SEMARAK ILMU PUBLISHING

Journal of Advanced Research in Applied Sciences and Engineering Technology

Journal homepage:
https://semarakilmu.com.my/journals/index.php/applied_sciences_eng_tech/index
ISSN: 2462-1943

Relationship between Agile Maturity and Digital Transformation Success

Sara Hassan Ahmed Sallam[1,*], Mohamed Mostafa Fouad[2], Fahd Hemeida[3]

[1] Graduate School of Business Arab Academy for Science, Technology, and Maritime Transport Cairo, Egypt
[2] College of Computing and Information Technology, Arab Academy for Science, Technology, and Maritime Transport Cairo, Egypt
[3] Faculty of Engineering and Technology, Arab Academy for Science, Technology, and Maritime Transport Cairo, Egypt

ARTICLE INFO

Article history:
Received 25 July 2023
Received in revised form 19 October 2023
Accepted 30 October 2023
Available online 15 November 2023

Keywords:
Software development; Agile Maturity Model; agile focus areas; digital transformation KPI; digital transformation process

ABSTRACT

Digital transformation has become increasingly important for information technology software companies, as it can have a significant impact on the organization's bottom line. However, many companies struggle to achieve success in their digital transformation journey. One of the key challenges that organizations face is the lack of agility. Organizations need to develop their agile maturity levels in order to achieve their desired results. This paper investigates the relationship between agile maturity levels and digital transformation success in information technology software companies. The study also examines the key agile practices that contribute to digital transformation success. A descriptive study was conducted on different software companies. 100 employees working on agile projects were given a survey, and the responses were examined using the SPSS software. In addition to the quantitative data, the study also conducted qualitative interviews with 10 professionals who have implemented agile transformation in their organizations. The findings of the study suggest that there is a significant positive relationship between agile maturity levels and digital transformation success. The correlation analysis revealed a strong relationship between the three agile maturity dimensions (self-organized team, agile project management, and test-driven development) and digital transformation success. It also showed a moderate relationship between the six agile maturity dimensions (performance management, defect prevention, customer availability, requirement management, collaborative development, and regular delivery) and digital transformation success. The paper also found that the key challenge that organizations face in their digital transformation journey is the lack of clarity around the goals of the transformation. The results of the paper have practical implications for agile practitioners and organizations in identifying the order of key areas of agile maturity and activities that should be introduced to achieve a successful digital transformation journey.

1. Introduction

In March 2020, the COVID pandemic changed the whole world and brought a sense of urgency to digital transformation, especially in the Information and Communication Technology (ICT) sector, where customer demands are volatile and market dynamics are changing rapidly. The pandemic

* *Corresponding author.*
E-mail address: sara_chimie@hotmail.com

https://doi.org/10.37934/araset.33.3.154168

forced numerous organizations to adopt new processes and technologies to survive and remain competitive [1].

According to a report by International Data Corporation (IDC), global spending on digital transformation is anticipated to reach $2.3 trillion in 2023. This represents more than half of all information and communications technology (ICT) spending. The report also predicts that the ICT sector will be one of the fastest-growing sectors with an annual growth rate of 7.6% [2]. Yet, Digital transformation is a challenging task that requires improving the existing project management methodologies.

In the IT field, there are two main business models for software development, namely the waterfall model and the agile model [3]. The Waterfall model is the traditional type, which includes five phases that should be completed in a sequential way to develop software, starting with requirement gathering and analysis, high-level design, coding, testing, and maintenance [4].

The waterfall model has significant time and cost constraints. In contrast to the Waterfall project management model, the Agile model implies that the project is structured into modules that follow the steps of Requirement analysis, Design, Coding, Testing, and Deployment, but also get the advantage of frequent customer feedback [3]. Being agile means responding to change, handling it, and succeeding in a chaotic and uncertain environment, which in turn helps in producing and marketing a wide variety of high-quality and low-cost products that deliver high value to the customers.

Agile frameworks offer several advantages over traditional project management frameworks for planning and executing complex projects in today's dynamic market. These advantages include flexibility, adaptability, collaboration, communication, and focus on delivering working software frequently [5].

However, the agile transformation process largely depends on project teams, their organizational context, and their maturity level. Therefore, to assess the consistency of applying an agile mindset and practices, the organizations use a systematic framework maturity model which is the Agile Maturity Model (AMM). This model allows understanding and benchmarking of their current level of agile practices and culture. Organizations can determine areas for improvement and create a plan to reach their objectives by measuring agile maturity.

The Agile Maturity Model is a five-level maturity model with eleven agile focus areas at each of its five levels. Each maturity level satisfies at least one of the main Agile principles introduced in the Agile manifesto [6].

Previous research has been carried out to investigate the process and challenges of agile implementation, as well as the changes required to meet the challenges of digital transformation [7,8]. In the context of agile maturity, researchers investigated the relationship between Agile maturity and perceived project success [9]. However, there is a gap in the literature on the relationship between agile maturity and digital transformation success. This is because digital transformation is not a project, but rather an ongoing and evolving process.

This paper intends to investigate the relevance of the agile maturity model in terms of its eleven focus areas and their relationship with digital transformation success in information technology software companies by addressing the below questions:

RQ1: "What is the relationship between Agile Maturity and digital transformation success in information technology software Companies."
RQ2: "How are the specific focus areas of the different maturity levels in the Agile Maturity Model (AMM) associated with digital transformation success?"
RQ3: "How do organizations measure their agile maturity?"

RQ4: "What are the key metrics that organizations use to measure digital transformation success?"
RQ5: "What are the challenges organizations face in their digital transformation journey?"

This paper suggests that organizations with high levels of agile maturity are more likely to be successful in their digital transformation journey. The findings of the study can be used by IT software companies to improve their agile maturity and to increase their chances of success in digital transformation by providing guidance on the most important agile focus areas that contribute more to its success.

1.1 Agile Software Development History

In software development, the term "agile" was first used in 2001 by seventeen software developers trying to address a critical problem, which is managing projects using the waterfall model, which divides the development into discrete phases. Because testing was at the end of the process, and customers often changed their minds about what they wanted the software to do during development, the process was often costly, off-schedule, and frustrating. The seventeen developers came up with a Manifesto for Agile Software Development based on four fundamental values, which are "Individuals and interactions over processes and tools, working software over comprehensive documentation; customer collaboration over contract negotiation; and responding to change over following a plan." The agile philosophy involves any method that supports the Agile Manifesto's values and principles [4].

Unlike the traditional methods that focus on up-front planning and strict management of change, the agile framework is designed to accept and efficiently manage change. In agile software development, the requirements evolve through collaboration between self-organizing teams and the customers. Hence, agile projects require significant client involvement in every part of the project to provide constant feedback openly and honestly [10]. The customer must be committed, knowledgeable, collaborative, representative, and empowered to avoid the risk of failure. People are the main drivers of agile projects, and agile teams work best when people are physically close to each other, and document preparation and dissemination are replaced by face-to-face communication and collaboration in agile frameworks and methodologies.

1.2 Agile Maturity Model (AMM)

Several studies highlight the misalignment between agile and CMMI. Hence, researchers and practitioners have developed several assessment tools and frameworks for assessing agile software development methods. Patel and Ramachandran developed an Agile Maturity Model with a similar structure to the CMMI. The model has been developed to enhance the adaptability of the agile software development methodology and its practices and provides both a software process improvement (SPI) framework and a maturity assessment framework [6].

The model shows how agile software development practices mature from an initial or ad-hoc level to a continuously improving level based on agile principles and practices. The model defines agile maturity in five levels, from "initial" to "sustained" based on the agile software development values, practices, and principles, and each level contains a set of focus areas, with eleven focus areas as shown in Figure 1. Each level has a predefined goal in this model to help practitioners or organizations focus on their improvement activities.

i. Level One - Initial

The initial level of the AMM is characterized by being dependent on heroic efforts with no specific, defined process in place. Outcomes are not repeatable, and there is no alignment with agile principles.

ii. Level Two - Explored

Level two of the AMM activities cover the initial set of focus areas that organizations implement to establish agile practices [6]. This level of maturity focuses on three areas: customer availability; requirements management, and project planning. A knowledgeable customer must be available to the development team daily and must be present at the start of the sprint to discuss requirements and provide any clarification needed [6]. The requirements are structured in the form of story cards written by the customer and provide details to derive the acceptance criteria for the functionality by decomposing it into the detailed tasks, and the effort per task is estimated by the developers. Project planning entails developing the project plan and schedules.

iii. Level Three - Defined

Level three changes the focus from establishing agile methods to better defining the specific agile implementation, focusing on the usage of technical and technological aspects of the implementation. This level is characterized by improved customer relationship management through enhanced customer presence and customer satisfaction through continuous feedback. This level involves more collaborative development approaches, such as test-driven development (TDD) and pair programming, and ensures that working software is delivered more frequently.

TDD is a software development practice in which the developer writes and corrects failing tests before developing new code. This helps to reduce code duplication because the developer writes small pieces of code at a time to pass tests. TDD enables developers to explain their work using test cases and the code itself, rather than descriptive words. TDD identifies defects as soon as new code is added to the system; hence, the source of the problem is more easily determined, improving software quality. TDD-written automated unit test cases are great assets to the project. Following that, when the code is improved or maintained, it starts running.

Collaborative development requires that all code be "paired programmed," the development team performs "peer reviews," and it involves collective code ownership across the team, which ensures more frequent and regular delivery of working software [11]. The agile manifesto's principles emphasize the need of delivering working software to customers on a continuous and regular basis. Frequent releases provide a feedback loop, which allows customers to contribute critical feedback to the development team, contributing to the improvement of future iterations [11].

iv. Level Four - Improved

The focus of level four switches to non-technical factors such as project, team, and people management. It is characterized by a trend towards project management and tracking based on successful delivery. This level focuses on project management, a sustainable pace, and a self-organized team. Agile project management techniques are critical to the success of agile implementations. It involves responsiveness and adaptability to complexity, uncertainty, and high volatility, so there is a particular need for alternative approaches to managing projects. Being

equipped with different approaches to project management will allow project managers to better match the characteristics of the project at hand.

The concept of maintaining a "continuous pace" gives the team the freedom to plan their development activities, their working hours are limited to guarantee a sustainable pace, and chances for improvement are regularly discovered [6].

Usually, in agile contexts, work is selected from the prioritized backlog by the development team in partnership with the customer. This type of work allocation is typical of a self-organized team, resulting in an environment in which the development team is trusted to do the work [12]. Individuals in self-organized teams manage their own workload, distribute work among themselves based on need and best fit, and participate in team decision-making. They manage their own work and organize around the details of their tasks. Self-organized teams must have a common focus, mutual trust, and respect.

v. Level Five - Sustained

At AMM level 5, the team focuses on performance management and identifying and eliminating the root cause of any defects discovered, ensuring quality delivery that fulfills customer satisfaction, and thereby maintaining an increased delivery velocity [6].

Performance management tries to meet the stated acceptance criteria specified by the customer in the requirements. Only when these conditions are met is the functionality regarded as "delivered." Additionally, reported production defects are used as a quality metric. Defect prevention broadens the scope of testing and quality assurance. A root cause analysis is performed on the defect, which is then rectified, and tests are developed to verify that the defect does not reoccur. Taking advantage of customer availability and involvement, the team agrees to prioritize defect removal over the future [6]. Performance management in the context of the AMM refers to issues of customer involvement and satisfaction. In environments where agile methodologies have been used for several years, the presence, availability, daily involvement, and dedication are all important.

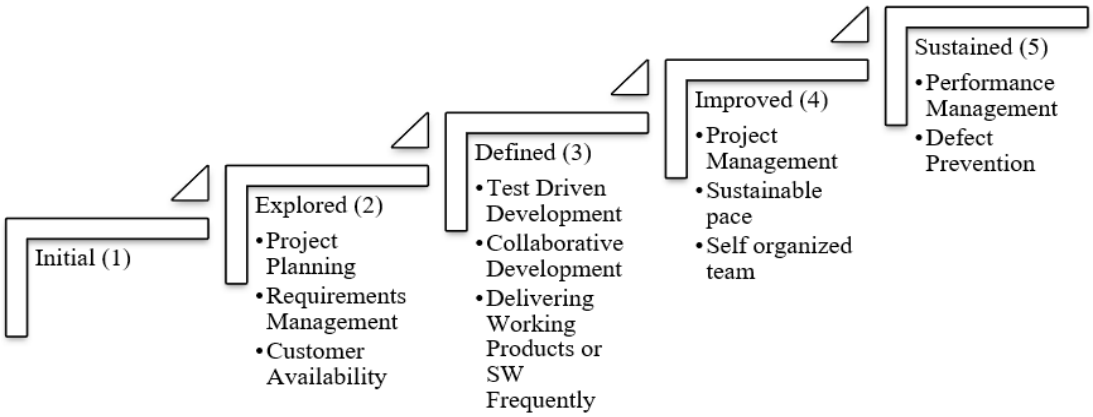

Fig. 1. Agile Maturity Model

1.3 Digital Transformation KPIs in Terms of Return on Investment

Digital transformation is not a new term; it dates to the 1990s, but the digital focus has been revitalized recently during the past few years, especially in an unexpected circumstance where the COVID pandemic accelerated the digital transformation for government and organizations.

Various definitions were used to define digital transformation. Digital transformation is defined as the use of technology to increase enterprise performance. In 2015, Bouée and Schaible defined

digital transformation as the networking of all the economic sectors and then adjusting the players to the new realities of the digital economy. Another definition was introduced by Schwertner who stated that digital transformation is the use of technology to create new business models, processes, software, or systems that increase revenue, create competitive advantage, and improve efficiency [13].

According to Bloomberg, as digital transformation evolves, the terms 'digitization' and 'digitalization' may cause some confusion [14]. Hence, Gartner defines digitization as "the process of changing from analogue to digital form", while digitalization is defined as "the use of digital technologies to convert a business model and provide new revenue and value-producing opportunities" [14]. Therefore, an organization can implement a series of digitalization projects, but digital transformation is not something the organization can implement as a project. It is a broader term that refers to the customer-driven strategic business transformation that involves organizational change and digital technologies [14]. Croft stated that digital transformation is never a one-and-done project. It is an ongoing process that shifts and evolves to meet both consumer and internal stakeholder needs. In the same context, Warner and Wäger [15] described digital transformation as an ongoing process of using new digital technologies daily in the organization.

Forbes Technology Council suggested important metrics to get a clearer picture of digital ROI [16]. The hours saved are an important measure of progress and innovation, especially for digital transformation. Another metric is business sustainability which refers to a company's strategy to limit the negative environmental impact of its operations in a specific market. It is a means of carrying out an organization's vision and mission. The operational improvement is also an important metric that represents the count of the number of processes that run on new software and how they affected productivity providing insight into the overall level of adoption and usability. Similarly, customer experience can be measured by Tracking user experience as often as possible to get an understanding of whether the digital transformation is going successfully or not. Finally, workforce productivity or the revenue generated per employee can also be used to track the digital transformation.

1.4 Relationship Between Agility and Digital Transformation

Digital transformation requires changing the organization's operating model through many iterative steps known as a journey. It imposes the need to react to rapidly changing market demands by sensing environmental change and responding readily. Thus, enterprises adopt and scale agile practices to increase speed and flexibility, and to increase the agile capabilities [17].

Green stated that agile provides an excellent framework for digital transformation because it provides a framework that enables fast iterations based on customer feedback and drives a broader cultural shift in an organization. The agile approach can minimize risks and can validate that they are meeting the required outcome as they move forward on their journey [16].

Similarly, one of the biggest barriers to implementing digital transformation is the co-mixing of operations, corporate IT, product development & technical, and strategic planning functionality [18]. Hence, both iterative and agile methods were developed to overcome the various obstacles faced in sequential forms of project organization [19].

Organizations like National Public Radio and GE stated that they have transformed into a "digital industrial company" with the help of Agile. MIT (Massachusetts Institute of Technology) reported that Agile companies grow revenue 37% faster and generate 30% higher profits than non-Agile organizations. Key industry leaders like General Electric (GE), Netflix, Nestle, and many others mentioned how Agile implementation has assisted in transforming their businesses [20]. Also, more than 20% of people in traditional hierarchy organizations think that non-adoption of Agile can lead

to high business risks. Hence, today, leading brands allocate 25% of their selected leaders' time to focus on agile leadership and team building [20].

2. Methodology

The research framework suggested in this paper illustrates the relationship between agile maturity levels and digital transformation success in information technology software companies. To answer the research question in this paper, we used the conceptual framework shown in Figure 2 to study the effect of software process maturity in eleven focus areas as the independent variable on the success of digital transformation in terms of the five tangible KPIs of the digital transformation recommended by Forbes Technology Council.

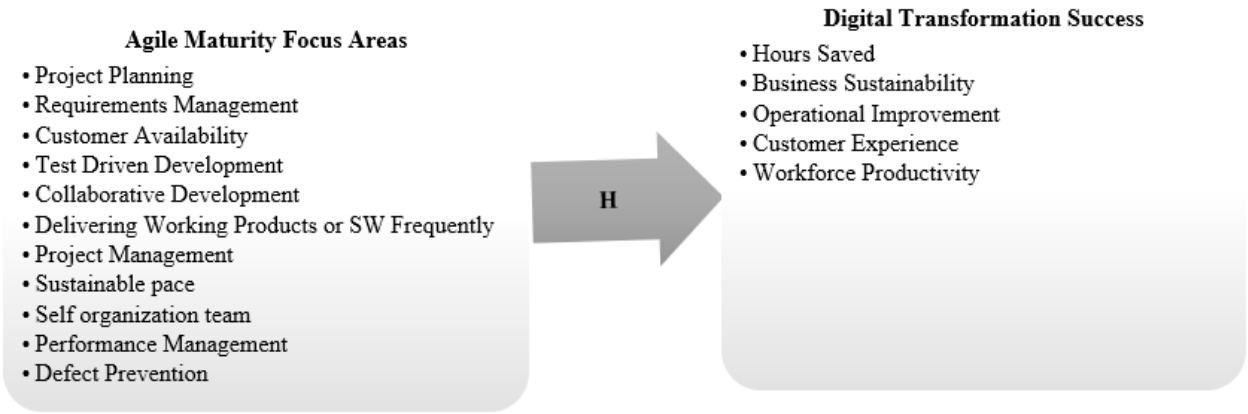

Fig. 2. Research framework

2.1 Hypothesis

We believe that agile maturity level and digital transformation success in information technology software organizations has a favorable association.

2.2 Sampling

The sampling technique chosen was a convenient sample with a sample size of 100 employees because the population of all employees working on agile projects in software enterprises implementing digital transformation is quite large and is difficult for the researchers to identify every member of this population. The survey was collected in one month and the sample included scrum masters, product owners, development team, and delivery leads.

2.3 Development of Measurement Items

To answer the research questions, we used a survey that contains three sub-sections. The first section is a demographic section to categorize the respondents according to their gender, age category, roles, and years of experience in agile. The second section measures the agile maturity based on the agile maturity model, which decomposes the maturity levels based on eleven focus areas. The questions used to measure agile maturity were derived from the AMM questions used by Patel and Ramachandran [6] for assessing the presence of the specific focus area characteristics for a given level of agile maturity; and the third section measures the digital transformation success through five questions derived from five tangible KPIs for the digital transformation recommended

by Forbes Technology Council (Hours Saved, Business Sustainability, Operational Improvement, Customer Experience, and workforce productivity). The survey uses a Likert five-point scale that ranges from 1 to 5, where one represents strongly disagree, and five represents strongly agree.

The study survey was distributed among employees working in large multinational software enterprises implementing agile projects including VOIS, Valeo, IBM, and DXC Technology through emails and LinkedIn. Participation in this survey was voluntary and they had been informed that the purpose of the survey was merely academic to encourage their participation. The collected data from the survey was passed to the IBM SPSS tool to generate reliability tests, descriptive and correlation statistics, and analysis.

The qualitative part of the study involved interviewing 10 individuals with experience in agile transformation. The participants included 3 senior developers, 5 scrum masters, and 2 delivery managers. The interviews were conducted online or in person and lasted approximately 30 minutes each. The interview questions focused on how the organizations measure agile maturity, the benefits of adopting agile, the key metrics used to measure the success of digital transformation, the challenges faced in digital transformation journeys, and the agile practices that contribute to digital transformation success.

The data from the interviews were analyzed using summative content analysis to identify the most important themes or topics that were mentioned by the interviewees.

3. Data Analysis

3.1 Reliability Test

To test the reliability, we conducted Cronbach's Alpha test as shown in Table 1.

Table 1
Reliability test analysis

Variables	Cronbach's Alpha
Agile Maturity	0.871
Digital Transformation Success	0.715

The internal consistency of agile maturity (independent variable) is good as the Alpha value is greater than 0.8 to 0.9 and the internal consistency of digital transformation success (dependent variable) is acceptable because the alpha value is higher than 0.7 and less than 0.8.

3.2 Sample Characteristics and Demographics

i. Distribution by Gender

The sample consists of 100 respondents working in VOIS, Valeo, IBM, and DXC Technology multinational large software enterprises; their demographic profile indicates that 70% of the respondents were males and 30% were females.

ii. Distribution by age category

The respondents' age was divided into three categories. Out of the total 100 respondents, employees between ages 20 and less than 30 were the majority with 75% (75 respondents), followed by employees with an age category between 30 and less than 40 with 18% (18 respondents), and finally employees above 40 years with 7% (7 respondents).

iii. Distribution by role

The respondents' roles were divided into five categories. Out of the total 100 respondents, 66 % were developers, 13% were scrum masters, 13% were product owners, and 8% were in other roles like delivery managers and DevOps.

3.3 Hypothesis Testing

To test the hypothesis, we used Pearson correlation analysis to measure the strength of the linear relationship between the two variables (Agile maturity and digital transformation success) as shown in Table 2.

Table 2
Correlation analysis between overall agile maturity and digital transformation success

Agile Maturity	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	0.419**	0.465**	0.578**	0.481**	0.503**	0.706**
Conclusion	Moderate	Moderate	Strong	Moderate	Strong	Strong

As shown in Table 3, the Pearson correlation coefficient between Project Planning and Digital Transformation Success is 0.244. This indicates a weak positive relationship between the two variables.

Table 3
Correlation analysis between project planning and digital transformation success

Project Planning	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	.098*	0.231*	0.247*	0.189	0.114	0.244*
Conclusion	Weak	Weak	Weak	Weak	Weak	Weak

As shown in Table 4, the Pearson correlation coefficient between Requirement Management and Digital Transformation Success is 0.379. This indicates a significant moderate positive relationship between the two variables.

Table 4
Correlation analysis between requirement management and digital transformation success

Requirement Management	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	0.163	0.257**	0.295**	0.305**	0.256*	0.379**
Conclusion	Weak	Weak	Weak	Moderate	Weak	Moderate

As shown in Table 5, and according to the Pearson correlation coefficient between Customer availability and Digital Transformation Success is 0.438. This indicates a significant moderate positive relationship between the two variables.

Table 5
Correlation analysis between customer availability and digital transformation success

Customer availability	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	0.223*	0.333**	0.187	0.293**	0.415**	0.438**
Conclusion	Weak	Moderate	Weak	Weak	Moderate	Moderate

As shown in Table 6, and according to the Pearson correlation coefficient between Test Driven Development and Digital Transformation Success is 0.530. This indicates a significant strong positive relationship between the two variables.

Table 6
Correlation analysis between test-driven development and digital transformation success

Test Driven Development	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	0.230*	0.400**	0.469**	0.429**	0.325**	0.530**
Conclusion	Weak	Moderate	Moderate	Moderate	Moderate	Strong

As shown in Table 7, and according to the Pearson correlation coefficient between Collaborative Development and Digital Transformation Success is 0.319. This indicates a significant moderate positive relationship between the two variables.

Table 7
Correlation analysis between collaborative development and digital transformation success

Collaborative Development	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	0.417**	0.167	0.287**	0.168	0.104	0.319**
Conclusion	Moderate	Weak	Weak	Weak	Weak	Moderate

As shown in Table 8, and according to the Pearson correlation coefficient between Regular Delivery and Digital Transformation Success is 0.304. This indicates a significant moderate positive relationship between the two variables.

Table 8
Correlation analysis between regular delivery and digital transformation success

Regular Delivery	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	0.500**	0.064	0.398**	-0.022	0.189	0.304**
Conclusion	Strong	Weak	Moderate	Weak	Weak	Moderate

As shown in Table 9, the Pearson correlation coefficient between Agile Project Management and Digital Transformation Success is 0.607. This indicates a significant strong positive relationship between the two variables.

Table 9
Correlation analysis between agile project management and digital transformation success

Agile Project Management	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	0.351**	0.433**	0.424**	0.415**	0.475**	0.607**
Conclusion	Moderate	Moderate	Moderate	Moderate	Moderate	Strong

As shown in Table 10, and according to the Pearson correlation coefficient between Sustainable pace and Digital Transformation Success is 0.241. This indicates a weak positive relationship between the two variables.

Table 10
Correlation analysis between sustainable pace and digital transformation success

Sustainable pace	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	-0.044	0.098	0.196	0.244*	0.331**	0.241*
Conclusion	Weak	Weak	Weak	Weak	Moderate	Weak

As shown in Table 11, and according to the Pearson correlation coefficient between Self Organized team and Digital Transformation Success is 0.645. This indicates a significant strong positive relationship between the two variables.

Table 11
Correlation analysis between self-organized teams and digital transformation success

Self-Organized Team	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	0.263**	0.509**	0.459**	0.473**	0.515**	0.645**
Conclusion	Weak	Strong	Moderate	Moderate	Strong	Strong

As shown in Table 12, and according to the Pearson correlation coefficient between Performance Management and Digital Transformation Success is 0.471. This indicates a significant moderate positive relationship between the two variables.

Table 12
Correlation analysis between performance management and digital transformation success

Performance Management	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	0.401**	0.229*	0.441**	0.224*	0.365**	0.471**
Conclusion	Moderate	Weak	Moderate	Weak	Moderate	Moderate

As shown in Table 13, and according to the Pearson correlation coefficient between Defect Prevention and Digital Transformation Success is 0.446. This indicates a significant moderate positive relationship between the two variables.

Table 13
Correlation analysis between defect prevention and digital transformation success

Defect Prevention	Hours Saved	Customer Experience	Operational Improvement	Business Sustainability	Workforce Productivity	Digital Transformation Success
Pearson Correlation	0.376**	0.229*	0.432**	0.267**	0.270**	0.446**
Conclusion	Moderate	Weak	Moderate	Weak	Weak	Moderate

3.4 Quantitative Findings Explanation

According to Pearson correlation coefficient values, the relationship between Agile Maturity and digital transformation success is a significantly strong relationship. Also, there is a strong relationship between the three Agile Maturity Focus Areas (Self-organized team, Agile Project Management, and Test-Driven Development) and digital transformation success.

Agile approaches focus on adaptability and speed. Self-organized teams are the key to any project's success, as they can quickly adapt their ways of working to meet deadlines with high quality. Their motivation, ownership, and collaboration lead to an enhanced performance level and allow them to handle problems faster. Agile project management is also crucial, as it allows rapid delivery in line with customer expectations with less cost and less risk by being responsive and adaptable to any new change. Likewise, test-driven development makes the code much more manageable and easier to maintain, which in turn decreases the effort required to fix the code and the cost of the product development and improves the quality of the deliverables.

The study also finds a moderate relationship between six Agile Maturity Focus Areas (Performance Management, Defect Prevention, Customer Availability, Requirement Management, Collaborative Development, Regular Delivery) and digital transformation success dimensions. Performance management is essential to digital transformation. It assists organizations in aligning their employees, resources, and systems to achieve their goals by providing early warning of potential problems and allowing for adjustments to keep the digital transformation journey on track. Defect prevention in the early stages of the development process saves time and leads to on-time delivery. It is cost-effective and saves time to identify the defects and fix them in the early stages of the development process because it is more difficult to fix a defect without having a negative impact that leads to rework.

Customer availability assists developers in determining what customers truly want. This assists the organization and team in improving the quality of the delivered product. Requirement management allows setting priorities to reach the organization's goals. Poor requirements management can slow down development, disrupt deadlines, and result in additional development stages. Collaborative development is crucial as every member of a team has different skills, expertise, and talents. When all the members work together, they utilize their experience, knowledge, and skills to achieve the shared goal. Frequent product delivery also builds confidence, commitment, quality, and strong communication with the customers, which creates valuable visibility for the organization and all team members. Finally, there is a weak relationship between project planning, sustainable pace, and digital transformation success dimensions.

3.5 Qualitative Findings Explanation

The qualitative analysis in this paper explored the relationship between agile maturity and digital transformation success by interviewing 3 senior developers, 5 scrum masters, and 2 delivery

managers from organizations that have implemented agile transformation. The interviews focused on the following questions:

i. How does your organization measure agile maturity?
ii. What are the benefits that your organization has seen from adopting agile?
iii. What are the key metrics that your organization uses to measure the success of your digital transformation?
iv. What are the challenges that your organization has faced in its digital transformation journey?

The responses to the first question revealed that the most commonly mentioned agile maturity assessment tool is the Scaled Agile Framework (SAFe). Other commonly mentioned tools include SEMM for Agile and DevOps, the Agile Readiness assessment survey, the Agile Maturity Model (AMM), and a combination of Agile metrics.

The responses to the second question demonstrated the most common benefit of adopting agile is better communication. Other commonly mentioned benefits include continuous process improvement, reduced time to market, increased team collaboration, increased team accountability, increased employees' productivity, better quality for deliverables, efficient product development, team flexibility, high business value, stronger relationships with customers, reduced risk, improved customer experience, effective decision-making, and increased number of team innovations.

The responses to the third question demonstrate the most commonly mentioned metrics for measuring the success of digital transformation are time to market and cost per feature. Other commonly mentioned metrics include customer satisfaction, number of new features and functionality released, customer lifetime value, ROI, defect density, number of automated processes, ability to operate more efficiently, customer retention, net promoter score, and business value.

The responses to the fourth question highlight that the most common challenge that organizations face in digital transformation is a lack of clarity around the goals of the transformation. Other commonly mentioned challenges include technical challenges, resistance to change from employees, budget constraints, lack of communication between the business and the technology teams, lack of skills and expertise in new technologies, legacy systems, and poor planning.

4. Conclusion

This paper found a statistically significant positive relationship between agile maturity levels and digital transformation success in information technology software organizations. The strongest correlation was found between self-organized teams and agile project management, which are level 4 focus areas, in addition to test-driven development, which is a level 3 focus area, and digital transformation success.

The success of any project or change is dependent on people's skills and commitment. That explains the strongest correlation between Self-organized teams and digital transformation success. Similarly, Agile project management plays a vital role in digital transformation projects as these are complex projects and often involve high levels of uncertainty. Agile Project Management helps identify and mitigate potential risks and issues that could impact digital transformation projects. Test-driven development also supports digital transformation because it is a fast and comparatively easy way to accelerate benefit realization. It helps in the early detection of defects, increases the code's efficiency, and saves time.

Likewise, the paper found a moderate correlation between the success of digital transformation and performance management, defect prevention at Level 5, followed by customer availability,

requirement management at Level 2, collaborative development, and regular delivery at Level 3. Therefore, accepting functionality if the acceptance criteria are met, recording bugs, allocating time to diagnose and fix the root cause of the issues, and preventing the bug from happening again in the future are vital practices for the success of the digital transformation because they improve overall productivity, reduce the cost of fixing defects, and reduce time to market. Also, having a knowledgeable customer present at the beginning of an iteration to ensure requirements are correctly understood, explained, and clarified ensures that the delivered service meets the customer's expectations and can make it better. Having the requirements presented in story cards and having enough detail to know what to deliver to satisfy the customer is important to the digital transformation's success. This provides a way to prevent mistakes and errors by tracking changes and enabling a consistent flow of communication with stakeholders from the beginning of the project throughout its lifecycle. Finally, implementing pair programming and doing code peer reviews, in addition to regularly showing the functionality to customers to get feedback and validate the work done, are also essential for the success of the digital transformation and allow for quick adaptation and reduced rework.

The qualitative study revealed that organizations adopting agile methodologies are increasingly looking for methods to assess the maturity of their agile practices. This is significant because it enables organizations to assess their agile practices' strengths and weaknesses and pinpoint areas for development. The paper revealed that customer-centricity is the most important factor in digital transformation success. Continuous customer feedback, customer involvement, and continuous improvement are all practices that can help organizations to be more customer-centric. By gathering and incorporating customer feedback throughout the product development lifecycle, organizations can ensure that their products and services are meeting the needs of their customers.

Overall, the paper provides valuable insights for organizations that are considering adopting agile or measuring the success of their digital transformation initiatives. The study's findings can help organizations to develop a successful digital transformation strategy that is aligned with their specific needs and goals.

This paper was subject to some limitations. The number of responses to the questionnaire was limited, and most of the respondents were in a development role, with a small number of respondents coming from a business or management background. Therefore, some recommendations can be offered for future researchers to take into consideration. A probability sample can be used instead of a convenience sample, and a broader sample size can help to understand the relationship better. Finally, the agile scaling model (ASM) could be used to test whether similar results would be obtained.

References

[1] Verma, Anju, M. Venkatesan, Mallika Kumar, and Jyoti Verma. "The future of work post Covid-19: key perceived HR implications of hybrid workplaces in India." *Journal of Management Development* 42, no. 1 (2023): 13-28. https://doi.org/10.1108/JMD-11-2021-0304

[2] Almaazmi, Jasim, Muhammad Alshurideh, Barween Al Kurdi, and Said A. Salloum. "The effect of digital transformation on product innovation: a critical review." In *International Conference on Advanced Intelligent Systems and Informatics*, pp. 731-741. Cham: Springer International Publishing, 2020. https://doi.org/10.1007/978-3-030-58669-0_65

[3] Maassen, Maria Alexandra. "Product development models in the IT sector-From Waterfall to Agile Project Management Model s in the case of AVIRA SOFT SRL." In *Proceedings of the International Conference on Business Excellence*, vol. 12, no. 1, pp. 568-578. 2018. https://doi.org/10.2478/picbe-2018-0051

[4] Sarker, Iqbal H., Faisal Faruque, Ujjal Hossen, and Atikur Rahman. "A survey of software development process models in software engineering." *International Journal of Software Engineering and Its Applications* 9, no. 11 (2015): 55-70. https://doi.org/10.14257/ijseia.2015.9.11.05

[5] Rodríguez, Pilar, Mika Mäntylä, Markku Oivo, Lucy Ellen Lwakatare, Pertti Seppänen, and Pasi Kuvaja. "Advances in using agile and lean processes for software development." In *Advances in Computers*, vol. 113, pp. 135-224. Elsevier, 2019. https://doi.org/10.1016/bs.adcom.2018.03.014

[6] Patel, Chetankumar, and Muthu Ramachandran. "Agile maturity model (AMM): a software process improvement framework for agile software development practices." *International Journal of Software Engineering, IJSE* 2, no. 1 (2009): 3-28. https://doi.org/10.4304/jsw.4.5.422-435

[7] Reginaldo, Fabio, and Gleison Santos. "challenges in agile transformation journey: A qualitative study." In *Proceedings of the XXXIV Brazilian Symposium on Software Engineering*, pp. 11-20. 2020. https://doi.org/10.1145/3422392.3422436

[8] Schwertner, Krassimira. "Digital transformation of business." *Trakia Journal of Sciences* 15, no. 1 (2017): 388-393. https://doi.org/10.15547/tjs.2017.s.01.065

[9] Henriques, Vaughan, and Maureen Tanner. "Assessing the Association between Agile Maturity Model Levels and Perceived Project Success." In *InSITE 2020: Informing Science+ IT Education Conferences: Online*, pp. 117-156. 2020. https://doi.org/10.28945/4519

[10] Moniruzzaman, A. B. M., and Dr Syed Akhter Hossain. "Comparative Study on Agile software development methodologies." *arXiv preprint arXiv:1307.3356* (2013).

[11] Turetken, Oktay, Igor Stojanov, and Jos J. M. Trienekens. "Assessing the adoption level of scaled agile development: a maturity model for Scaled Agile Framework." *Journal of Software: Evolution and Process* 29, no. 6 (2017): e1796. https://doi.org/10.1002/smr.1796

[12] Stettina, Christoph Johann, and Jeannette Hörz. "Agile portfolio management: An empirical perspective on the practice in use." *International Journal of Project Management* 33, no. 1 (2015): 140-152. https://doi.org/10.1016/j.ijproman.2014.03.008

[13] Schallmo, Daniel, Christopher A. Williams, and Luke Boardman. "Digital transformation of business models-best practice, enablers, and roadmap." *International Journal of Innovation Management* 21, no. 08 (2017): 1740014. https://doi.org/10.1142/S136391961740014X

[14] O'Leary, Daniel E. "Digitization, digitalization, and digital transformation in accounting, electronic commerce, and supply chains." *Intelligent Systems in Accounting, Finance and Management* 30, no. 2 (2023): 101-110. https://doi.org/10.1002/isaf.1524

[15] Warner, Karl S. R., and Maximilian Wäger. "Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal." *Long Range Planning* 52, no. 3 (2019): 326-349. https://doi.org/10.1016/j.lrp.2018.12.001

[16] Quazi, Hebab A., and Scott M. Shemwell. *Smart Manufacturing: Integrating Transformational Technologies for Competitiveness and Sustainability*. CRC Press, 2023. https://doi.org/10.1201/9781003156970

[17] Gerster, Daniel, Christian Dremel, and Prashant Kelker. "How enterprises adopt agile structures: A multiple-case study." In *Proceedings of the 52nd Hawaii International Conference on System Sciences*, pp. 4957-4966. 2019. https://doi.org/10.24251/HICSS.2019.596

[18] Gurusamy, Kavitha, Narayanan Srinivasaraghavan, and Sisira Adikari. "An integrated framework for design thinking and agile methods for digital transformation." In *Design, User Experience, and Usability: Design Thinking and Methods: 5th International Conference, DUXU 2016*, Held as Part of HCI International 2016, Toronto, Canada, July 17-22, 2016, Proceedings, Part I 5, pp. 34-42. Springer International Publishing, 2016. https://doi.org/10.1007/978-3-319-40409-7_4

[19] Simons, Tad, Arvind Gupta, and Mary Buchanan. "Innovation in R&D: Using design thinking to develop new models of inventiveness, productivity and collaboration." *Journal of Commercial Biotechnology* 17 (2011): 301-307. https://doi.org/10.1057/jcb.2011.25

[20] Kotler, Philip, Hermawan Kartajaya, and Iwan Setiawan. *Marketing 5.0: Technology for humanity*. John Wiley & Sons, 2021.