STRATEGIC ASSESSMENT OF ADOPTING AGILE PROJECT MANAGEMENT IN LEBANESE IT COMPANIES

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Abstract

Purpose- This research aims at investigating the effect of agile project management on cost, time, and productivity. Deductive in nature, this study scrutinizes the effect of adopting agile processes in the Lebanese IT sector.

Design/methodology/approach - The study follows a deductive analytical approach to test three hypotheses formulated in accordance to the existing body of knowledge. The proposed relationships focus on the potential causal effect of a short-cycled work breakdown structure, the adaptability to change, receiving feedback from customers and employees, and collaboration on cost savings, wasted time, and employee productivity. Quantitative data was collected through the use of a questionnaire. The random sample for the study consists of 353 respondents who are familiar with agile processes. The data was analyzed via multiple linear regression modelling and statistical results were featured and analyzed leading to testing the proposed hypotheses.

Findings - The results show that agile processes have a significant effect on the three variables of wasted time, cost, and productivity. The adoption of short-cycled work-breakdown structures and ability to exert changes were found to significantly impact all three dependent variables of cost savings, wasted time, and productivity. Moreover, productivity was affected by two additional independent variables, feedback from customers and collaboration.

Research limitations/implications - The speed of response acquisition was impeded by the COVID-19 pandemic, which also resulted in the inability of conducting in-person interviews. Furthermore, it was hard to reach a larger number of participants, as the number of individuals who are familiarized with agile processes is somewhat limited. There were no cost-induced limitations, however, the needed time to complete the research was relatively tight, and further temporal delays were incurred due to personal circumstances. However, this study builds upon the findings of previous studies that have explored agile processes. It provides insights into the benefits of applying agile practices specifically in the Lebanese IT sector.

Practical implications - The study offers insights to managers looking forward to enhancing their work through achieving cost savings, reducing wasted time and improving their team productivity showing that the application of agile practices to their daily project management helps them reach the aforementioned goals.

Originality/value – This study could be one of the first studies tackling the adoption of agile practices and their benefits in the Lebanese IT sector. Knowing that the agile methodology is still considered a new approach in project management, it offers a solid evidence or example of the benefits of using agile

practices for people wishing to achieve cost-savings, wasted-time reductions and team productivity enhancement in project management.

Keywords – project management, agile practices, cost-savings, wasted-time reduction, productivity

Chapter 1

Introduction

The last years have witnessed a remarkable increase in innovation and technological advancements paired with a higher tendency to reduce costs and create user friendly products at a quick pace. Eventually, the business market has been shaped by an everchanging environment where businesses continuously thrive to remain competitive through being more flexible to change and catering to the customers' and users' needs and priorities while strictly adhering to cost reduction and cutting out phases in order to reduce time to market. Adding to these factors the spread of the Covid-19 pandemic, businesses were left with no choice other than being able to adapt to the unexpected changes happening every day and being able to have teams working remotely from anywhere around the globe. As a result, the adoption of agile methodologies in project management have seen a significant increase across the world.

Agile practices are marked with the iterative and incremental delivery of the product allowing for more frequent communications with customers and feedback from them. This allows agile teams to prioritize requirements and develop useful products which continue to be convenient by the time they are completed. Unlike traditional project management approaches, agile practices put people at the core during the implementation rather than the process itself thus reducing the time wasted on documenting and delivering a full product

where changes can only be applied at the end when the product is completed thus consuming more time and money to apply the requested changes and sometimes resulting in a less useful product due to the technological advancement and innovation that would happen by the time the product is ready. The frequent delivery of increments of the product and receipt of feedback from customers allows agile teams to apply changes and innovate on the go during the implementation process; therefore, providing a more satisfying product and reducing time spent on less necessary requirements, documentation and full change. It was also found to contribute to increasing the productivity within the team itself and eventually to the success of the business.

This paper studies the impact of adopting agile practices on reducing costs and wasted time along with increasing productivity among team members. Chapter 2 provides a thorough review of the exiting literature on the subject under study. As the literature shows that the majority of research done to date focuses on qualitative analysis and very few quantitative studies rather than more quantitative analysis of big samples that could represent the majority of the population. The purpose of this paper is to quantitatively study the impact of applying agile practices on three areas: reducing costs, decreasing wasted time and enhancing productivity. Chapter 3 describes the methodology and procedure adopted in this research going through the hypotheses, philosophical dimension and reasoning approach, description of variables, sample and data, method, as well as analysis framework. Chapter 4 is dedicated to the statistical results that were obtained following the collection of 353 observations. It discusses the

results, and then progresses to inferential statistics. It also analyzes the obtained findings, which allows for the testing of hypotheses. Chapter 5 summarizes the findings, tackles validity issues and discusses the theoretical and managerial implications of the research, along with the limitations and suggestions for future research.

Chapter 2

Literature Review

2.1 Brief Introduction to Traditional and Agile Project Management

PMI (Project Management Institute) defines traditional project management as "the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements." As per the PMBOK, traditional project management involves the following processes: initiating, planning, executing, monitoring and controlling, and closing. Successful projects are those which abide by the triple constraints of scope, time and cost.

However, although some projects meet these requirements, they still turned to be unsuccessful when it comes to meeting the end users' or stakeholders' expectations especially when the degree of uncertainty and complexity is high. "Agile systems developments methods emerged as a response to the inability of previous plan-driven approaches to handle rapidly changing environments" (Abrahamsson et al., 2009).

The agile method was adopted in response to the need for "responsiveness and adaptability" in managing complex projects which are "characterized by uncertainty" (Fernandez, 2009). According to Dyba and Dingsoyr, "agile project management is about managing the impact of complexity and uncertainty on a project" (Dyba & Dingsoyr, 2015).

The Agile Alliance defines agile as “the ability to create and respond to change. It is a way of dealing with, and ultimately succeeding in, an uncertain and turbulent environment” (Agile Alliance, 2022).

Unlike traditional project management, the agile method adopts “short cycles of iterative and incremental delivery of product features and continuous integration of code changes” (Dyba & Dingsoyr, 2015). As mentioned in The Agile Manifesto, agile methods give top priority to customer satisfaction and “continuous delivery of valuable software” (The Agile Manifesto, 2001).

In its report “Pulse of the Profession” entitled “Achieving More Agility: The People and Process Drivers that Accelerate Results”, PMI defined agility as “the capability to quickly sense and adapt to external and internal changes to deliver relevant results in a productive and cost-effective manner” (PMI, Pulse of the Profession, 2017). The same report considered agile to be a “mindset based on a set of key values and principles designed to better enable collaborative work and deliver continuous value through a “people-first” orientation” (PMI, Pulse of the Profession, 2017).

According to the Agile Alliance, “one thing that separates Agile from other approaches to software development is the focus on the people doing the work and how they work together. Solutions evolve through collaboration between self-organizing cross-functional teams utilizing the appropriate practices for their context” (Agile Alliance, 2022).

In brief, the agile method is based on forming the work breakdown structure around short-cycles of iterative and incremental processes and the continuous

delivery of product features with customer satisfaction, employees' engagement and change adaptability being at the core.

2.2 History of Project Management Practices

Tom Seymour and Sara Hussein believe that project management existed ever since "humans inhabited earth" referring to the many projects that were executed in ancient times such as the Pyramids of Giza, the Great Wall of China and the Coliseum (Seymour & Hussein, 2014). According to them, many of those projects involved a high degree of "complexity and uncertainty", were of a large scope and required huge effort, "many years of work", upfront planning and "precise execution" (Seymour & Hussein, 2014).

Basic project management principles go back to the 1900. At that time, Gantt charts were used for scheduling projects followed by the use of flowcharts from 1900 to 1950. (Rico et Al., 2009)

Modern project management started taking place in the late 1950s where projects were tracked based on tasks, timelines and schedules. "The U.S. Navy greatly contributed to the formulation and documentation of principles of modern project management methodologies and techniques" (Seymour & Hussein, 2014). In their research paper, Seymour and Hussein mentioned the Manhattan project as being a great contributor to the advancement of modern project management practices (Seymour & Hussein, 2014).

The next major revolution in project management took place in the 1960s. In 1967, the cost/schedule system appeared followed by the work breakdown structure in 1968 and the "formation of the Project Management Institute in 1969" (Seymour & Hussein, 2014). In the 1970s, "technological advancement made the creation of project management software possible, via software companies such as Oracle" (Seymour & Hussein, 2019). In the 1980s, computers became "affordable" and "smaller companies started using them for project management" (Seymour & Hussein, 2014). "In 1984, the Project Management Institute began certifying project managers and in 1987 formed the Project Management Body of Knowledge (PMBoK)" (Rico et Al., 2009).

According to Jiang and Eberlien, "the terms "agile" and "agility" can be traced back to the manufacturing industry in 1991 when "lean development" emerged in manufacturing with the aim of eliminating waste, amplifying learning, delivering as fast as possible and empowering teams" (Jiang & Eberlien, 2009). Some researchers traced some agile practices to years before 1991.

For instance, in the 1930s, a quality expert at Bell Labs used "iterative and incremental development to improve product quality" (Jiang & Eberlien, 2009). According to Larman and Bassili, that expert was named Walter Shewhart and he proposed a "plan-do-study-act (PDSA)" cycles for quality improvement (Larman & Bassili, 2003). Then, in the 1940s, W. Edwards Deming started "promoting PDSA" and later described it in his book "Out of Crisis" (Larman & Bassili, 2003). Tom Gilb and Richard Zultner also highlighted using PDSA in software development in later works (Larman & Bassili, 2003).

In the 1980s, “Gladden and Gilb have proposed the practice of “delivering working software early”. These practices can be directly mapped to the agile practice “frequent delivery” and “continuous integration”” (Jiang & Eberlein, 2009). According to Jiang and Eberlein, “a similar idea to the use of prototypes of working software can be found in manufacturing as early as 1982” (Jiang & Eberlein, 2009).

Agile project management first appeared in the early 1990 (Confronto et al., 2016). It then emerged in the following years as a method used in software development (Birkinshaw,2018).

In February 2001, a group of 17 practitioners gathered at Snowbird, Utah and began brainstorming new ways. They formed the Agile Alliance and came up with a new approach that they called “agile” and explained its principles in the Agile Manifesto to Software Development. The Agile Alliance defined agile as “the ability to create and respond to change. It is a way of dealing with and ultimately succeeding in uncertain and turbulent environment” (Agile Alliance, 2022). The word “agile” was chosen by the authors of the manifesto because it “represented the adaptiveness and response to change” (Agile Alliance, 2022).

Later, PMI recognized the agile approach and described it as “the capability to quickly sense and adapt to external and internal changes to deliver relevant results in a productive and cost-effective manner” (PMI’s Pulse of the Profession, 2018).

The Agile Alliance itself says that agile was practiced before the meeting in 2001 when software developers found that old ways of management were

inadequate and “started mixing old and new ideas and created methodologies for their teams” (Agile Alliance, 2022). “Those methodologies emphasized close collaboration between the development team and business stakeholders; frequent delivery of business value, tight, self-organizing teams; and smart ways to craft, confirm, and deliver code” (Agile Alliance, 2022). According to the Agile Alliance, those software developers created frameworks to share their methodologies with others. “This is where frameworks such as Scrum, Extreme Programing, Feature-Driven Development (FDD), and Dynamic Systems Development Method (DSDM), among others, started to appear” (Agile Alliance, 2022).

2.3 Research Studies

The concept of agile project management can be traced back to the 1990's when it was first used in software development (Stettina & Horz, 2015).

According to PMI’s 10th Global Project Management Survey, Pulse of the Profession issued in 2018 and named “Success in Disruptive Times”, sticking to the traditional project management triple constraint theory is the major challenge facing companies nowadays.

71% of organizations have increased their use of agile since 2013 achieving a 27% drop in the amount of money wasted as a result of poor project performance (PMI-Pulse of the Profession, 2018). Companies with high success rate of projects are the ones whose managers have the needed skills to be able to deal

with change in such ever-changing environment. (PMI's Pulse of the Profession, 2018).

In a recent study conducted in 2019, Elena Mircea provided a clear history of the way software development methods evolved starting from adopting the "code and fix" (Elena, 2019) approach in which the entire software was developed before providing it to the customer. At that time, fixing any bug was done at the end and implementing changes was really hard to the extent that sometimes the entire program had to be changed. She goes on to say that in the mid-1950s a new method was being implemented which involved specifying customer requirements first, followed by "design, development, integration, testing and deployment" (Elena, 2019). This method became known as the waterfall approach in the 1970s and is still being used in traditional project management. The customer is not quite involved during the process and moving from one phase to another during development requires the previous phase to be fully completed and going backward to implement modifications is quite hard as well, she says. According to the same study, around ten years later, the "Spiral" method showed up to be the first to involve an iterative and incremental process. Then in the 1990s, the "idea of frequent feedback" (Elena, 2019) started to be used. Later in the year 2001, the agile method was declared (Elena, 2019). The agile method helps provide what she called "flexible, dynamic and client focused products" (Elena, 2019).

The same study says that agile management is a culture rather than a method, a culture under which “all team members are equals, positions are not clearly defined” (Elena, 2019). “The agile processes help the team to work after their own rules, improving the model based on the constant feedback. Each team member has the opportunity to get involved and expose his ideas” (Elena, 2019). Communication, simplicity and flexibility are at the core of any agile process yet this sort of project management is well organized unlike what is sometimes believed and although agile does not solve all problems, teams can bring to the table solutions that can be used in all cases (Elena, 2019). Producing products that are more client focused, reducing the time needed to finish the product and implementing improvements were core achievements of agile practice, according to the study (Elena, 2019). Knowledge sharing and learning are other benefits of the agile approach when team members collaborate and communicate properly (Elena, 2019). According to Elena, agile methodologies can be applied to several sectors, departments and even daily activities outside the IT field. The study provides a good description of the agile methodologies and highlights the benefits of adopting them both to the team and the client/product.

Petersen and Wohlin conducted a case study at a development site of Ericsson in Sweden in the year 2010. Interviews with 33 employees were conducted to compare using traditional project management to agile project management at the company. After years of adopting the traditional method, Ericsson discovered that by the time the product was ready, it has become outdated and

changes were highly needed, yet the implementation of changes requested at the end of the project were more costly and took more time and effort to be implemented adding to the time scheduled for the project completion since a big amount of rework involving design and coding had to be done. Eventually, the company decided to shift to agile methodologies adopting incremental and iterative processes, holding frequent standup meetings, shortening work cycles throughout each project and prioritizing requirements. The purpose of the shift was to gain more flexibility and shorten the time to market. As a result, requirements were prioritized, more specific and less. Also, less changes were required. Detecting errors was much easier and made earlier. Less documentation was needed as smaller teams worked together and communicated more frequently. Less testing time was needed. Maintenance costs as a result of customer testing and use of the product slightly decreased which could reflect an improvement in product quality. However, the adoption of agile processes was not found to influence employee productivity. Nevertheless, it had led to more frequent releases of functional products which allowed earlier return on investment. Early testing of the product during the development process led to a decrease in errors. Finally, adopting the agile method remarkably improved motivation and communication within the team itself (Petersen & Wohlin, 2010). Although the results confirmed the benefits of using agile, the researchers noted that more research is still needed "to make agile studies comparable" (Petersen & Wohlin, 2010).

In his dissertation study titled “An Investigation into the Effectiveness of Agile Software Development in a Highly Distributed Environment”, Kile says “by removing the process boundaries erected by traditional software development methodologies and by maintaining the discipline needed to produce quality software, it strikes a balance between software development as an engineering discipline and software development as a creative endeavor” highlighting the fact that agile project management allows teams to be more creative. He states that by adopting agile methods, teams are able to overcome “communication and social barriers” (Kile, 2007) which he considers to have resulted in the failure of some projects. He investigated the ability of companies to overcome team collocation and still make use of the benefits of agility. Frequent communications with the customer as well as the incremental delivery of the product under development allowed the customer to know exactly what functional features are needed and the team to prioritize requirements to deliver functional increments throughout the project. This also allowed the team to detect any misfunctions from the user’s side and prioritize them instead of waiting till the project is completed and discovering them at the end when the product is in the hands of the users, which eventually led to end-user high satisfaction. Integration was continuously being done which helped reduce cost and time. Also, having to spend less time on administrative tasks helped the team to use the time dedicated for such tasks in development which meant less wasted time. The agile process helped reduce the cost spent on system testing after full

integration completion. It also allowed the team to improve the quality of the product which resulted in dropping maintenance costs by 24% (Kile, 2007).

In 2008, Laanti, Salo and Abrahamsson found that studies on the effectiveness of applying agile in large companies were still few and started conducting a study on the transformation into agile methods at Nokia in seven countries in Europe, North America and Asia. The study aimed at knowing if agile was there to last considering that if its application proved to be beneficial to the company, then it will continue to be used. They performed a quantitative study through a questionnaire answered by 1000 respondents and a qualitative study through interviews with employees at Nokia. In the quantitative study, Laanti et al. concluded that the majority of respondents claimed that agile could achieve "higher satisfaction, a feeling of effectiveness, increased quality and transparency, increased autonomy and happiness and earlier detection of defects" (Laanti et al., 2011). 60% of respondents were pleased by the use of agile and didn't want to go back to using traditional methods. In the qualitative study, also 60% of the respondents wanted to stick to using agile while 9% wanted to return to the use of traditional methods and the remaining 31% didn't tackle any difference in the shift to using agile. 90% of these respondents worked in Research and Development while the remaining 10% worked in marketing, design and process development. 21% of the respondents involved in the qualitative study were not experienced in agile. The researchers used the 21% to explain the 31% who didn't tackle any difference in the shift to agile. Laanti et

al. concluded that the longer the experience in practicing agile methods the higher the tendency to choose to continue using agile (Laanti et al.2008). However, the researchers did not study the effect of using agile on the end results such as increased productivity, or reduced time and cost. The study rather questioned the effectiveness of agile methods based on the attitudes of practitioners while focusing on the length of their experiences in using agile and traditional methods. Moreover, in the qualitative study, 90% of respondents worked in research and development whereas 10% worked in marketing, design and process development. Therefore, employees who worked in process development represented a very small percentage. A bigger percentage would have added more value to the results and conclusions. Furthermore, the study was conducted at one organization only which has recently shifted to the use of agile. Eventually, taking all these facts into consideration, the study doesn't seem to be sufficient to answer the question if agile was there to stay.

A paper presented by Daniel J. Fernandez and John D. Fernandez in 2008 to provide information on the use of agile methodology concluded that the adoption of agile methodologies seems to achieve gains in "the predesign and design phases of construction; iterative and incremental development can facilitate creative solutions, particularly to complex and uncertain requirements" (Fernandez, 2008). As an example provided in the same paper, managers at Lockheed Martin, a U.S. global aerospace, defense, security and advanced technologies with a net income of $2.002 billion in 2017, "chose agile practices

in order to improve four areas that were consistently part of management's focus: managing changing requirements, increasing productivity, ensuring quality standards were met, and developing and delivering a product increment more often" (Fernandez, 2008). The paper discussed differences between traditional and agile project management from a methodological way without any qualitative or quantitative researches.

Yu Cui and Nis Olsson performed a study in the year 2008 on 82 governmental projects in Norway where agile is adopted as a management approach. The results of the study showed that "60 of 82 projects have listed reductions in items" (Cui & Olsson, 2008) which eventually led to cost reductions.

Korhonen conducted a case study of a large organization with over 150 experts working in globally distributed projects. Most of them were experienced in traditional software development and some had experience in agile development. The organization had projects in different countries around the globe. The purpose of the study was to explore the effect of using agile methodologies on managing defects. The researcher depended on the defect data records along with interviews before agile transformations and 2 surveys during the first year of agile management adoption. Defect data were collected from three similar projects in terms of coding and complexity. The researcher named the projects: A, B and C (Korhonen, 2011). Project A adopted the traditional waterfall approach. Projects B and C adopted agile methods. Data from project

B were collected 6 months from starting the agile transformation. Data from project C were collected 12 months after starting the agile transformation (Korhonen, 2011). The number of reported defects in projects B and C was lower than those in project A. In projects B and C, the correction of more than 50% of defects was done in one sprint or less. In project A, only 45% of defects were corrected in that same time. In project A, it took 3 sprints to correct 80% of defects whereas in B and C, 80% of defects were corrected in less than two and a half sprints (Korhonen, 2011). Both surveys reported improvement in early detection of defects by 57.5% of respondents after 6 months and 65% of respondents after 12 months. A smaller percentage of respondents reported that the detection of defects was slower and more difficult due to the fact that the testing time was too short and by the time testing was done and bugs were identified the software development team had already developed a newer version which caused pressure on the testing team (Korhonen, 2011). In general, the study found that agile project management allowed for earlier detection and correction of defects than traditional project management. However, the study didn't mention the number of interviewees or that of survey respondents.

Pikkarainen et al. conducted a study on three software engineering companies in Finland in 2012. The first case studied company develops finance-related products and has 8000 employees. The second is a market leader in the production of applications and services for telecommunication devices. The third company produces information security products for more than 90

countries. The application of agile methodologies in the three companies resulted in better communications and collaboration between stakeholders, better management of requirements due to prioritization, and the production of better UI designs due to better involvement of stakeholders and communication between UI designers and developers. Agile adoption also allowed companies to improve the products they deliver. The study further highlighted the importance of the management's full support and commitment when deciding to shift to agile project management as well as the importance of choosing "tailored processes" for each company and allowing developers to improve their own agile development process continuously" (Pikkarainen et al., 2012). Training team members to understand the agile method was found to contribute to the success of the process (Pikkarainen et al., 2012). The study provides valuable information and recommendations regarding the adoption of agile, yet the analyzed data could be subjective as being collected through interviews. Supporting the study with a quantitative analysis of anonymously-collected data would have helped demolish the mentioned limitation.

According to a study conducted by Baruah and Ashima, small and medium Indian enterprises are using agile methodologies in order to "improve quality and productivity" (Baruah & Ashima, 2012). The same study confirms the advantage of customer-developer communication and the production of "small software releases" which allows customers to demand changes on-the-go and even late in the project and developers to effectively implement those

requirements thus improving the product and keeping track with the pace of frequent changes in response to market demand (Baruah & Ashima, 2012).

In a case study that involved four senior engineering students requested to develop and release a mobile application within a period of two semesters using the agile method, results came very promising. The work was distributed over two-week sprints. The team was continuously communicating with each other. At the end of each sprint, a meeting was held with the mentor and the client lasting approximately one hour, in which achievements were brought to the table, a prototype was presented and requirements were thoroughly discussed. At the end of the second semester, the project was fully completed leaving the client very satisfied reporting that frequent communication with the team under the agile method allowed quality enhancement and the production of a good product with highly functional features. The team was able to implement all needed changes and the product was improved in a timely and effective manner. The outcome was a “fully functional product” (Rover et al., 2014), a satisfied client and higher performance of team members (Rover et al., 2014). The study involved students only and further case studies or quantitative data could have added to the results.

In their study titled "Agile Portfolio Management: An Empirical Perspective on the Practice in Use", Stettina and Horz chose 14 large European IT organizations with more than 250 employees applying agility to their portfolio and program

management and conducted well-structured interviews with around 30 employees. The results showed that the case-studied organizations turned to use agile management in portfolio and program management after having applied it to individual projects and touching the benefits of such approach. Using agile in software development encouraged them to adopt agility in portfolio management. According to the same study, the agility of the organization as a whole is determined by its ability to learn fast and be effective while being able to address major challenges such as resource allocation and "silo thinking" (Stettina & Horz, 2015) which happens when certain departments or teams don't wish to share information with others in the same organization. The application of agile methods helped touch base with customers frequently and implement changes whenever needed more easily. It also helped enhance transparency and effective cooperation among their teams (Stettina & Horz, 2015). The study highlighted the importance of using agile for both project and portfolio management and tried to focus as well on the strategic planning perspective yet the case-studied organizations didn't seem to be applying agility well on the strategic level.

Agile methods "directly address the challenges so often confronted in dealing with dynamic projects in changing environments" (Serrador and Pinto, 2015). According to Serrador and Pinto, the use of iterative and incremental cycles in the agile method not only allows for frequent feedback from stakeholders but also helps respond to change of requirements in a better manner and do the

necessary adjustments as the project is being implemented (Serrador & Pinto, 2015). The study conducted by Serrador and Pinto involved 1386 projects. Data was collected through a questionnaire, the respondents to which were mostly from USA, 499 respondents, India, 96 respondents, Canada, 93, Australia, 31, Spain, 24, Brazil, 18, Singapore, 18, and Germany, 14 respondents. 85% of respondents had over 5 years of experience. The study aimed at testing the impact of using agile methods on efficiency and stakeholders' satisfaction against the organization's goals. As a result, the researchers found that "the higher the agile/iterative approach was reported, the higher the reported project success" (Serrador & Pinto, 2015). In other words, the research findings helped conclude that the extent to which the agile approach was adopted affected the overall success of the project in terms of efficiency, stakeholders' satisfaction and project performance. The adoption of agile methods contributed to improving efficiency, quality, performance and satisfaction regardless of team experience or project complexity (Serrador & Pinto, 2015). In general, the study can be considered one of the few that involved such a considerable number of projects and respondents from different countries with a quantitative analysis of the responses.

Kisielnicki and Misiak conducted a study in the year 2016 in an attempt to answer the question "Is agile more efficient in business intelligence implementation compared to traditional methods?" (Kisielnicki & Misiak, 2016). They compared agile to traditional project implementation methods

noting that agile focuses on the business value and uses that to "determine quality levels and possible technology constraints" (Kisienlnicki & Misiak, 2016) whereas traditional project management focuses on the scope of the project and uses that to set the time and cost of the project. They also noted that the need for effective BI solutions is increasing and the effectiveness of such solutions is based on the value they add and their fast implantation. To be able to answer the question they posed, they conducted a case study at a large telecommunication company having around 20,000 employees and considered a key player in the local and global market. The company adopted the agile approach in implementing BI solutions. The results showed a reduction in costs of implementation by 90% as compared to using the traditional waterfall method. The project was delivered in less time than it would have been needed using the traditional approach. Less error and higher customer satisfaction were achieved as customers were more often involved and the solutions were delivered in iteration. The researchers went further to survey and interview 65 BI end-users from 3 companies: the telecommunication company mentioned before along with a digital company having 10,000 employees and adopting the traditional approach and an insurance company with 17,000 employees also using the traditional approach. 15 among the 65 end-users experienced using the agile method whereas the remaining 50 users had experience using the traditional method. The results showed that using agile methods was effective in the implantation of BI projects. The return on investment was achieved more quickly. Delivery was done in less time. Added-value was achieved earlier.

Users were more satisfied and could receive functional products in less time. Whereas the implementation of BI solutions using the traditional methods were not as successful due to the fact that implementation required more time and the projects were not as flexible at the end as compared to projects delivered using the agile approach (Kisielnicki & Misiak, 2016). Although this study compares using agile to using traditional methods at three companies which require similar products and have similar sizes, yet the sample size is small and more studies are needed to confirm the results.

Azanha and his team conducted an exploratory study at a large Brazilian pharmaceutical company characterized by mass production. One of the researchers was working at the company and had access to all the required information. The case study was about the development of IT project using the agile approach. The project was developed in five sprints with each sprint conducted in 20 days. The team had open communications and frequent meetings. Although the project was not fully completed by the end of the first sprint, the presented product by that time was already useful. According to the traditional project management plan put by the team, the project was supposed to be completed within seven months (for the first release without considering upcoming changes to the project) and cost USD291,000. However, using the agile method, the team was able to complete the project in four months after implementing changes throughout the development process for a cost of USD145,000 only which means the agile approach saved the company 50% in

costs and allowed to reduce the time taken to implement by 80% considering that the implementation of the adopted changes would have taken more time. The same study concluded that "frequent deliveries" (Azanha et al., 2017) had a motivational effect on employees and significantly improved the "working environment" (Azanha et al., 2017). According to the study, using agile helped improve project control especially over its scope through continuous delivery of increments (Azanha et al., 2017). Bias was one of the limitations of the study due to the fact that one of the researchers was a team member in the project. Being an exploratory qualitative study involving one organization makes generalization of results not applicable. If paired with more case studies of other organizations and a quantitative study, the current study would be more robust and would have provided for a higher possibility of result verifications and generalization.

J. Birkinshaw conducted a study at ING Bank of Netherlands in 2018, three years after the bank started transforming its management from traditional to agile. The researcher interviewed 15 of the bank's employees including its CIO and COO who were responsible for leading the transformation process. The study took 8 months to be concluded. ING was inspired by Amazon, Spotify and Zappos whose adoption for agile methodology enhanced "customer orientation and employee engagement" (Birkinshaw, 2018). ING changed its operations making use of each of Google's, Netflix's and Zappos' models. The bank put its 3500 employees into groups of nine employees each. Each group was

responsible for an end-to-end specific customer-related activity. Eighteen months following the adoption of the agile approach, the bank's cost-to-income ratio dropped from 65% to 51%. Its net promoter score, an index ranging from -100 to 100 measuring customers' willingness to recommend the bank, rose from -21% to -7%. Employee engagement also increased as a result of the transformation, according to a survey conducted internally (Birkinshaw, 2018). In conclusion, although the transformation process was not yet complete at the time of the study, progress was tangible in terms of higher customer satisfaction, lower cost-to-income ratio and improved employee engagement. The study would have achieved better results had it been done when the transformation was totally done and had it involved a quantitative analysis and more interviewees since the bank had 3500 employees, yet it provides good insight on the adoption of agile in non-technical industries.

In a dissertation study, Bennett noticed the change of OER (Operating Expense Ratio), ROA (Return on Assets) and revenues for over 8 years of organizations before adopting agile project management and after adopting it. The study used financial data from the organizations under study and concluded that adopting agile methodologies helped increase efficiency through reducing OER, Operating Expense Ratio "which is a measure of profitability and efficiency" (Bennett, 2019) (Operating Expenses/Revenue) noting that "the lower the OER the more efficiently the organization is generating revenue" (Bennett, 2019), and increasing ROA, Return on Assets which "measures the overall profitability of

the organization" ("the amount of profit generated expressed as a percentage of its total assets" (Bennett, 2019)). It also found that revenues increased but couldn't attribute this increase solely to the adoption of agile methodologies. In other words, the study concluded a causal relationship between the implementation of agile project management and each of OER decrease (i.e. cost reduction) and ROA increase yet the same causality was not concluded between agile implementation and revenue increase (Bennett, 2019). Financial data analysis is a distinguished feature that makes such a study important as it is a one of its kind to analyze the relationship between agile implementation and OER, ROA, and revenue.

Cooper & Sommer conducted a study on what early adopters of agile management are learning about the use of agile including the benefits and challenges. The researchers case studied six manufacturing organizations holding interviews with three employees at the senior level in each of the organizations. The organizations under study are: Chamberlain, Danfoss, Tetra Pak, LEGO Group, Honeywell and GE. They all use a hybrid approach involving stage-gate and agile.

Chamberlain is a US company that manufactures remote controlled home devices and has adopted the hybrid approach for four years at the time of the study. David Schuda, a business transformation leader at the company, said that adopting the hybrid model allowed the company to reduce time by 20-30%

because it contributed to increasing productivity and limiting the amount of work redone (Cooper and Sommer, 2018).

Danfos is a company that manufactures valves and fluid-handling equipment and have adopted the agile-stage-gate approach for two years at the time of the study. The company uses agile in development and with customers. Its senior director, Bo Bay Jorgensen said that adopting the hybrid model helped achieve "30% reduction in time to market" (Cooper & Sommer, 2018).

"Honeywell is a process controls firm whose development programs include both software and hardware" (Cooper & Sommer, 2018). Although its global technical director, Willem van der Werf, believed that it was still early to tackle "major improvements" (Cooper & Sommer, 2018), frequent communications with customers had a positive influence on projects "by changing the culture internally and yielding success in the market place with several pilot projects" (Cooper & Sommer, 2018).

Lego Group has been using the agile method for over ten years at its IT department but recently shifted to adopting the hybrid model in its manufacturing projects in the year 2015. Its management claims the model have been fruitful saying that "projects finish on time and exceed expected market success" (Cooper & Sommer, 2018).

Tetra Pak is one of the world's leading food processing and packaging solutions company. At the time of the study, it has been using the agile-stage-gate model for four years. Pontus Anderson, one of the interviewees at the company says

"we need to fail fast, and learn and adapt our approach along the way" (Cooper & Sommer, 2018).

Interviewees at the mentioned companies consented that adopting the hybrid approach achieved a 30% decrease in time to market and improved productivity by 30%. The study provides some valuable insights yet it is limited to a small sample size and lacks quantitative measures.

Later in the year 2019, Sommer conducted a study on how Lego Group implemented agile transformation at two of its large IT Departments. Although the study was not meant to highlight the benefits of the transformation, the researcher reiterated that adopting the agile model helped reduce time to deliver projects, made response to change faster and improved employee satisfaction and motivation. (Sommer, 2019).

Recently in 2020, FitzGerald conducted a study on the effectiveness of agile project management on time, scope, quality and cost titled "Examination of the application of agile project management in information technology service management". The study was qualitative, yet it could confirm that adopting agile in IT companies achieved remarkable results as it contributed to delivering products that satisfy the client, and helped "improving project processes concerning time, scope, cost and quality" (FitzGerald, 2020). Participants in the study highlighted an important fact which says that since in agile project management work was done incrementally and frequent feedbacks were received from customers as projects progress, this helped identify the scope of

the project more easily and earlier, so instead of doing something wrong and moving on without knowing, the continuous delivery of pieces of the project along with communication with clients helped identify errors earlier which eventually led to reducing wasted time. According to the same study, the decrease in wasted time meant a cost saving. In other words, by detecting the scope and errors earlier in the project, less time was spent on changes as compared to implementing changes at the end of the project as is the case with traditional project management, which meant less working billable hours. Regarding quality improvement, the study found that receiving feedback frequently and correcting on the go helped employees learn more quickly and improve the quality of the work done. The study also confirmed that the agile method helped overcome miscommunications with clients and within the team itself due to frequent meetings and communications (FitzGerald, 2020). Had the study been paired with quantitative research, the results would have been verified and would have provided a stronger basis for reference.

Vlad-Valentin Fireteanu conducted a case study on the benefits of using agile methodologies in designing and developing home automation products based on the Internet of Things (IOT). The study involves the implementation of an Iot home automation project using the agile approach. Stemming from the fact that the Iot field is characterized by high technological advancements with continuous updates and frequent changing requirements requested by the client, Fireteanu finds that adopting agile approaches helps deal more flexibly with

changes as compared to using the traditional waterfall method. According to the researcher, the agile approach allowed for more frequent testing and identification of errors which helped improve the quality of the delivered product, an advantage that was not applicable using the traditional approach. The incremental delivery of the product accompanied by more frequent communications with the client and stakeholders increased transparency and helped identify risks and mitigate them and adapt to change of requirements earlier in the project. It also helped identify the team capacity and better task allocations to meet deadlines in addition to meeting the client's expectations. The risk of outdated features and project failure was reduced as a result. Adopting the agile methodology contributed to better cost assessments, reduced the time to market supported by early releases, improved customer satisfaction and relationship, and provided a healthier work environment (Fireteanu, 2020). The study focused on one project in which the researcher was a team member which creates a probability of bias. If paired with case studies from other organizations or a quantitative study, the results would be measurable and the study more robust.

In a study recently published in 2021, Mohammad et al. conducted a survey on the effect of using agile methodologies on project performance in the IT sector in Pakistan. The study ended up with 176 respondents from different areas of Pakistan. The application of agile practices was found to have a positive effect on project performance in general. Breaking down the project into work units

with tasks being allocated to the competent employees helped achieving set goals with less obstacles along the way. Also, the choice of projects had a great impact such that organizations choose the projects which they find themselves competent enough to accomplish successfully. Flexibility and prioritization, being two important factors applied in the agile methodology, helped improve performance and reduce losses. The researchers found that adopting agile practices helped teams adapt and deal more efficiently with complexities while leadership competences played an important role in the efficiency and success of accomplishing complex projects (Muhammad et al., 2021). In conclusion, the study took into consideration project complexity as the only mediatory variable. Using other variables as well would have helped analyze the full impact of using agile project management.

Marcia Lensges, Timothy Kloppenborg and Frank Forte conducted a study in 2018 based on the fact that traditional project management is a “one size fits all approach” and that the reason why projects failed was that customers were not quite realistic and certain about their requirements and communication between them and the team was not sufficient to allow for quick feedback and problem solving. The study aimed at determining the agile behaviors that would highly contribute to the success of “traditionally managed project” (Lensges et al, 2018). The researchers began with setting a list of 106 behaviors that they detected through literature review and the opinion of experts in agile management. To trim the list down and be able to identify the most impactful

behaviors which if incorporated in traditional project management would positively impact the outcomes, they created a focus group of 10 experts in the field of agile project management. According to the study findings, although early planning would be beneficial, whether using traditional, hybrid or agile methods, it will be very essential and useful to incorporate the following agile behaviors to achieve better results: 1) adopting shorter cycles through producing chunks of the product which allows customers to "visualize the end product" (Lensges, 2018) and teams to receive a quick feedback; 2) "face-to-face communication" (Lensges, 2018) for exchanging thoughts and getting a quick feedback; 3) focusing on individuals and interactions instead of the process itself helps the customer and the teams to reach "answers more quickly in high complexity/high uncertainty endeavors" (Lensges et al, 2018); 4) focusing on "enabling teams" (Lensges et al, 2018) contributes to building a culture where teams are result-oriented and risks are early identified and mitigated; 5) discussing risks in "daily stand-up meetings and at the end of each iteration"(Lensges et al, 2018) to find solutions at an early stage; 6) developing and sharing the vision at an early stage. The product itself is the vision. Teams keep it in mind and work to achieve it; 7) producing the product at the "pace the team can produce" (Lensges et al, 2018). The team should be asked "what they can commit to end" when setting deadlines which "makes outcomes more predictable and can deliver value to the customer sooner" (Lensges et al, 2018); 8) "Maximizing the work not done" (Lensges et al, 2018). Identifying the next most important step according to the customer helps teams prioritize the work

that need to be done in order to get early feedback from the customer and "elaborate on the product" (Lensges et al, 2018) as they proceed. This helps the customer to see the "benefits of the product" (Lensges et al, 2018) and achieve a return on investment at an earlier stage; 9) focusing on "delivering value to the customer quickly" (Lensges et al, 2018) which helps teams to receive feedback quickly, set priorities as for what to execute next and improve the product throughout the process. According to the researchers, their study is "preliminary research" (Lensges et al, 2018) depending on literature reviews and the focus group's input which produced what they called "basic ideas" (Lensges et al, 2018). Pairing this research with a quantitative study involving a survey would be beneficial to verify results and produce more solid conclusions.

Ravaglia et al. conducted a study on the use of agile project management in software development in Brazil. The researchers collected data through a questionnaire. 21 experts with over 10 years of experience in the field of software development responded to the questionnaire. 72% of the respondents worked at large companies with over 99 employees whereas the rest worked at companies of either 50-99 employees or up to 9 employees. 81% of the respondents considered agile to be of significant importance. The respondents emphasized the importance of communication in the agile methodology and its contribution to the success of projects. They also agreed on the benefits of using agile management when it comes to the speed of delivery. 71% of respondents reported improved financial results due to the use of agile methods. The majority

of respondents believed that the agile method helped enhance team productivity, reduce learning time, improve quality and ease maintenance (Ravaglia et al., 2021). Although the study highlighted some of the benefits of using agile project management, it only involved 21 respondents and adopted the descriptive and context analysis rather than quantitative analysis which means further quantitative research needs to be conducted to be able to generalize the results.

A team of researchers, Zuzek et al., conducted a case study on the benefits of implementing agile practice in the industrial field, more exactly at a medium-sized Slovenian company that manufactures wire harness for the automotive industry. In March 2019, the company received a request to manufacture complex wire harness for a large internationally recognized enterprise. The project was believed to be highly risky "because the company had not yet collaborated with either the customer, the toolmaker or the equipment supplier, and there were also several new materials and technologies that the company had not yet worked with" (Zuzek et al., 2020). Therefore, it decided to adopt some agile practices to be able to mitigate risks and adopt to changes. The chosen agile practices involved "dedicated and co-located project team, daily stand-up meetings, active customer collaboration and weekly teleconferences, supplier involvement, and iterative and adaptive planning" (Zuzek et al., 2020). During the implementation of the project, the plan was changed several times to meet the requirements. Incremental production and frequent meetings and communication with the customer allowed for better identification of

requirements, early detection of problems and early problem solving in which the team and suppliers were highly collaborative and some parts were replaced which incurred more costs. The project was successfully completed in September 2019. The researchers concluded that the use of the agile practices improved communication, collaboration and stakeholders' satisfaction including the team, client, suppliers and top management. The project was completed on time with all requirements met. The head of the project noted that had the traditional method been used, not all the requirements would have been met. Although there was an increase in cost due to the problems faced and solved, the project met the budget. The adoption of the agile practices was found to have "reduced waste and rework rate" (Zuzek et al., 2020) and improved quality (Zuzek et al., 2020). The study adds to the body of knowledge regarding the use of agile practices in the industrial field, yet a more quantitative approach would be beneficial.

In their study, Ciric et al. found that adopting agile project management in innovation management and product development and in construction and real-estate, helped reduce costs and planning time, deal flexibly with customer requirements, and improve communication, productivity and effectiveness. On the other hand, adopting agile methods in education also helped improve productivity and quality of work, increase "collaboration and responsiveness" (Ciric et al., 2018) and deliver results more quickly. Agility also had a good impact in the field of services where it helped achieve higher customer

satisfaction, improve quality and speed of service and monitor and implement changes more flexibly (Ciric et al., 2018).

Estler et al. conducted a case study that involved more than 31 companies developing 66 projects in Europe, Asia and the Americans. Of the 66 projects, 36 were developed using the agile method and 30 were developed using the traditional structured method. The study aimed at comparing the results of using agile versus traditional project management within "globally distributed development teams" (Estler et al., 2013) in terms of the success of projects, cost reductions, team motivation and communication, the customer as well as "the emergence of critical issues" (Estler et al., 2013). The researchers collected data from questionnaires and interviews and conducted a quantitative and qualitative analysis as a result of which they found no significant difference between the impact of using agile and traditional methodologies in globally distributed teams. However, communication seemed to be harder when adopting the traditional approach, yet "cultural differences and ineffective management" (Estler et al., 2013) appeared to be "more severe" (Estler et al., 2013) when adopting agile approach. Nevertheless, the difference was statistically insignificant (Estler et al., 2013). Pairing quantitative with qualitative data was of high value to the study as the quantitative analysis could measure the insignificance of correlations and thus help the researchers conclude that the choice of agile or traditional approaches was an independent variable when it comes to project success, cost reductions, and communication, yet it failed to

report any findings regarding customer satisfaction although it is one of the very few if not the only study to conclude no statistical difference between project development using agile versus traditional methods.

A qualitative study conducted by Cao and Ramesh on 16 U.S. software development organizations which practiced agile project management in their projects emphasized the importance of face-to-face communications between developers and their customers allowing to reduce time and unnecessary requirements and documentations. The study found that this sort of communication can be challenging because it requires customers to: be available to hold frequent meetings with developers, have consensus between their involved groups for example when there is more than one customer representative, and trust the development team. It also found that organizations which adopted the traditional management approach had a problem trusting developers easily. 14 out of the 16 organizations studied stated that requirements are not predetermined at the start of the project but rather during the development process. As the project evolved, customers were able to identify their requirements more easily after each meeting. However, customers highlighted challenges including the inability to provide accurate time and schedule estimations due to the fact that the scope is ever changing during the course of development, problems caused by "minimal documentation" (Cao & Ramesh, 2008) when communication breakdown happens due for example to employee turnover and quick adjustments to the scope, and taking into

consideration major functional requirements and ignoring non-functional ones such as safety, maintenance, and performance on a larger-scale. Requirement prioritization takes place at the beginning of the agile development process which helps customers identify the business value early in the project. Agility allows for reprioritization at each cycle which helps customers to identify "business reasons for each requirement" (Cao & Ramesh, 2008) and developers to better understand customers' priorities and provide the needed requirements (Cao & Ramesh, 2008). The study is one of the few early exploratory studies which highlighted both benefits and challenges providing valuable insights on using agile through interviews with stakeholders at different levels.

In a study published in 2014, Kautz et al. case studied an organization with over 40 years of experience in IT software development employing around 3000 employees, 45 of which worked at the department under study. Eleven employees were interviewed, six of which were developers, four held leadership roles, and one worked in customer service. The purpose of the study was to highlight the impact of using agile methodology in an organization that recently shifted to agile project management. The organization under study had started using agile in 2011 and the department had finished three releases by the time of the study. The researchers found that the number of interruptions slightly decreased because the way employees viewed interruptions changed. Employees didn't view them as "disturbances" (Kautz et al., 2014) but rather a way to improve on the go. The team could easily meet deadlines after the shift to agile

due to the use of iterations, and the proper distribution and prioritization of tasks which helped them overcome the problem of spending several months developing an entire project and then having to start all over again due to errors or lack of resources for example. Interviewees also reported a reduced risk of doing unnecessary tasks due to iterations and short development cycles or sprints. “The respondents stated that they were now working more efficient because problems were solved within the teams and because they had better knowledge about the tasks” (Kautz et al., 2014). Less repetition of mistakes was also reported. Managers viewed agility to have improved employee performance. All these factors positively impacted productivity and efficiency (Kautz et al., 2014). The study was focused on one department within one organization and was based on oral interviews with employees which makes the risk of bias high. Had it been paired with more case studies involving more experienced employees in agile project management, the study would have been more robust.

Solinski and Petersen conducted a quantitative study on the benefits and limitations of adopting agile practices. 63 questionnaires were filled, 45 of which were fully completed but even uncomplete surveys were considered. All respondents were experienced practitioners from 22 different organizations with different sizes. Two sorts of benefits were studied: external and internal. External benefits refer to quality, time, cost, customer relationship and satisfaction regarding the end product. Internal benefits refer to benefits reaped

at the development organization itself such as knowledge and learning including collaboration, communication, adaptability, and employee satisfaction. Results showed that the use of agile practices even if combined with some traditional project management practices contributed to increasing value delivered, improving quality and enhancing the relationship with customers. Internally, results showed an improvement in knowledge and learning as well as employee satisfaction added to better adaptability and delivery of quality products due to frequent testing and incremental developments. When choosing to shift to using agile practices, it was recommended that the transition does not go in a complete wholistic manner as it might result in reducing quality. As limitations to the success of using agile practices, the study identified "professional skill-specific demands, scalability and lack of suitability for specific product domains" (Solinski & Petersen, 2014) as key limitations. The researchers recommended training and coaching along with choosing small teams instead of large ones to adopt agile approaches (Solinski & Petersen, 2014). Although the study was based on quantitative analysis, a bigger sample size study would help in better generalization of results.

Recker et al. conducted a field study at a large international retail company having around 1000 stores and over 180,000 employees. The aim of the study was to understand the relationship between agile methodologies and practices on one side and the team's responsiveness to customer requirements on the other. The researchers collected data through a set of three questionnaires

directed to staff working in software development. The purpose of using three questionnaires was to study the effect of agility on team responsiveness once the project kicks off, then mid-way through the process and at the end of the project. The first questionnaire was distributed once the project started. The second was distributed 3 months later and the third was distributed three months after that. The organization's IT department works on 2 types of projects: large projects which were implemented using the traditional waterfall method and small projects which were delivered faster using agile method. The department executes 2-3 large projects and over 10 small projects a year. It also uses the word agile to refer to iterative delivery of functional software and "frequent involvement of customers" (Recker et al., 2017) rather than a specific agile method. 71 participants responded to the three questionnaires and the data collected was used to conclude the results. The researchers found that adopting the agile approach contributes to the success of IT development projects yet "selecting the right practices from a portfolio of methodologies" can be considered as a challenge facing organizations trying to go agile (Recker et al., 2017). On the other hand, frequent customer involvement requires more effort from the team to respond and thus lowers their response efficiency. However, team response efficiency "contributes to process performance, customer satisfaction and software functionality" (Recker et al., 2017). Recker et al. also concluded that not only having a good team is important to the success of the project but also the choice of agile practices (Recker et al., 2017), yet the scope of the study could not go in depth regarding the specific practices that contribute

to success. In general, the study only questions the use of agile in one organization and the number of participants, being 71 only, is relatively low.

Several confirmed benefits were highlighted by Kaim et al. in their literature review-based study. Using agile project management helped lower transaction costs, reduce wasted time and error, improve productivity, commitment and communication within the team itself and with clients thus achieving higher customer satisfaction in environments characterized by high complexity and uncertainty (Kaim et al., 2019). However, according to the researchers, the application of agility can adversely affect transaction costs resulting in higher costs due to acceptance problems, yet adequate team training can mitigate the risk and help reach targets and harvest agile benefits more easily with enhanced abilities to respond to changes and more understanding of agility (Kaim et al. 2019). The study was based on literature review analysis rather than quantitative results.

In a study conducted in 2011 on 17 organizations which shifted to using agile, Conboy et al. found that the shift was beneficial to some organizations by helping them reduce costs, improve quality and achieve higher customer and stuff satisfaction whereas the shift was troublesome to others. The researchers found that the agile process exposes the weaknesses of the development as the continuous integrations and testing bring to light low-quality codes which affects the developers' self-esteem (Conboy et al., 2011). Also, the increased

social interaction with clients is a challenge since managers need to know what not to communicate to clients as some issues might cause sensitivities or expose confidential information. The study identified “performance evaluation criteria” and lack of adequate agile education as additional challenges (Conboy et al., 2011).

Frequent meetings as the product was evolving led to exposing the weaknesses and failures of some teams thus lowering their self-esteem. However, some organizations were capable of addressing this problem through allowing their team members to choose to discuss their problems openly during standup meetings or not to do so. Another organization had its developers document their concerns and any problems they are facing instead of exposing them directly in standup meetings. In nine cases, junior developers were put in teams with more experienced developers which allowed them to overcome showing their weaknesses and improve their skills (Conboy et al., 2011).

The same study found that adopting the agile method requires developers to master several skills other than development such as having good communication skills, quality assurance skills as well as skills related to customer satisfaction. Knowing that not every member of the team was able to master the entire set of skills, organizations had to pay a high cost to train employees thus incurring more costs while some employees were still talented in some areas and proved to be unable to master some other skills (Conboy et al., 2011).

Five out of the seventeen companies reported that although their teams had the needed skills to go agile, they still lacked motivation to do so thinking that the method is “complex and time-consuming” (Conboy et al., 2011). In order to encourage their staff to adopt agile, they shared with them some agile success stories. (Conboy et al., 2011).

Evaluating individual team members was another challenge faced in practicing agile according to the same study. Recruitment as well wasn’t easy as the needed set of skills in agile cannot be easily found in candidates and adopting the traditional evaluation criteria was insufficient when it comes to hiring personnel for agile projects (Conboy et al., 2011). The study highlighted several challenges as reported by senior managers through interviews conducted with them yet it failed to interview developers and lower-level employees whose insights would have been beneficial to add to the study as they worked daily on the agile projects.

Adopting agile project management in government and public sectors are also important and beneficial according to Nerurkar and Das because government projects “run over several years” and involve several “stakeholders, vendors and complexities” (Nerurkar, 2017). “Agile methodology can help engage stakeholders better, create faster usable products and services, monitor projects at a closer level and most importantly increase the confidence of citizens in the government “(Nerurkar, 2017).

Nerurkar and Das highlighted several challenges faced during the adoption of agile project management in government and public sectors. According to the study, “varying stakeholder perspectives” is one of the challenges faced. “The significant difference between the perception of project issues at the field level and at the senior government official level” resulted in challenges during the implementation. Another challenge was scope-related since the “effort and cost estimations” were “driven by the senior government officials rather than the actual time or cost required” this resulted in “lesser flexibility” during the implementation of the project. “Project planning, communication planning, change and stakeholder management” were other challenges (Nerurkar & Das, 2017)

Boehm and Turner identified working with life cycles, “managing variability in subsystems and teams”, “applying agile processes to legacy systems”, as well as specifying project requirements, as challenges faced in the application of agile project management (Boehm & Turner, 2005).

2.4 Conclusion

In brief, the existing literature highlights the importance of using agile project management, sheds some light on the challenges or limitations faced and provides few recommendations.

In general, adopting the agile practices helped companies reduce costs and wasted time by limiting the amount of work redone, identifying errors early in the project during the implementation process and reducing the time to market and in some cases allowing for faster return on investment. It also helped improve employee productivity.

Although the existing literature contributes to the body of knowledge, it is majorly shaped by qualitative research where case studies involve a small number of participants or organizations. Quantitative research tackling agile project management is still very few. For this reason, the current paper will look into the benefits of using agile practices through quantitative research. This shall add to the existing literature valuable insights on the effect of using agile project management on three aspects being cost reductions/savings, wasted time and employee productivity.

In order to observe the effect of agile processes on the mentioned aspects (cost savings, wasted time and employee productivity), this research proposes three main research questions:

- What is the effect of applying agile processes on the costs of a project?
- What is the effect of applying agile processes on wasted time during the implementation of projects?
- What is the effect of applying agile processes on employee productivity?

Accordingly, and based on the existing body of knowledge, 3 hypotheses were developed and formulated based on the existing theoretical and empirical literatures:

H1: Agile processes reduce the costs incurred throughout the delivery of a project

H2: Agile processes lead to less wasted time during the implementation of projects

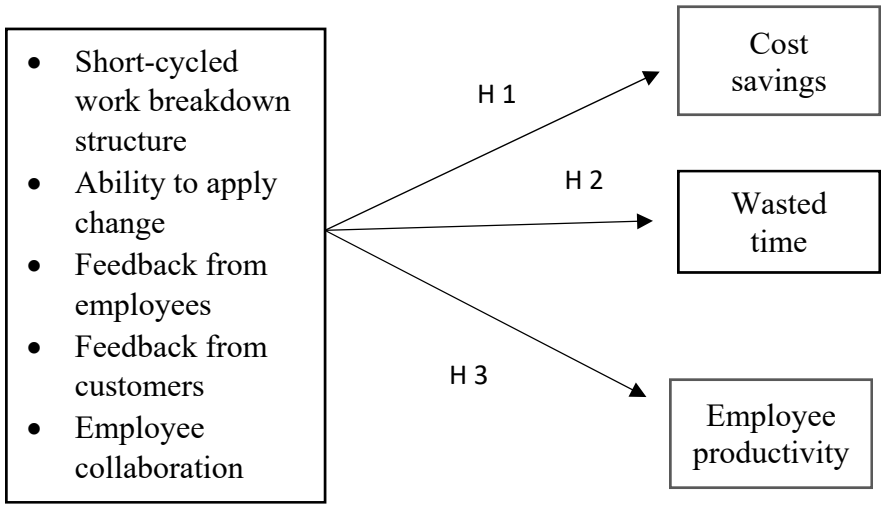
H3: The adoption of agile processes renders employees more productive

Since agile methodologies are mainly characterized by short-cycled work breakdown structures, ability to change, feedback from involved employees and customers along with team members' collaboration, the independent variables chosen for this research are: short-cycled work breakdown structure, ability to change, feedback from employees, feedback from customers, and employee collaboration.

In order to scrutinize the effect of adopting agile practices, the following three dependent variables are chosen for this research: 1) cost savings, 2) wasted time, 3) employee productivity.

The below figure 2.1 illustrates the conceptual framework of the research:

Figure 2.1 Conceptual framework



The following chapter will thoroughly discuss the adopted methodology.

Chapter 3

Procedure and Methodology

3.1. Introduction

This study aims at investigating if and how the application of agile processes can affect the costs and completion time that are associated with a project, in addition to the performance of involved employees. More specifically, agile processes are measured through five main characteristics, those being short-cycled work breakdown structure (WBS), ability to apply change, feedback from group members, feedback from customers, as well as employee collaboration. Following the review of literature and existing studies on Agile project management in the previous chapter, this current chapter will discuss the adopted research methodology. The following sections will subsequently go through the hypotheses, philosophical dimension and reasoning approach, description of variables, sample and data, method, as well as analysis framework. The final section will then feature a comprehensive summary of the whole chapter.

3.2. Research Questions and Hypotheses

In order to scrutinize the effect of agile processes on cost, wasted time, and productivity, this research proposes three main research questions:

- What is the effect of applying agile processes on the costs of a project?
- What is the effect of applying agile processes on wasted time during the implementation of projects?
- What is the effect of applying agile processes on employee productivity?

Accordingly, and based on the existing body of knowledge, 3 hypotheses were developed and formulated based on the existing theoretical and empirical literatures:

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H2: Agile processes lead to less wasted time during the implementation of projects.

H3: The adoption of agile processes renders employees more productive.

3.3 Philosophical Dimension and Reasoning Approach

Within social sciences, various epistemologies exist along the spectrum that are defined by the two extremes of positivism and phenomenology. Positivism can be simply defined as being grounded in purely scientific methods, which imply

that measurements should mostly be quantitative in nature. Moreover, it also advocates the usage of deductive approaches that aim at revalidating existing knowledge. In addition, it also targets large scale research and aims at generalizing findings. In contrast, phenomenology aims at interpreting social phenomena through in-depth case studies through interaction with subjects, that are usually qualitative in nature. Additionally, most interpretivists aim to inductively extract meaningful insights rather than to generalize findings (Trochim, 2006). This research is initiated from a post-positivist perspective, as the researcher is aware that full objectivity cannot be attained, but also recognizes the need to attain its highest levels. In this line, a quantitative deductive reasoning approach is used, along with an aim at extracting insights rather than generalizing. The hypotheses are deductively formulated based on the existing theoretical and empirical knowledge on agile project management, and the choice of quantitative methods is justified through facilitation in accessing the needed data.

3.4 Variables and Operationalization

3.4.1 Independent variables

Short-cycled work breakdown structure

As mentioned in the literature review, unlike traditional project management, the agile method adopts “short cycles of iterative and incremental delivery of

product features and continuous integration of code changes" (Dyba & Dingsoyr, 2015). Therefore, the three questions that aim to measure it focus on short cycles, task-orientation, functionality, collaboration, and refinement from high level to detailed.

Ability to apply change

The Agile Alliance defined agile as "the ability to create and respond to change (Agile Alliance, 2022). PMI defined agility as "the capability to quickly sense and adapt to external and internal changes to deliver relevant results in a productive and cost-effective manner" (PMI, Pulse of the Profession, 2017). Henceforth, the three questions that target this variable were focused on the ability to exert changes during the implementation stage, the reality if people were placed first in the change management structure (as opposed to processes), as well as if change was driven by team members in a proactive manner and not a reactive one to superiors' orders.

Feedback from employees

"While processes and tools are important, it is more important to focus on personal communication" (Kraft, 2018). "Agile processes emphasize the importance of effective informal communication among developers" (Estler et Al, 2014). Thus, the three questions that targeted this variable focused on whether group members provided constant and timely feedback to their

superiors, if written feedback was encouraged and provided constantly, and if one-on one feedback was often requested by superiors.

Feedback from customers

"Agile requirement analysis heavily relies on customer involvement to provide detailed requirements" (Ramesh et al., 2010). "Agile project management involves the study of completing tasks through iteration and communication across all departments and customers. When a task reaches completion, the client receives a notification to see if there are any necessary changes and then moves to the next task in the process" (Fitzgerald, 2019). Hence, the three questions that measured this variable investigated if customer feedback was consistently sourced at key project milestones, if it was integrated in the next sprint before due dates, as well as if customer feedback was recorded and shared with all project stakeholders.

Employee collaboration

According to the Agile Alliance, "one thing that separates Agile from other approaches to software development is the focus on the people doing the work and how they work together. Solutions evolve through collaboration between self-organizing cross-functional teams utilizing the appropriate practices for their context" (Agile Alliance, 2022). In this line, the three questions that measured this variable focused whether team members followed a clear communication protocol to maintain high collaboration, they displayed high

levels of self-motivation, and if they regularly carried out a 360-degree internal feedback session.

3.4.2 Dependent variables

Cost savings

"Conforto et al. adopted the following definition of APM: "an approach based on a set of principles, whose goal is to render the process of project management simpler, more flexible and iterative in order to achieve better performance (cost, time, and quality) with less management effort and higher levels of innovation and added value for the customer" (Zuzek et al., 2020). "According to (Abdalhamid & Mishra, 2017), software development organizations adopt agile methods as a solution for fast software delivery, with high quality, reduced deadlines, presenting adequate responses to problems and offering quick, better and low-cost solutions, in a constantly changing environment" (Ravaglia et al., 2021). According to Nazir et al., "survey on five different aspects related to agile practices has shown that companies have successfully adopted agile and experienced reduction in cost and increased productivity with improved stakeholder satisfaction" (Nazir et al., 2016).

Wasted time

"Agile frameworks attempt to improve operating efficiency, throughput, quality, customer satisfaction, reduced overhead, greater alignment with

business priorities, and shorter time to market" (Bennett, 2019). "Reducing the cycle time for software development is frequently considered the highest priority in agile projects. A lengthy requirements analysis phase is considered to hinder the speed of development, and therefore, lightweight practices such as prototyping are adopted to quickly build an application" (Ramesh at al., 2010).

Employee productivity

"Agile provides a number of additional benefits, including increased team productivity and employee satisfaction" (Kraft, 2018). According to Baruah and Ashima (2012), small and medium Indian enterprises are using agile methodologies in order to "improve quality and productivity" (Baruah & Ashima, 2012). Schuda, a business transformation leader at the US company, Chamberlain, said that adopting the hybrid model allowed the company to reduce time by 20-30% because it contributed to increasing productivity and limiting the amount of work redone (Cooper and Sommer, 2018). In their study, Ciric et al. found that adopting agile project management in innovation management and product development and in construction and real-estate, helped reduce costs and planning time, deal flexibly with customer requirements, and improve communication, productivity and effectiveness. On the other hand, adopting agile methods in education also helped improve productivity and quality of work, increase "collaboration and responsiveness" (Ciric et al., 2018).

3.5. Method

3.5.1 Sampling procedures

In order to collect the needed data and obtain access to target groups in Lebanon, a quantitative survey was electronically sent to employees working in different software development companies across Lebanon. In order to provide meaningful answers to the research questions, the selected sample consisted of project managers, product managers, supervisors, team leaders and developers who are familiar with agile processes and declared applying them in the implementation of their IT projects. In order to fulfill the requirements of the study, a random sample of 353 observations was sourced, as it guarantees quantitative feasibility at a 95% confidence level, especially that the study does not aim at generalizing the expected findings.

3.5.2 Instrumentation

A questionnaire was created based on the existing theoretical foundations that define agile processes, as it allows for the capturing of the multiple aspects of agile project management. The main reason for opting to follow a quantitative approach is the ability to access the needed number of observations within the spatio-temporal limitations of the research, as well as the imposed restrictions of the ongoing COVID pandemic.

The first stage of data collection focused on piloting the questionnaire, in order to establish inter-rater reliability. Therefore, the survey was sent to 12 project managers and university professors in order to provide insights in regards to the content and clarity of the questions. The following phase consisted of electronically sharing the questionnaire with project and product managers, supervisors, team leaders, and developers working at IT software development companies in Lebanon in order to obtain primary data. The respondents were targeted through their LinkedIn accounts because such accounts not only provide an easy way to contact them but also provides good insights on the roles and companies they work at. Having explained the purpose of the study as well as guaranteed confidentiality throughout the introductory section, the first section of the questionnaire targeted the five independent variables under agile processes, those being:

- X1: Short cycled work breakdown structure - Questions 1-3
- X2: Change adaptability/flexibility - Questions 4-6
- X3: Feedback from group members - Questions 7-9
- X4: Feedback from customers - Questions 10-12
- X5: Employee collaboration - Questions 13-15
- Y1: Cost savings - Question 16
- Y2: Wasted time - Question 17
- Y3: Employee productivity – Question 18

Measurement was carried out via the use of quasi-metric scales ranging from 1 “strongly disagree” (SD) to 7 “strongly agree” (SA).

The second section included the questions that targeted the three dependent variables. Cost savings were expressed throughout 7 equal categories ranging from 0% to more than 25%, Wasted time was measured via 7 equal categories spanning from 0 days to more than 150 days. Lastly, productivity was measured by quasi-metric scales ranging from 1 “strongly disagree” (SD) to 7 “strongly agree” (SA). All items and their respective measurements are

The average needed time to complete the questionnaire by the 12 participants in the pilot study was estimated to be around 6-8 minutes, therefore providing a suitable time-frame that can result in acceptable response rates. The full questionnaire is hereby included in the appendix.

3.5.3 Analysis framework

Data was initially organized in excel sheets, and was then entered and analyzed via the use of SPSS as a software tool. SPSS was used as a straight-forward tool for the purpose of analyzing the collected statistical data in-depth. Normality statistics were produced by mainly calculating Skewness and Kurtosis, whereby the first should range between -1 and +1, and the second between -3 and +3. In other words, skewness and kurtosis were used to assure that the data were normally and symmetrically distributed. Reliability of scales was measured

through Cronbach alpha, which should score 0.7 and above. Since the answers of the questions in the questionnaire are measured through a scale ranging from 1 “strongly disagree” to 7 “strongly agree”, Cronbach alpha is the best way to measure if the scales used were reliable. Correlations were checked and measured using Pearson correlation at a 95% CI. Pearson correlation measures the strength of the linear relationship between two variables, as well as significance within a well-defined confidence interval. It was used to check whether variables are positively, negatively or not correlated and how strongly or weakly correlated the variables are. Causality was tested via classical linear regression modeling (CLRM), as the sample was random and normally distributed, as well as items showed significance levels below the threshold of 0.05. The regression analysis was used to mathematically study the impact of the independent variables on the dependent variables. It is a process used to observe the relationship between independent and dependent variables and infer the casual relationship between them. The main choice behind regression as being the optimal method of analysis can be traced to its ability of establishing whether or not causality exists between the independent variables on one hand and the dependent on the other. Additionally, it also provides weights (Beta), which shows the relative effect of the variables that are included in the model. Moreover, it can also explain the amount of variation in the dependent variable that is caused by the included significant variables using the coefficient of determination R square. Lastly, it also enables the comparison of R square with adjusted R square, in order to know if adding more variables to the model would

enhance its explanatory power. Having run the regression model using the stepwise option, multi-collinearity was checked using VIF and tolerance levels in order to verify if there are any causality issues across the independent variables. Autocorrelation was checked through the Durbin Watson score, in order to make sure that residuals are not autocorrelated. To add, normality of errors was checked through the PP plot, which shows their dispersion along the normal probability plot. Finally, correlation between residuals and independent variables was checked using Pearson correlation in order to make sure that there are not significant correlations at the 5% level.

3.6 Conclusion

This chapter introduced the framework for the data analysis leading to the derivation of results and conclusion of findings. It started with the research questions that led to the formulation of the hypotheses. Then, it identified the hypotheses that are to be measured, along with the independent and dependent variables. It also provided a description of the used sample, and explained the data collection procedure, the adopted philosophical and reasoning approach, as well as the analysis framework.

In summary, the research aims at investigating if and how agile processes reduce cost and wasted time, as well as positively affect employee productivity. Epistemologically, the research is grounded in post-positivism, where reasoning follows a deductive approach in the formulation of hypotheses.

Methodologically, a quantitative questionnaire is employed, in order to access the needed data collected from project managers, product managers, supervisors, team leaders and developers working at Lebanese IT companies. In this line, this chapter's contribution can be well-defined as the logic that drives this research. It identifies the philosophical position and epistemology, which drives the methodology, reasoning approach, and method. Alternatively, if the researcher was pillared upon a different epistemology, then different methods and reasoning approaches may have been plausibly applied.

The following chapter will be dedicated to the results and analysis of findings, where all the statistical tests that were conducted will be featured, alongside a detailed analysis of the obtained findings.

Chapter 4

Findings

4.1 Introduction

This chapter is dedicated to the statistical results that were obtained following the collection of 353 observations. In detail, it initially discusses descriptive results, and then progresses to inferential statistics. It also analyzes the obtained findings, which allows for the testing of hypotheses. Lastly, the final section concludes with a comprehensive summary and introduces the chapter to follow.

4.2 Descriptive statistics

As shown in Table 4.1, the skewness and kurtosis values for all independent variables are within the acceptable range of $-1<S<1$ and $-3<K<3$, and therefore implying a normal distribution. Moreover, the respective means and standard deviations for the variables WBS, change flexibility, feedback from employees, feedback from customers, and collaboration are (5.4079; 1.02330), (5.1303; 1.03384), (4.9764; 1.19411), (5.2823; 1.24845), and (5.2833; 1.10683). The means indicate that on average, respondents were more inclined to describe their processes as having slightly higher than average scores. Moreover, the standard deviations indicate that on average, the observations were closely to moderately dispersed from the means.

Table 4.1: Descriptive statistics for independent variables

Statistics

		WBS	Change	Feedback E	Feedback C	Collaboration
N	Valid	353	353	353	353	353
	Missing	0	0	0	0	0
Mean		5.4079	5.1303	4.9764	5.2823	5.2833
Std. Deviation		1.02330	1.03384	1.19411	1.24845	1.10683
Skewness		-.838	-.408	-.654	-.971	-.573
Std. Error of Skewness		.130	.130	.130	.130	.130
Kurtosis		1.290	.142	.669	1.367	.264
Std. Error of Kurtosis		.259	.259	.259	.259	.259
Minimum		1.00	1.67	1.00	1.00	1.67
Maximum		7.00	7.00	7.00	7.00	7.00

As for the dependent variables, the skewness and kurtosis values for all dependent variables are within the acceptable range of $-1<S<1$ and $-3<K<3$, and therefore also implying a normal distribution.

Table 4.2: Descriptive statistics for dependent variables.

Descriptive Statistics

	N	Min	Max	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Cost Savings	353	1	7	5.08	1.201	-.668	.13	.534	.259
Wasted Time	353	1	6	3.30	1.243	.173	.13	-.492	.259
Productivity	353	1	7	5.3569	1.16168	-.650	.13	.479	.259
Valid N	353								

4.3 Reliability Analysis

In order to check and establish the reliability of the scales, Cronbach alpha was calculated and showed a coefficient of 0.852>0.7, and therefore indicated that the scales are sufficiently reliable as shown in Table 4.3.

Table 4.3: Reliability of scales

Reliability Statistics

Cronbach's Alpha	N of Items
.852	15

4.4 Correlations

As shown in the below Table 4.4, all independent variables are significantly and positively correlated to cost savings at the 99% confidence level. The correlation coefficients and significance for each of the variables are as follows. Short-cycled work breakdown structure (0.782;0.000), Flexibility to change (0.630; 0.000), Feedback from employees (0.380; 0.000), Feedback from customers (0.356; 0.000), and collaboration (0.468; 0.000).

Table 4.4: Pearson correlation/ Cost savings

Correlations

		WBS	Change	Feedback E	Feedback C	Collaboration	Cost Savings
Cost Savings	Pearson Correlation	.782**	.630**	.380**	.356**	.468**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	353	353	353	353	353	353

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

As shown in the below Table 4.5, all independent variables are significantly and negatively correlated to wasted time at the 99% confidence level. The correlation coefficients and significance for each of the variables are as follows. Short-cycled work breakdown structure (-0.672;0.000), Flexibility to change (-0.568; 0.000), Feedback from employees (-0.321; 0.000), Feedback from customers (-0.326; 0.000), and collaboration (-0.392; 0.000)

Table 4.5: Pearson correlation/ Savings in wasted time

Correlations

		WBS	Change	FeedbackE	FeedbackC	Collaboration	WastedTime
Wasted Time	Pearson Correlation	-.672**	-.568**	-.321**	-.326**	-.392**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	353	353	353	353	353	353

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

As shown in the below Table 4.6, all independent variables are significantly and positively correlated with employee productivity at the 99% confidence level. The correlation coefficients and significance for each of the variables are as follows. Short-cycled work breakdown structure (0.663;0.000), Flexibility to change (0.563; 0.000), Feedback from employees (0.400; 0.000), Feedback from customers (0.417; 0.000), and collaboration (0.592; 0.000).

Table 4.6: Pearson correlation/ Employee productivity

Correlations

		WBS	Change	Feedback E	Feedback C	Collaboration	Productivity
Productivity	Pearson Correlation	.663**	.563**	.400**	.417**	.592**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	353	353	353	353	353	353

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

4.5 Regression analysis

Causality between the independent variables and each of the three dependent variables was tested via multiple regression modelling as shown below:

$$Y= \alpha + \beta1.X1 + \beta2.X2 + \beta3.X3+ \beta4.X4 + \beta5X5+ \varepsilon$$

Where:

α = the intercept;

β = the regression coefficients;

ε = the error term.

Normality was ensured by having kurtosis and skewness scores within the acceptable ranges, and the independent variables showed significant correlations with the dependent ones. Having ran the models on SPSS, the obtained results are shown as follows.

4.5.1 Model 1/Cost savings

As shown in Table 4.7, there was no significance at the 95% confidence interval in any of the variables: feedback from employees 0.680, feedback from customers 0.745 and collaboration 0.466. Therefore, we ran the regression model again excluding the mentioned variables.

Table 4.7: Coefficients/cost savings

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-.570	.244		-2.336	.020
	WBS	.716	.050	.610	14.333	.000
	Change	.287	.047	.247	6.098	.000
	FeedbackE	.015	.037	.015	.413	.680
	FeedbackC	.011	.034	.012	.326	.745
	Collaboration	.031	.043	.029	.730	.466

a. Dependent Variable: Cost Savings

As shown in Table 4.8, the coefficient of determination (R square) showed 0.655, which implies that 65.5% of the variations in the dependent variable cost savings are caused by the independent variables short-cycled work breakdown structure and flexibility to change. The remaining 34.5% of the variations in the dependent variable cost savings could be caused by other independent variables not studied in this research such as prioritizing features and limiting them to the most necessary to develop a useful product. Also in some cases, the adoption of agile may have not showed any significant or evident reduction in costs. Moreover, R square did not differ by more than 10% from adjusted R square (0.653), hence indicating that the explanatory power of the model would not improve if more variables were added. Furthermore, the Durbin-Watson score

of 1.937 is close to 2 (between 1.9 and 2.1), and therefore suggests that there is no autocorrelation of the errors.

Table 4.8: Model 1/cost savings

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.782[a]	.611	.610	.750	
2	.809[b]	.655	.653	.707	1.937

a. Predictors: (Constant), WBS

b. Predictors: (Constant), WBS, Change

c. Dependent Variable: Cost Savings

As shown in the below table 4.9, there is a significant variation in the dependent variable at the 1% level.

Table 4.9: ANOVA/cost savings

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	310.396	1	310.396	551.970	.000[b]
	Residual	197.383	351	.562		
	Total	507.779	352			
2	Regression	332.723	2	166.361	332.616	.000[c]
	Residual	175.056	350	.500		
	Total	507.779	352			

a. Dependent Variable: Cost Savings

b. Predictors: (Constant), WBS

c. Predictors: (Constant), WBS, Change

As displayed in Table 4.10, the beta for short-cycled WBS is 0.738;0.000, and that of change 0.301;0.000, and thus signifying that the largest impact on the dependent variable.

Table 4.10: Coefficients/cost savings

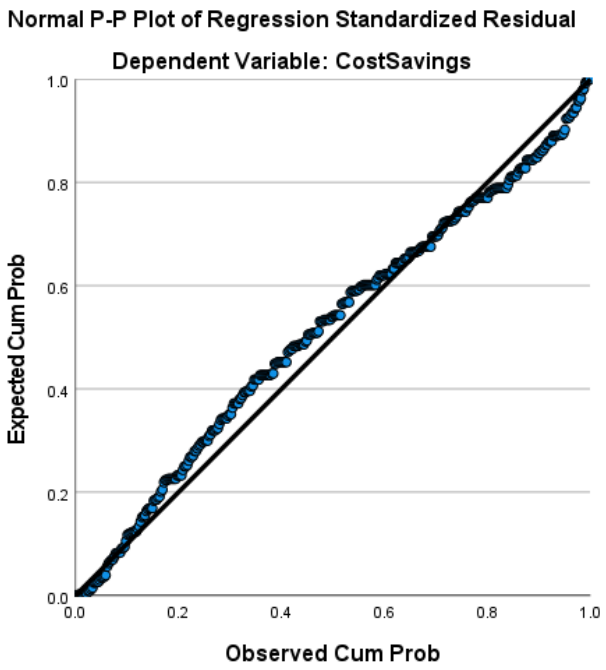
Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
Constant	-.460	.220		-2.087	.038		
WBS	.738	.046	.629	16.196	.000	.653	1.531
Change	.301	.045	.259	6.681	.000	.653	1.531

a. Dependent Variable: Cost Savings

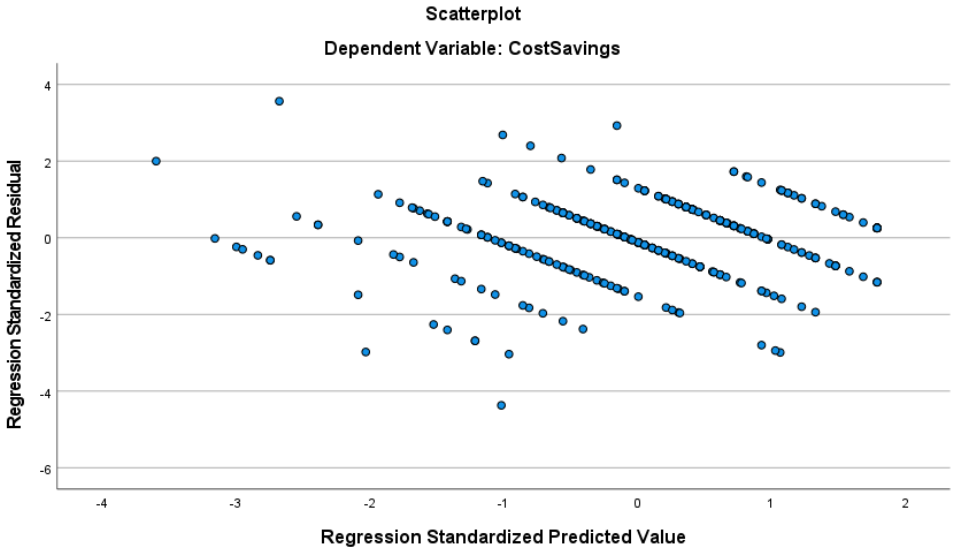
As shown in the below figure 4.1, residuals (errors) are dispersed along the normal distribution curve, hence implying that they are normally distributed.

Figure 4.1: P-P plot for standardized residuals/cost savings



Furthermore, the below Figure 4.2 shows that residuals do not follow a clear pattern, as the dots are scattered throughout the plot. In this line, there is no heteroscedasticity issues and the errors are deemed as homoscedastic.

Figure 4.2: Scatterplot/cost savings



Lastly and as shown in the below table 4.11, the Pearson correlation matrix asserts that there are no significant correlations between any of the independent variables with the standardized residuals.

Table 4.11: Correlation/cost savings residuals

Correlations

		WBS	Change	Feedback E	Feedback C	Collaboration	Standardized Residual
WBS	Pearson Correlation	1	.589**	.402**	.404**	.519**	.000
	Sig. (2-tailed)		.000	.000	.000	.000	1.000
	N	353	353	353	353	353	353
Change	Pearson Correlation	.589**	1	.411**	.330**	.450**	.000
	Sig. (2-tailed)	.000		.000	.000	.000	1.000
	N	353	353	353	353	353	353
Feedback E	Pearson Correlation	.402**	.411**	1	.339**	.453**	.034
	Sig. (2-tailed)	.000	.000		.000	.000	.526
	N	353	353	353	353	353	353
Feedback C	Pearson Correlation	.404**	.330**	.339**	1	.384**	.028
	Sig. (2-tailed)	.000	.000	.000		.000	.601
	N	353	353	353	353	353	353
Collaboration	Pearson Correlation	.519**	.450**	.453**	.384**	1	.043
	Sig. (2-tailed)	.000	.000	.000	.000		.421
	N	353	353	353	353	353	353
Standardized Residual	Pearson Correlation	.000	.000	.034	.028	.043	1
	Sig. (2-tailed)	1.000	1.000	.526	.601	.421	
	N	353	353	353	353	353	353

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

4.5.2 Model 2/Wasted time

As shown in Table 4.12, there was no significance at the 95% confidence interval in any of the variables: feedback from employees 0.986, feedback from customers 0.403 and collaboration 0.990. Therefore, we ran the regression model again excluding the mentioned variables.

Table 4.12: Coefficients/Wasted time

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.402	.306		27.490	.000
	WBS	-.614	.063	-.505	-9.814	.000
	Change	-.310	.059	-.258	-5.262	.000
	Feedback E	.001	.047	.001	.018	.986
	Feedback C	-.036	.043	-.036	-.838	.403
	Collaboration	-.001	.054	-.001	-.013	.990

a. Dependent Variable: Wasted Time

As shown in Table 4.13, the coefficient of determination showed 0.497, which implies that 49.7% of the variations in the dependent variable wasted time are caused by the independent variables short-cycled work breakdown structure and flexibility to change. The remaining 50.3% of the variations in the dependent

variable wasted time could be caused by other variables not studied in this research such as less documentation and early identification of errors. Moreover, R square did not differ by more than 10% from adjusted R square (0.494), hence indicating that the explanatory power of the model would not improve if more variables were added. Furthermore, the Durbin-Watson score of 1.959 is close to 2 (between 1.9 and 2.1), therefore suggests that there is no autocorrelation of the errors.

Table 4.13: Model 2/Wasted time

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.672[a]	.451	.450	.922	
2	.705[b]	.497	.494	.885	1.959

a. Predictors: (Constant), WBS

b. Predictors: (Constant), WBS, Change

c. Dependent Variable: Wasted Time

As shown in the below table 4.14, there is a significant variation in the dependent variable at the 1% level.

Table 4.14: ANOVA/Wasted time

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	245.652	1	245.652	288.841	.000[b]
	Residual	298.518	351	.850		
	Total	544.170	352			
2	Regression	270.253	2	135.126	172.659	.000[c]
	Residual	273.917	350	.783		
	Total	544.170	352			

a. Dependent Variable: Wasted Time

b. Predictors: (Constant), WBS

c. Predictors: (Constant), WBS, Change

As displayed in Table 4.15, the beta for WBS is -0.628;0.000, and that of change -0.316;0.000, and thus signifying that the largest impact on the dependent variable of wasted time was that of WBS. Furthermore, this implies that wasted time is significantly and negatively affected by the variables WBS and flexibility to change at the 1% level. The Variance inflation factor (VIF) is below 10, and the tolerance exceeds the minimum acceptable value of 0.1, therefore implying that there are no multicollinearity problems across the independent variables.

Table 4.15: Coefficients/Wasted time

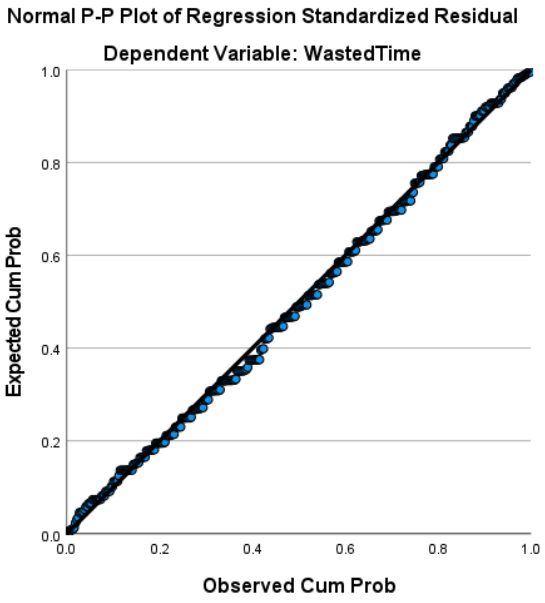
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	T	Sig.	Tolerance	VIF
1	(Constant)	7.715	.264		29.184	.00		
	WBS	-.816	.048	-.672	-16.995	.00	1.00	1.000
2	(Constant)	8.320	.276		30.189	.00		
	WBS	-.628	.057	-.517	-11.015	.00	.653	1.531
	Change	-.316	.056	-.263	-5.607	.00	.653	1.531

a. Dependent Variable: Wasted Time

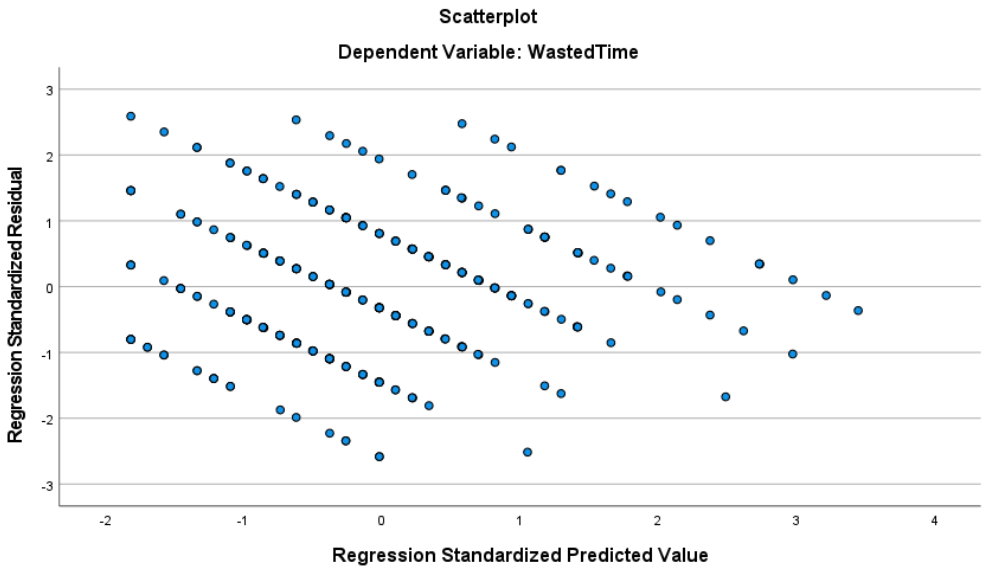
As shown in the below figure 4.3, residuals are dispersed along the normal distribution curve, hence implying that they are normally distributed.

Figure 4.3: P-P plot for standardized residuals/Wasted time



Furthermore, the below Figure 4.4 shows that residuals do not follow a clear pattern as the dots are scattered throughout the plot. In this line, there is no heteroscedasticity issues and the errors are deemed as homoscedastic.

Figure 4.4: Scatterplot/Wasted time



Lastly and as shown in the below table 4.16, the Pearson correlation matrix asserts that there are no significant correlations between any of the independent variables with the standardized residuals.

Table 4.16: Correlation/Wasted time residuals

Correlations

		WBS	Change	Feedback E	Feedback C	Collaboration	Standardized Residual
Standardized Residual	Pearson Correlation	.000	.000	-.007	-.042	-.008	1
	Sig. (2-tailed)	1.000	1.000	.895	.431	.877	
	N	353	353	353	353	353	353

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

4.5.3 Model 3/Productivity

As shown in Table 4.17, there was no significance at the 95% confidence interval in the variable feedback from employees 0.622. Therefore, we ran the regression model again excluding the mentioned variable.

Table 4.17: Coefficients/Productivity

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.037	.269		-.136	.892
	WBS	.414	.055	.365	7.537	.000
	Change	.207	.052	.185	4.002	.000
	Feedback E	.020	.041	.021	.494	.622
	Feedback C	.089	.038	.096	2.364	.019
	Collaboration	.287	.047	.273	6.062	.000

a. Dependent Variable: Productivity

As shown in Table 4.18, the coefficient of determination showed 0.556, which implies that 55.6% of the variations in the dependent variable productivity are caused by the independent variables short-cycled work breakdown structure, flexibility to change, collaboration and feedback from customers. The remaining 44.4% of the variations in the dependent variable productivity could be caused by other independent variables not mentioned in this research such as factors pertaining to the companies HR policies, for instance, not giving good incentives, time off, high wages etc. Moreover, R square did not differ by more than 10% from adjusted R square (0.0.551), hence indicating that the explanatory power of the model would not improve if more variables were added. Furthermore, the Durbin-Watson score of 1.956 is close to 2 (between

1.9 and 2.1), therefore suggests that there is no autocorrelation of the errors.

Table 4.18: Model 3/Productivity

Model Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.663[a]	.439	.437	.87128	
2	.724[b]	.523	.521	.80419	
3	.740[c]	.548	.544	.78446	
4	.745[d]	.556	.551	.77884	1.956

a. Predictors: (Constant), WBS

b. Predictors: (Constant), WBS, Collaboration

c. Predictors: (Constant), WBS, Collaboration, Change

d. Predictors: (Constant), WBS, Collaboration, Change, Feedback C

e. Dependent Variable: Productivity

As shown in the below table 4.19, there is a significant variation in the dependent variable at the 99% confidence level

Table 4.19: ANOVA/Productivity

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	208.570	1	208.570	274.748	.000[b]
	Residual	266.455	351	.759		
	Total	475.025	352			
2	Regression	248.674	2	124.337	192.258	.000[c]
	Residual	226.351	350	.647		
	Total	475.025	352			
3	Regression	260.259	3	86.753	140.976	.000[d]
	Residual	214.766	349	.615		
	Total	475.025	352			
4	Regression	263.931	4	65.983	108.776	.000[e]
	Residual	211.094	348	.607		
	Total	475.025	352			

a. Dependent Variable: Productivity

b. Predictors: (Constant), WBS

c. Predictors: (Constant), WBS, Collaboration

d. Predictors: (Constant), WBS, Collaboration, Change

e. Predictors: (Constant), WBS, Collaboration, Change, Feedback C

As displayed in Table 4.20, the beta for WBS is 0.417;0.000, collaboration 0.293;0.000, change 0.212;0.000, and Feedback from customers 0.092;0.000, and thus respectively reflecting the impact from largest to smallest on the dependent variable of productivity. Moreover, this implies that performance is significantly and positively affected by the variables short-cycled WBS, collaboration, flexible change, and collaboration at the 1% level. The Variance inflation factor (VIF) is below 10, and the tolerance exceeds the minimum

acceptable value of 0.1, therefore implying that there are no multicollinearity problems across the independent variables.

Table 4.20: Coefficients/Productivity

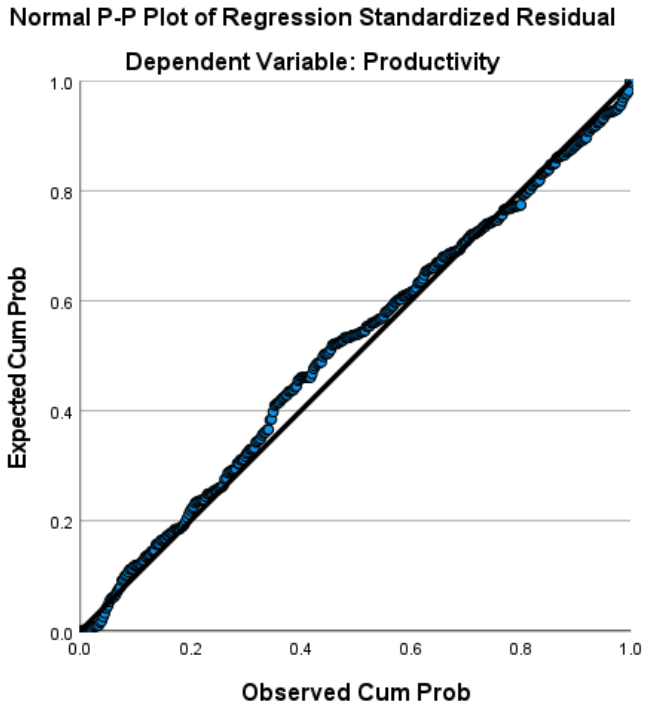
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	T	Sig.	Tolerance	VIF
1	(Constant)	1.289	.250		5.160	.000		
	WBS	.752	.045	.663	16.576	.000	1.000	1.000
2	(Constant)	.486	.252		1.930	.054		
	WBS	.552	.049	.486	11.271	.000	.731	1.368
	Collaboration	.357	.045	.340	7.875	.000	.731	1.368
3	(Constant)	.154	.258		.598	.550		
	WBS	.443	.054	.390	8.203	.000	.572	1.747
	Collaboration	.316	.045	.301	6.988	.000	.699	1.430
	Change	.222	.051	.198	4.339	.000	.625	1.601
4	(Constant)	-.016	.265		-.059	.953		
	WBS	.417	.055	.367	7.617	.000	.550	1.817
	Collaboration	.293	.046	.279	6.390	.000	.670	1.492
	Change	.212	.051	.188	4.155	.000	.620	1.612
	Feedback C	.092	.037	.099	2.460	.014	.789	1.267

a. Dependent Variable: Productivity

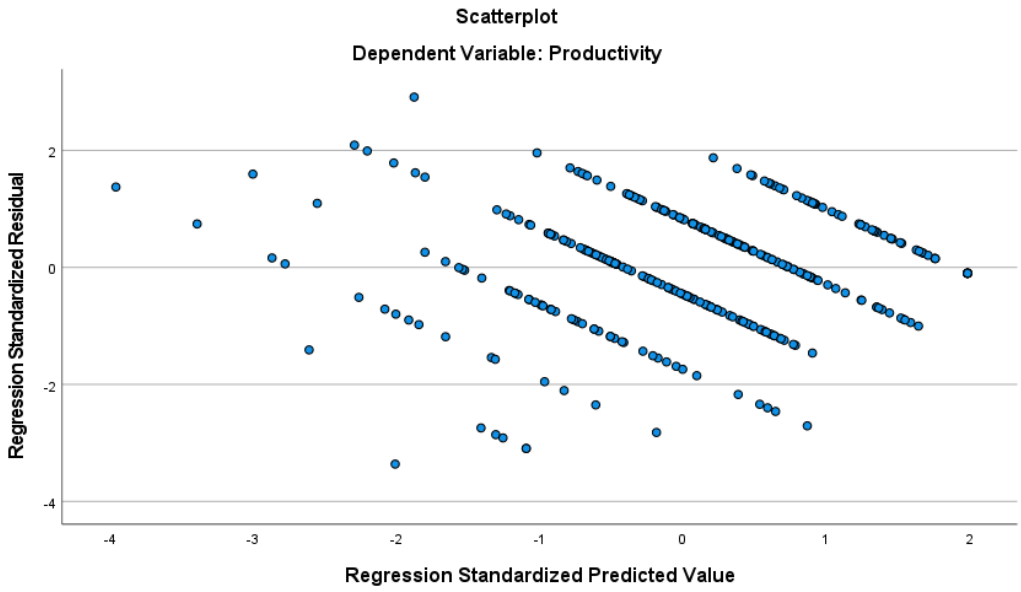
As shown in the below figure 4.5, residuals are dispersed along the normal distribution curve, hence implying that they are normally distributed.

Figure 4.5: P-P plot for standardized residuals/Productivity



Furthermore, the below Figure 4.6 shows that residuals do not follow a clear pattern as the dots are scattered throughout the plot. In this line, there is no heteroscedasticity issues and the errors are deemed as homoscedastic.

Figure 4.6: Scatterplot/Productivity



Lastly and as shown in the below table 4.21, the Pearson correlation matrix asserts that there are no significant correlations between any of the independent variables with the standardized residuals.

Table 4.21: Correlation/Productivity

Correlations

		WBS	Change	Feedback E	Feedback C	Collaboration	Standardized Residual
WBS	Pearson Correlation	1	.589**	.402**	.404**	.519**	.000
	Sig. (2-tailed)		.000	.000	.000	.000	1.000
	N	353	353	353	353	353	353
Change	Pearson Correlation	.589**	1	.411**	.330**	.450**	.000
	Sig. (2-tailed)	.000		.000	.000	.000	1.000
	N	353	353	353	353	353	353
FeedbackE	Pearson Correlation	.402**	.411**	1	.339**	.453**	.022
	Sig. (2-tailed)	.000	.000		.000	.000	.674
	N	353	353	353	353	353	353
FeedbackC	Pearson Correlation	.404**	.330**	.339**	1	.384**	.000
	Sig. (2-tailed)	.000	.000	.000		.000	1.000
	N	353	353	353	353	353	353
Collaboration	Pearson Correlation	.519**	.450**	.453**	.384**	1	.000
	Sig. (2-tailed)	.000	.000	.000	.000		1.000
	N	353	353	353	353	353	353
Standardized	Pearson Correlation	.000	.000	.022	.000	.000	1
	Sig. (2-tailed)	1.000	1.000	.674	1.000	1.000	
	N	353	353	353	353	353	353

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

4.6 Discussion of the findings

The aforementioned results show that adopting short-cycled work breakdown structures has the greatest impact on the three aspects: cost savings, reduction in wasted time, and improved productivity. Adopting short-cycled WBS and adaptability to change have a significant effect on cost reductions. These results are consistent with the existing literature which already states that agile methods are characterized by using short-cycled WBS/sprints and flexibility to change. For example, according to Nazir et al., "survey on five different aspects related to agile practices has shown that companies have successfully adopted agile and experienced reduction in cost and increased productivity with improved stakeholder satisfaction" (Nazir et al., 2016). Using short-cycled WBS allows for iterative and incremental delivery of functional products/prototypes, prioritization of requirements, internal testing at an early stage of the development process, early and continuous feedback from customers, reduction or cutting off of unnecessary requirements and early identification of bugs or errors. When paired with flexibility to change, it allows for fixing bugs/errors at an early stage and not implementing unnecessary requirements at a later stage. Eventually this leads to reducing unnecessary costs, thus contributing to cost savings. In this line, the hypothesis H1: Agile processes reduce the costs incurred throughout the delivery of a project is accepted.

On the other hand, the results show that adopting short-cycled WBS and being more flexible to change negatively affect wasted time which implies that they both lead to a reduction in wasted time. Again, these findings match the existing literature. For instance, according to Ramesh et al., "reducing the cycle time for software development is frequently considered the highest priority in agile projects. A lengthy requirements analysis phase is considered to hinder the speed of development, and therefore, lightweight practices such as prototyping are adopted to quickly build an application" (Ramesh at al., 2010). Therefore, as proposed by the existing literature, instead of implementing all requirements planned at the beginning of the project as is the case with traditional project management methodologies, agile methods focus on implementing functional requirements that lead to a useful satisfying product. That said, agile teams implement necessary requirements to deliver a functional product that satisfies the customer and end user. Unnecessary requirements are laid off and errors are detected and fixed early in the project instead of implementing necessary and unnecessary requirements and fixing bugs when the product is finished which has been found to take more time as the entire code has to be fixed most of the times. Adopting the agile methodologies, at the end of each cycle/sprint, the team shares with the customer the developed increment and internally tests it. Then, the customer is able to identify what modifications are needed and what requirements are needed next, again cutting off unnecessary requirements. Therefore, the team will be able to respond to change, fix bugs/errors early and move to the next stage while prioritizing the needed requirements to deliver a

functional product in the light of any technological advancements, thus reducing the time wasted on the development of unnecessary requirements and entire code fixing. Therefore, the hypothesis H2: Agile processes lead to less wasted time during the implementation of projects is accepted.

Lastly, the results show that employee productivity is positively affected by adopting short-cycled WBS, flexibility to change, feedback from customers and team collaboration. These findings are consistent with the existing literature, as adopting agile project management practices is found to enhance productivity among team members. For instance, "Agile provides a number of additional benefits, including increased team productivity and employee satisfaction" (Kraft, 2018) and according to Baruah and Ashima (2012), small and medium Indian enterprises are using agile methodologies in order to "improve quality and productivity". Being able to deliver functional increments of the product, adapt to change throughout the implementation of the project, receiving frequent feedback from customers and maintaining a collaborative environment render employees more productive. Therefore, the hypothesis H3: The adoption of agile processes renders employees more productive is accepted.

Adopting short-cycled WBS has the greatest impact on the three aspects: cost savings, wasted time, and employee productivity, followed by flexibility to change which affects the three aspects but to a lesser extent. Feedback from customers and team members collaboration positively affect productivity but have no significant impact on cost savings and waste time. Whereas, employees' feedback is found to have no significant effect on any of the three aspects. This

can be interpreted as the feedback from employees alone, if not combined with other features of the agile methodologies, will not have an impact on any of the mentioned aspects.

The below table 4.22 showcases the research questions, hypotheses, statistical tests, as well as results.

Table 4.22: Summary of Results

Research question	Hypotheses	Test	Result
What is the effect of applying agile processes on the costs of a project?	H1: Agile processes reduce the costs incurred throughout the delivery of a project.	Multiple regression analysis	Accepted
What is the effect of applying agile processes on wasted time during the implementation of projects?	H2: Agile processes lead to less wasted time during the implementation of projects.	Multiple regression analysis	Accepted
What is the effect of applying agile processes on employee productivity?	H3: The adoption of agile processes renders employees more productive.	Multiple regression analysis	Accepted

4.7 Conclusion

This chapter initially showcased the descriptive statistics that were obtained. More specifically, central tendency, dispersion, and normality measures were produced and discussed. Central tendency was measured via mean scores, and dispersion was measured though standard deviation. Normality of the sample

was insured through Kurtosis and Skewness, and whereby all scores of both independent and dependent variables fell within the acceptable ranges -3<K<3, and -1<S<1. Then, reliability of scales was measured and ensured via Cronbach alpha, which exceeded the minimum acceptable value of 0.7. Correlation was consequently tested using Pearson correlation, as the variables satisfied all conditions for conducting parametric testing, those being a random sample, normal distribution, and metric data. Causality was tested via multiple regression modelling, having all significantly correlated variables included. There were no multi-collinearity problems, as all VIF scores were under 10, as well as no autocorrelation or heteroscedasticity issues, with residuals being normally distributed in all three models.

Having obtained the results, the findings were then interpreted in accordance with the existing body of knowledge, as well as in relation to factual reality in the workplace. The findings concur with the existing literature, which suggests that agile methods have a significant impact on cost savings, wasted times, and productivity. For instance, “Conforto et al. adopted the following definition of APM: “an approach based on a set of principles, whose goal is to render the process of project management simpler, more flexible and iterative in order to achieve better performance (cost, time, and quality) with less management effort and higher levels of innovation and added value for the customer” (Zuzek et al., 2020). According to the findings, the adoption of short-cycled work-breakdown structure has the largest effect on all the three aspects as it is the main driver of daily practices within any project no matter the nature. Moreover, flexibility to

change also affects all three aspects as a quick response to customer demands may save costs and time by preventing errors rather than rectifying them, and which also enhances employee productivity. Furthermore, feedback from customers and team members collaboration have a positive and significant effect productivity, however do not impact cost savings and waste time. Lastly, employee feedback has no significant effect on any of the three aspects.

Having discussed the results and findings, the following chapter will be dedicated to concluding the study. More specifically, the relevant sections will be dedicated to discussing validity issues, those mainly being internal, external, statistical, and conclusion validity. Furthermore, chapter 5 will also discuss the limitations of the study, in addition to the recommendation for future research on agile processes. Finally, it will also feature a section that is dedicated to the theoretical, practical and managerial implications of the research.

Chapter 5

Conclusions and Recommendations

This research aims at investigating the effect of agile project management on cost, time, and productivity. In detail, it follows a deductive analytical approach to test three main hypotheses that are formulated in accordance to the existing body of empirical knowledge and theoretical foundations. The proposed relationships focus on the potential causal effect of a short-cycled work breakdown structure, the flexibility of applying change, the integration of feedback from customers and employees, as well as collaboration on cost savings, wasted time, and employee productivity. The employed methodology of surveying was undertaken via the collection of quantitative data through the use of a questionnaire. The random sample for the study consists of 353 respondents including project managers, product managers, supervisors, team leaders and developers who are familiar with agile processes and had declared applying them in the implementation of previous IT projects. The data was analyzed via multiple linear regression modelling, as it was deemed to be the most suitable statistical alternative for a parametric testing causality. Throughout the preceding chapter, the statistical results were featured and analyzed, which led to the testing of the proposed hypotheses. In this line, this herein chapter will be dedicated to summarizing the findings, as well as tackling validity issues. Moreover, it will also discuss the managerial implications of the research, along with the limitations and avenues for future research.

5.1 Main Findings

The findings show that all three alternative hypotheses were accepted, H1: Agile processes reduce the costs incurred throughout the delivery of a project, H2: Agile processes lead to less wasted time during the implementation of projects, H3: The adoption of agile processes renders employees more productive. In detail, the short-cycled work-breakdown structure and ability to exert change were found to significantly impact all three dependent variables of cost savings, wasted time, and productivity. Moreover, productivity was affected by two additional independent variables, those being feedback from customers and collaboration.

In order to test the quality of any research, several reliability and validity issues should be considered. More specifically, reliability refers to the robustness of the data measurement tool and scales, and validity is concerned with internal, statistical, external, conclusion validity.

In order to guarantee reliability, the survey was sent to 12 project managers and university professors in order to provide insights in regards to the content and clarity of the questions. Therefore, inter-rater reliability was established. Furthermore, Cronbach alpha was calculated in order to test the reliability of scales and was confirmed by having a coefficient higher than the minimum threshold of 0.7.

Knowing that the aim of the study is to quantitively test for causality, therefore it is crucial for the independent variable to have a significant impact on the chosen dependent variables. In detail, the short-cycled work breakdown structure and ability to change were found to significantly impact cost savings, wasted time, and productivity. In addition, productivity was impacted by two additional independent variables, those being feedback from customers and collaboration. Henceforth, the independent variables were responsible for the observed changes in the dependent variables. This can be shown by the coefficients of determination R square, which showed the values of 0.655, 0.497, and 0.556, which imply that medium to high levels of variations in each of the dependent variables were caused by the included independent factors. Moreover, the values of adjusted R square figures of 0.653, 0.494, and 0.550 did not differ from their respective R squares by more than the acceptable 10% threshold. Henceforth, the independent variables are deemed to possess a strong statistical explanatory power for the observed variations in all three dependent variables. As for potential threats to internal validity, there were no history, longitudinal, or pre-post threat, as the design did not integrate any intervention method or possess any temporal aspects. In regards to statistical validity, all of the conditions that allow for the conduction of parametric testing were ensured and met, specifically by having a random sample, all variables being normally distributed with Kurtosis and skewness figures being within the acceptable ranges of $-3<K<3$ and $-1<S<1$. Moreover, there were no autocorrelation issues detected, as the Durbin-Watson figures for all three models fell within the

acceptable range of 1.9 and 2.1. As for conclusion validity, the findings concur with those of previous studies in the literature, which propose that agile processes have a significant positive impact on cost savings and productivity, as well as decrease wasted time.

5.2 Limitations

In social research, every study is prone to face limitations, mainly those related to time, cost, and access to data. Within the context of this research, the speed to collect the data was affected by the COVID-19 pandemic, which slowed down the response acquisition of many participants. Moreover, the pandemic also implied the inability of conducting in-person interviews, hence limiting the ability of employing different methodological approaches. Furthermore, it was hard to reach a larger number of participants, as the number of individuals who are familiarized with agile processes is somewhat limited throughout other sectors, as well as their identification was cumbersome. There were no cost-induced limitations, however, the needed time to complete the research was relatively tight, especially knowing that the researcher is an active project manager with several duties in hand. Lastly, further temporal delays were incurred due to personal circumstances, which required the researcher to pause all activity for recovery purposes.

5.3 Theoretical and Managerial Implications

This study serves as a theoretical contribution that furthers the existing knowledge on agile processes. In detail, it builds upon the findings of previous studies that have explored agile processes and established theoretical foundations that detail these aspects and their benefits. Moreover, it offers a research agenda through paving the way for future studies with a similar aim or focus, as it provides an insight into the benefits of applying agile processes, specifically within the Lebanese IT sector. The study offers insights to managers looking forward to enhancing their work through achieving cost savings, reducing wasted time and improving their team productivity showing that the application of agile practices to their daily project management helps them reach the aforementioned goals. Adopting short-cycled work breakdown structures and being more flexible to change throughout the implementation process helps managers reduce incurred costs as well as wasted time. Together with receiving frequent feedback from customers and enhancing collaboration, adopting short-cycled work breakdown structures and being highly flexible to change gives a push to employees thus enhancing their productivity. Based on this study and the existing body of knowledge, managers will be encouraged to shift from adopting the traditional project management methodologies to using agile project management practices to be able to achieve cost savings, less wasted time and higher employee productivity.

5.4 Future Research

Suggestions for future research include the employment of novel methodologies of quantitative and/or qualitative natures, which can provide alternative perspectives on agile processes. Additionally, future studies could either attempt to conduct case studies that offer in-depth insights inside one organization, or alternatively adopt a similar design within a different sector or industry. Lastly, and in order to advance our knowledge on agile processes, future studies can also attempt to scrutinize the effect of agile project management on other organizational or individual-level aspects.

5.5 Recommendations

As per this research, the adoption of agile practices was found to have a positive effect on the success of projects through reducing costs and wasted time and improving employee productivity which draws the attention to the importance of shifting to agile project management or at least incorporating some aspects of such practices into the existing traditional project managements methods. Businesses are recommended to adopt agile practices and invest more in training their employees to be able to master agile methodologies. Employees as well are encouraged to accept the shift to agile practices, communicate more and collaborate to achieve better results. Customers too should be willing to communicate with teams more frequently and set their priorities regarding the

product they wish to bring to the market in order to help agile teams reach more fruitful results and thus reduce their production costs and time to market. However, if organizations cannot shift to completely adopting the agile approach, they can still integrate some of the agile practices into their daily traditional project management methods thus adopting a hybrid model. For example, they can start by prioritizing the requirements of the projects by choosing the most important features to develop a useful product and begin with developing such features. They can as well arrange for more frequent team meetings to discuss the process, the work done and future tasks. They can as well hold more frequent meetings with their clients and show them the product as it is being developed which helps to identify errors and fix them early instead of waiting till the end of the project and to add necessary features and delete unnecessary ones. Moreover, they can emphasize team collaboration by fostering a collaborative approach where managers engage more frequently with their teams and listen to their concerns and address them.

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Appendices

Appendix A

QUESTIONNAIRE
Agile project management

Thank you for taking the time to complete this questionnaire which aims at identifying the effects of agile project management on reducing wasted time, increasing employee productivity and reducing costs in Lebanese ICT companies. This survey is conducted as part of MBA thesis research paper at Notre Dame University. Your opinion is vital for the success of this research and will be treated in the strictest confidentiality within the ethical code of practice for field research at Notre Dame University; thus, the information gathered will solely be used to compile statistics. No data about you as an individual will be disclosed in any published results.

SECTION 1 –Agile processes

Please circle the number that corresponds to your degree of agreement with the below statements (from 1 to 7, where 1 is Strongly disagree and 7 is Strongly agree).

Throughout my latest project:

1.01 The work breakdown structure was characterized as being short cycled & task-oriented.	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.02 The WBS was characterized as focused on functionality delivered to production in a collaborative manner (as opposed to deliverables aligned with functional role responsibilities)	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.03 The WBS was refined over time from high level to detailed	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.04 You were able to exert the needed changes (if any) that might have occurred along the implementation stage.	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.05 People were placed first in the change management structure (as opposed to processes).	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.06 Change was driven by team members in a proactive manner and not a reactive one to superiors' orders.	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.07 Group members provided constant and timely feedback to their superiors.	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.08 Written feedback was encouraged and provided constantly.	Strongly agree 1 2 3 4 5 6 7 Strongly disagree

1.09 One-on One feedback was often requested by superiors.	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.10 Customers were consistently asked to provide their feedback at key project milestones.	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.11 Customer Feedback was integrated in the next sprint before a key project milestone was due	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.12 Customer Feedback was recorded and shared with all project stakeholders	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.13 Team members followed a clear communication protocol to maintain high collaboration levels amongst each other	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.14 Team members displayed high levels of self-motivation	Strongly agree 1 2 3 4 5 6 7 Strongly disagree
1.15 Team members regularly carried out a 360-degree internal feedback session	Strongly agree 1 2 3 4 5 6 7 Strongly disagree

SECTION 2 – Cost, time, and productivity Please circle the number that corresponds to your degree of agreement with the below statements	
Within the context of my latest/previous project:	
2.01 The cost savings can be estimated at around:	a- 0% b- 1-5% c- 6-10% d- 11-15% e- 16-20% f- 21-25% g- >25%
2.02 The estimated wasted time throughout the delivery was about:	a- 0 day b- 1-30 days c- 31-60 days d- 61-90 days e- 91-120 days f- 121-150 days g- >150 days
2.03 Employees showed higher productivity	Strongly agree 1 2 3 4 5 6 7 Strongly disagree