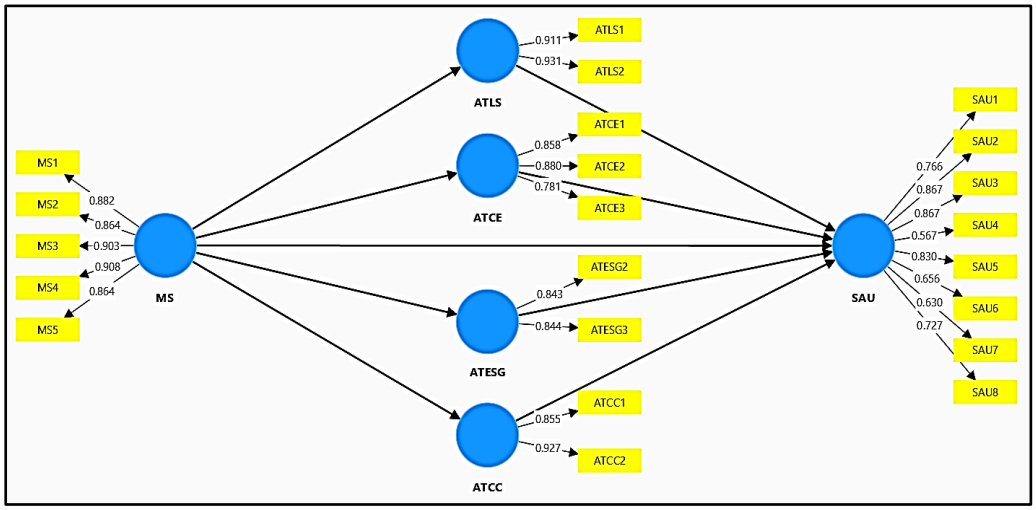
Assessing the measurement model is the initial step in analysing PLS-SEM results. It allows researchers to examine the relationship between the latent constructs and their measures (corresponding indicators) (Hair et al., 2019). Measurement models can be reflective or formative by nature. Reflective indicators are defined as "effects" of latent constructs. By contrast, formative constructs are distinguished as establishing latent constructs. In the current study, all the constructs are designed as reflective constructs. The disjoint two-stage approach was tailored since the model contains lower- and higher-order constructs. The first stage includes analysing the results of the lower-order measurement model (Hair et al., 2019; Sarstedt et al., 2019).

Figure 7 depicts a graphical representation of the lower order validated measurement model created in Smart PLS4 software. Here, 'ATLS', 'ATCE', 'ATESG', and 'ATCC' are the subdimensions of the construct 'AM' (mediating variable). Importantly, we removed the 'ATESG1' item from the model after carefully evaluating the problematic cross-loadings to address the discriminant validity issues of the model. Then, the lower-order reflective measurement model was conducted.

The first step is assessing the outer loadings (indicator loadings), which aims to measure the indicator reliability with each respective construct. According to the guidelines of Hair et al. (2010), the conventional lower limit for outer loadings starts at 0.5, with a preferable value above 0.708. As shown in Table 1, the reported lower-order outer loadings ranged from 0.567 – 0.931, indicating that the variables/dimensions explain more than 50% of the indicator's variance (Hair et al., 2019). Therefore, the outer loadings demonstrate satisfactory indicator reliability.

The next step is assessing the internal consistency reliability. Here, it was measured using 2 measures: composite reliability (CR) 'rho_c' and Cronbach's alpha (CA). Both measures have the same threshold, the values above 0.6 to 0.7 are considered acceptable and the values between 0.7 and 0.9 fall within the satisfactory to good category. However, values above 0.95 indicate that are problematic, which tends to cause validity issues (Hair et al., 2019). In this study, all the CR and CA values lie within the 0.593 and below the 0.95 range, which indicates that all are in an acceptable condition.

Figure 7. Lower-order Measurement Model



Source: Authors' compilation based on PLS algorithm graphical output.

Table 1. Outer Loadings (OL), Composite Reliability (CR), Cronbach's alpha (CA), Average Variance Extracted (AVE)

Sub-dimensions/ Indicators	OL	CR	CA	AVE
ATLS1 ← ATLS	0.911	0.918	0.822	0.848
ATLS2 ← ATLS	0.931			
ATCE1 ← ATCE	0.858	0.878	0.791	0.707
ATCE2 ← ATCE	0.880			
ATCE3 ← ATCE	0.781			
ATESG2 ← ATESG	0.843	0.831	0.593	0.711
ATESG3 ← ATESG	0.844			
ATCC1 ← ATCC	0.855	0.886	0.749	0.795
ATCC2 ← ATCC	0.927			
MS1 ← MS	0.882	0.947	0.930	0.782
MS2 ← MS	0.864			
MS3 ← MS	0.903			
MS4 ← MS	0.908			
MS5 ← MS	0.864			
SAU1 ← SAU	0.766	0.908	0.882	0.557
SAU2 ← SAU	0.867			
SAU3 ← SAU	0.867			
SAU4 ← SAU	0.567			
SAU5 ← SAU	0.830			
SAU6 ← SAU	0.656			
SAU7 ← SAU	0.630			
SAU8 ← SAU	0.727			

Source: Authors' compilation based on PLS.

The last step is measuring construct validity. It was estimated using convergent validity and discriminant validity. Convergent validity (the level to which a measure positively correlates with different measures of the same construct) is measured using the average variance extracted (AVE). AVE values above 0.5 indicate that the construct is explaining more than 50% of the variance of its indicators (Hair et al., 2019). Here, convergent validity has been established since all the AVE values are well above the recommended threshold, which is 0.5. Discriminant validity (the level to which a construct is practically distinct from alternative constructs) is measured using the Heterotrait-Monotrait (HTMT) ratio. As per the guidelines of Hair et al. (2019), when discriminant values are higher than 0.9, indicate that discriminant validity is not present. Here (Table 2), all the values are below 0.9, indicating that the discriminant validity of the lower-order measurement model has been established.

Table 2. Discriminant Validity (Lower-order) – HTMT Ratio

	ATCC	ATCE	ATESG	ATLS	MS
ATCC					
ATCE	0.746				
ATESG	0.867	0.814			
ATLS	0.695	0.891	0.887		
MS	0.454	0.662	0.683	0.680	
SAU	0.616	0.672	0.829	0.839	0.739

Source: Authors' compilation based on PLS.

Since all the criteria have been established, the lower-order measurement model is validated.

Here, this section evaluates the results of the second stage which is analysing the results of the higher order validated measurement model. First, the construct 'AM' was validated using the LV scores of the corresponding dimensions as shown in Figure 8. Following that, the same analysis in the previous section was performed here as well. First, the reliability analysis and convergent validity were assessed.

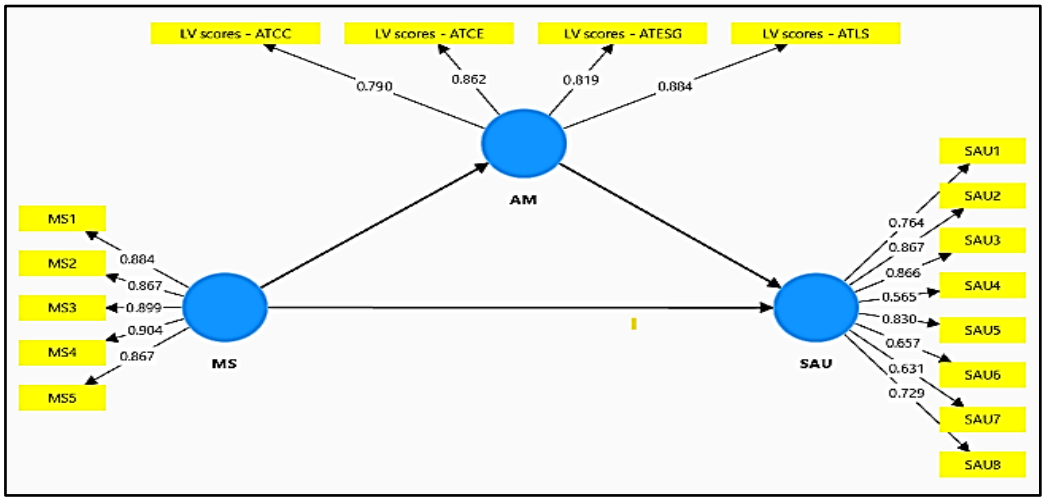
Table 3. Higher-order internal consistency reliability and convergent validity

Construct	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
AM	0.861	0.905	0.705
MS	0.930	0.947	0.782
SAU	0.882	0.908	0.557

Source: Authors' compilation based on PLS.

According to Table 3, all the derived results fall under the recommended thresholds as mentioned in the prior section. Therefore, internal consistency reliability and convergent validity are established in the higher order stage. Next, the discriminant validity was assessed using the HTMT ratio.

Figure 8. Higher-order Measurement Model



Source: Authors' compilation based on PLS algorithm graphical output.

Table 4. Discriminant Validity (Higher-order) – HTMT Ratio

	AM	MS	SAU
AM			
MS	0.686		
SAU	0.815	0.739	

Source: Authors' compilation based on PLS.

According to Table 4, discriminant validity is established at the higher-order level as well considering all are lower than the recommended threshold (0.9) Therefore, the second stage of the disjoint two-stage approach is achieved.

After verifying that the construct measures are valid and reliable, the second step in the PLS-SEM is evaluating the structural model. Here it primarily focuses on investigating the linkages between study constructs in the model. Figure 9 depicts the structural model with indicator loadings, path coefficients and p-values. Structural model evaluation is executed by using the Percentile bootstrap method based on 10,000 subsamples at a 95% confidence level. First, the Variance Inflation Factor (VIF) values of the inner model were examined to identify whether they are at an acceptable level which supports the continuity of the assessment.

Table 5. Collinearity Statistics

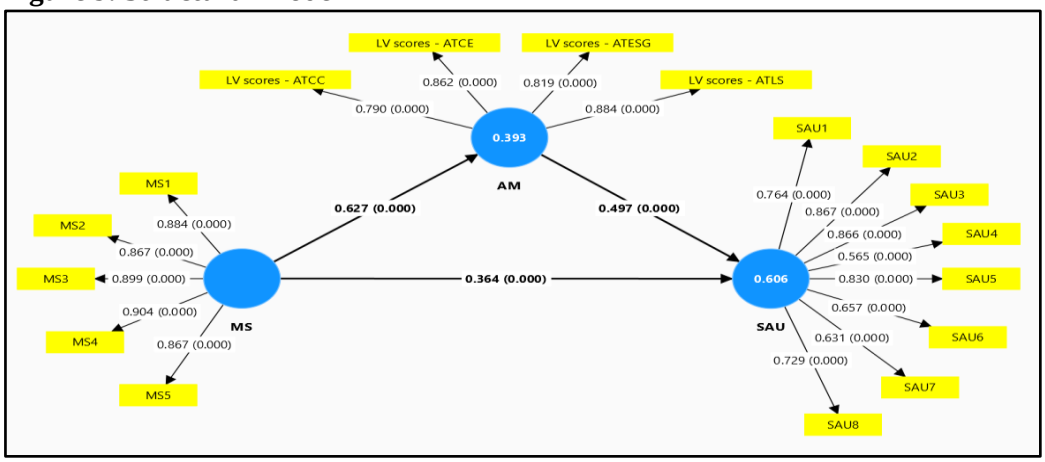
Links	VIF
AM → SAU	1.646
MS → AM	1.000
MS → SAU	1.646

Source: Authors' compilation based on PLS.

According to Hair et al. (2019), VIF values above 5 indicate potential collinearity issues exist in the model, and he recommends that ideally, VIF should be closer to 3 or lower. Here (Table 5), all the derived values are lower than 3.0. Therefore, in the current study,

collinearity was within the safe boundary. The next step is assessing the explanatory power of the model by using the coefficient of determination (R2) of the endogenous constructs (AM and SAU). The R2 value of AM (0.393) means that a 39.3% variance in AM can be explained by MS. Moreover, the R2 value of SAU (0.606) represents that a 60.6% variance can be explained by MS and AM (See Figure 9).

Figure 9. Structural Model



Source: Authors' compilation using Bootstrapping graphical output.

Here, the hypotheses (H1 – H3) were tested at 5% significance, where a hypothesis was rejected if its p-value was greater than 0.05 (insignificant), or if its t-value was below 1.66.

Table 6. Hypothesis Testing Results

Hypothesis	Beta coefficient (β)	t-value	p-value	Decision
$H_{1:}$ MS → SAU	0.364	4.276	0.000	Supported
$H_{2:}$ MS → AM	0.627	6.666	0.000	Supported
$H_{3:}$ AM → SAU	0.497	6.463	0.000	Supported

Source: Authors' compilation.

As in Table 6., H1 evaluates whether the MS provided by an ASD firm significantly and positively affects the SAU of that team. The result revealed that MS has a significant impact on SAU (H1: $\beta = 0.364$, $t = 4.276$, $p < 0.05$). Hence H1 was supported. H2 evaluates whether MS significantly and positively affects the AM. The result revealed that MS has a significant positive impact on AM (H2: $\beta = 0.627$, $t = 6.666$, $p < 0.05$) and H2 was supported. H3 evaluates whether AM significantly and positively affects the SAU of that team. The results revealed that AM has a significant and positive impact on the SAU of the team (H3: $\beta = 0.497$, $t = 6.463$, $p < 0.05$). Hence, H3 was also supported.

Mediation analysis was performed to assess the mediating role of AM in the relationship between MS and SAU.

Table 7. Mediation Analysis Results

Effect	Beta coefficient (β)	t-value	p-value	Decision
Total effect (MS → SAU)	0.675	9.953	0.000	Supported
Direct effect H_1: (MS → SAU)	0.364	4.276	0.000	Supported
Indirect effect H_4: (MS → AM → SAU)	0.311	4.839	0.000	Supported

Source: Authors' compilation.

According to Table 7., the derived results revealed a significant indirect effect of MS on SAU through AM (H4: $\beta = 0.311$, $t = 4.839$, $p < 0.05$). The total effect of MS on SAU was significant ($\beta = 0.675$, $t = 9.953$, $p < 0.05$), with the inclusion of the mediator the effect of MS on SAU was still significant (H1: $\beta = 0.364$, $t = 4.276$, $p < 0.05$). This shows a complementary partial mediating role of AM in the relationship between MS and SAU. Hence, H4 was supported.

V. DISCUSSION

First, the current study's findings resonate with the established prior research, revealing that MS has a significant positive impact on achieving SAU. Therefore, the primary objective of this study is achieved. According to the presented findings by Senapathi and Drury-Grogan (2017), the probable rationale for this linkage would be, in an ASD context, MS is not limited to merely providing training and financial funding, but further involves active participation and dedication to effectively implement the agile processes. Moreover, adopting a lean leadership mindset (which means prioritizing value creation for customers while preventing waste of inefficiencies), encouraging a culture of team problem-solving and creating an approachable and healthy atmosphere where individuals feel valued and respected. Furthermore, developing a whole system of embracing agile values enables lasting transformations, navigating towards a flatter structure while aligned with funding and resourcing models supporting flexibility and promoting faster decision-making within ASD teams and defining roles like scrum masters and Agile coaches demonstrating embracing the transformation.

Second, the derived findings were able to concur that MS has a significant positive impact on an individual's AM (H3). The probable rationale for this relationship is explained by Ozkan et al. (2023). He highlights employing an appropriate leadership approach and investing in training, measuring the team's AM, and placing AM trainer roles internally and externally such as scrum masters and Agile coaches. Next, the results were able to establish that AM has a significant positive impact on SAU (H3), which is supported by Senapathi and Drury-Grogan (2017). Their study explained the most likely reasoning as AM facilitates routinized behaviour in ASD teams which drives long-term success in Agile adoption. Moreover, their findings emphasize that without acquiring such a mentality, Agile transformation will not last longer. Thereby, we can assert that previously mentioned studies ground for the postulation of a mediating role of AM between MS and SAU which is also further statistically proven by the current study's results. Interestingly, Senapathi and Srinivasan (2014) who introduced AM and MS as critical success factors of SAU, were unable to obtain significant results in their study using the same analysis technique. However, the current study is passed to represent the aforementioned hypotheses of the study are significant in the Sri Lankan ASD context.

VI. CONCLUSION AND RECOMMENDATIONS

The study has made a significant contribution to the Agile software development context by examining the impact of MS on the sustaining usage of the Agile methodologies. This research was carried out with the primary objective of examining the impact of MS on SAU, also investigating the mediating role of the AM in fostering the same. It was discovered that MS has a positive significant impact on SAU, supporting the main objective of the study. This reveals that MS has a vital role in sustaining Agile usage at the team level by not merely providing training and funding but rather empowering a supportive and collaborative Agile culture. Furthermore, it is notable through the results of the analysis, that when AM mediates the relationship between MS and SAU, the relationship between MS and SAU remains as significant, which indicates a partial mediation. Therefore, the study successfully achieves the secondary objective as it posits that AM mediates the relationship between MS and SAU. Furthermore, this study fills a major gap in the literature by providing quantitative evidence to support how the sociological factors of MS and AM interact to foster SAU, while previous research has primarily explored these factors through qualitative methods (Senapathi & Drury-Grogan, 2017). In addition to that, this study is an eye-opener for managers in the ASD field. To attain the SAU at the team level, they should carefully study and empower the individual's AM by administering indirect psychometric tests to be well aware of the individual's mentality and providing targeted training programs to create a psychologically safe environment that values openness, innovation, and adaptability. Concerning the limitations of the study, which does not evaluate the functions of their subdimensions to cultivate SAU, it can be identified as a potential gap that future researchers could address. Additionally, the cross-sectional design of the study limits its ability to uncover conclusions on causality, which further suggests conducting longitudinal investigations to comprehend how these would evolve over the period. Furthermore, researchers could look for the same components or incorporate probable elements that promote AM across different domains and nations to acquire new insights from a variety of sectors.

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