

Czech University of Life Sciences Prague
Faculty of Economics and Management
Department of Information Technologies



Bachelor Thesis

IT Project Management Methods

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

BACHELOR THESIS ASSIGNMENT

Tia Semeradova

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Thesis title

IT project management methods

Objectives of thesis

The main objective of the thesis is to compare traditional project management and agile project management methodologies applied to IT projects.

Partial goals of the thesis are such as following:

- to identify latest trends and research in IT project management;
- to conduct a survey about usage of the methodologies within software development companies;
- to evaluate impacts of the methodologies on project budget and welfare of the project team members.

Methodology

Methodology of the thesis will be based on document studies, such as literature, related articles and analysis of past projects, together with practical research, which will focus on direct observations of the team members during a project and their interviews.

The proposed extent of the thesis

30 – 40 pages

Keywords

Project management, IT, methodology, comparison, PRINCE 2, PMBOK.

Recommended information sources

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Declaration

I declare that I have worked on my bachelor thesis titled "IT project management methods" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 08 Mar. 21 _____

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IT project management methods

Abstract

This bachelor thesis deals with project management methodologies used in the IT industry and IT departments. Three main project methodologies were chosen for the purpose of this work : Prince2, PMBOK and Agile Methods.

The literature review characterises project management in IT with focus on project success and failure. It also focuses on characterising traditional project management and traditional project methodologies and comparing them with Agile methods used in IT with focus on methodology structure and team structure. Practical research consists of questionere distributed to respondents working in IT industry and experience on working on IT projects. Research aims to identify aspects influencing project success in the eyes of team members and finding the most influential aspects. It also aims to identify whether team members view methodologies as a positive influence on team welfare and their methodology preference.

Results of practical part of this thesis show that among IT project team members the most known and most popular project methodology is Agile. General project outcome that was experienced by the respondents was that the majority of projects were delivered on time and within their original budget.

Regarding aspects that can influence project success, majority of respondents agree that the strongest positive aspect is having established realistic goals and objectives and the strongest negative aspect that can influence project outcome is having poor communication between team members.

Regarding team welfare, most respondents somewhat agree that using project management methodologies helps allocate a sufficient amount of work between team members and limit the oversized workload.

Findings from this thesis and its research can be used by IT project managers and IT team managers when planning new IT projects.

Keywords: Project management, Project management methodologies, Prince2, PMBOK, Agile, Team Welfare, Project Success, Project Failure, Project Budget, Project Deadline, Project Manager, Information Technology, Traditional Project Management, Agile Project Management.

Metody řízení IT projektů

Abstrakt

Bakalářská práce se zabývá metodikami řízení projektů používanými v IT průmyslu a IT odděleních. Pro práci byly vybrány tři hlavní projektové metodiky: Prince2, PMBOK a Agile Methods.

Teoretická část charakterizuje projektové řízení v IT se zaměřením na úspěch a neúspěch projektu. Teoretická část se také zaměřuje na charakterizaci tradičního projektového řízení a tradičních metodik projektu a jejich srovnání s agilními metodami používanými v IT se zaměřením na strukturu metodik a strukturu týmu.

Praktický výzkum se skládá z dotazníku distribuovaného respondentům pracujícím v IT průmyslu a zkušeností s prací na IT projektech. Výzkum si klade za cíl identifikovat aspekty ovlivňující úspěch projektu v očích členů týmu a identifikování nejméně úspěšných aspektů. Jeho cílem je také zjistit, zda členové týmu považují metodiky za pozitivní vliv na blahobyt týmu a preference metodiky.

Výsledky praktické části této bakalářské práce ukazují, že mezi členy IT projektového týmu je neznámější a nejpobulárnější metodika řízení projektu; Agile. Nejčastějším výsledkem projektu, který respondenti zaznamenali, bylo, že většina projektů byla dodána včas a v rámci jejich původního rozpočtu.

Pokud jde o aspekty, které mohou ovlivnit úspěch projektu, většina respondentů souhlasí s tím, že nejsilnějším pozitivním aspektem je stanovení realistických cílů a nejsilnějším negativním aspektem, který může ovlivnit výsledek projektu, je špatná komunikace mezi členy týmu.

Pokud jde o „welfare“ týmu, většina respondentů do určité míry souhlasí s tím, že používání metodik řízení projektů pomáhá rozdělit správně množství práce mezi členy týmu a omezit nadměrné pracovní vytížení.

Poznatky z této práce a jejího výzkumu mohou využít manažeři IT projektů a manažeři IT týmů při plánování nových IT projektů

Klíčová slova: Projektové řízení, metodiky projektového řízení, Prince2, PMBOK, agilní, týmová péče, úspěch projektu, selhání projektu, rozpočet projektu, termín projektu, projektový manažer, informační technologie, tradiční projektový management, agilní projektový management.

Table of Contents

1	Introduction	14
2	Objectives and Methodology	15
2.1	Objectives	15
2.2	Methodology	15
3	Literature Review	16
3.1	IT Project Management	16
3.1.1	Failures in IT Project Management	17
3.1.2	Pillars of Successful IT Project	18
3.1.3	Budgeting and Cost Management in IT projects	19
3.1.4	Negative effects on project budget	20
3.1.5	Team Welfare in Project Management	21
3.2	Traditional Project Management	22
3.2.1	Start of Project	22
3.2.2	Project Reporting	23
3.2.3	Project Performance Measures-Earned Value Analysis	23
3.3	PMBOK and Prince2	24
3.3.1	Structure in Prince2 and Structure in PMBOK	24
3.3.2	Comparing PMBOK with Prince2	25
3.3.3	The role of a project manager in PMBOK and the role of a project manager in PRINCE 2	25
3.3.4	Project Team Roles in Prince 2	26
3.3.5	Project Team Roles in PMBOK	27
3.3.6	Project Budgeting and Project Cost Management in Prince2 and PMBOK	27
3.4	Agile Project Management	28
3.4.1	Self-managed teams	29
3.4.2	Budgeting with Agile Project Management - SABP	30
3.4.3	SCRUM	31
3.5	Agile vs Traditional Project Management	32
4	Practical Part	34
4.1	Research	34
4.1.1	Objectives of the work	34
4.1.2	Research methods	34
4.1.3	The questionnaire	35
4.2	Respondents profile	35
4.3	Ratings of selected Project Methodologies	37
4.4	General Project Outcome	40

4.5	Aspects influencing project success.....	41
4.6	Differences between aspect rating: Project Managers and Non-Project Managers 43	
4.6.1	Hypothesis- Aspects influencing Project Success.....	43
4.7	Aspects influencing team welfare.....	46
4.7.1	Results regarding the statements over the influence of project methodology over team welfare.....	47
4.7.2	Hypothesis - Effect of project management methodologies over team welfare. 48	
5	Results and Discussion.....	50
5.1	Results.....	50
5.1.1	Ratings of selected Project Methodologies.....	50
5.1.2	General Project Outcome.....	52
5.1.3	Aspects influencing project success.....	52
5.1.4	Aspects influencing team welfare.....	53
5.1.5	Comparing responses of Project Managers and Non-Project Managers...	54
6	Conclusion.....	55
	References.....	57
7	Appendix.....	61
7.1	Results interpretation for Kruskal Wallis test.....	61
7.1.1	Realistic Goals and Objectives.....	61
7.1.2	Team Qualification.....	61
7.1.3	Project manager qualification.....	62
7.1.4	Realistic project budget.....	63
7.1.5	Adequate software tools.....	63
7.1.6	Adequate project methodology.....	64
7.1.7	Poor project management.....	64
7.1.8	Insufficient project funds.....	65
7.1.9	An insufficient audit during project life phases.....	66
7.1.10	Overwhelming size and complexity of a project.....	66

List of Figures

Graph 1	Realistic Goals and Objectives Boxplot.....	61
Graph 2	Realistic Goals and Objectives Histogram.....	61
Graph 3	Team Qualification Boxplot.....	62
Graph 4	Team Qualification Histogram.....	62
Graph 5	Project manager qualification Boxplot.....	62
Graph 6	Project manager qualification Histogram.....	62
Graph 7	Realistic project budget Boxplot.....	63
Graph 8	Realistic project budget Histogram.....	63

Graph 9 Adequate software tools Boxplot.....	63
Graph 10 Adequate software tools Histogram.....	64
Graph 11 Adequate project methodology Boxplot.....	64
Graph 12 Adequate project methodology Histogram.....	64
Graph 13 Poor project management Boxplot	65
Graph 14 Poor project management Histogram	65
Graph 15 Insufficient project funds Boxplot.....	65
Graph 16 Insufficient project funds Histogram.....	65
Graph 17 Insufficient audit during project life phases Boxplot.....	66
Graph 18 Insufficient audit during project life phases Histogram.....	66
Graph 19 Overwhelming size and complexity of a project Boxplot	66
Graph 20 Overwhelming size and complexity of a project Histogram	67
Graph 21 Poor communication between team members Boxplot	67
Graph 22 Poor communication between team members Histogram	67

List of Tables

Table 1 Overall respondents' profile	37
Table 2 Overall Rating of Project Methodologies.....	39
Table 3 Relation of respondents' opinion and their experience with PM position.	40
Table 4 General Project Outcome.....	41
Table 5 Aspects positively influencing projects success	42
Table 6 Aspects negatively influencing projects success	42
Table 7 Summarized results-Positive Aspects.....	45
Table 8 Summarized results-Negative Aspects	45

1 Introduction

The topic of IT project management methodologies was chosen based on my aspiration to follow this career path. The original premise for this work was to compare Prince2 and PMBOK. However, after conducting pre-thesis research and finding more current trends in Agile methods, this work focus changed into a comparison between traditional project management methodologies and agile project management methodologies.

Managing successful projects is not an easy task, especially in a quick changing and ever-developing field like Information Technology. It is essential to choose the correct methodology to help the project managers and the project team throughout all project's life cycles, from planning to closing.

Methodologies contain steps for project managers to follow when managing projects. Projects and their requirements are quickly evolving together with the Information Technology field, and project managers need to evolve with them.

The Agile Manifesto is considered one of the milestones of transition between the traditional project management and the modern approach. This work will compare these two sides of one coin and describe their structures and approaches.

The practical part will focus on team members and their opinions about project methodologies and aspects that can be influenced by project methodology, which can positively or negatively affect project success.

2 Objectives and Methodology

2.1 Objectives

The thesis's main objective is to compare traditional project management and agile project management methodologies applied to IT projects.

Partial goals of the thesis are such as the following:

- to identify the latest trends and research in IT project management;
- to conduct a survey about the usage of the methodologies within software development companies;
- to evaluate the impacts of the methodologies on the project budget and welfare of the project team members.

2.2 Methodology

The thesis's methodology will be based on document studies, such as literature, related articles about project management in information technology and analysis of past projects, together with practical research, which will focus on interviews of the team members that attributed to a finished project.

3 Literature Review

3.1 IT Project Management

The Project Management Institute (PMI) formally defines project management as follows; “The application of knowledge, skills, tools and techniques to project activities to meet the project requirements.” (1) Wysocki offers a similar definition, “Project management is an organised common-sense- approach that utilises the appropriate client involvement to deliver client requirements that meet expected incremental business value.” (2)

Prince2 writes a theoretical example of why we need project management. They explain it in a situation in which we are building a house. The process of house completion is achieved via sketches, building parts of the house such as walls, floors, windows, etc. However, that is not project management. Project management is ensuring that – regarding the house anthology –that the roofing contractor does not arrive before the walls are built. (3)

Project management plans stand as a crucial part of any project from any sphere. However, successfully managing information technology (IT) projects is an immensely complicated endeavour. What works in one organisation may not work in the other, and since one size does not fit all, to satisfy the demand of clients, there are many project management methodologies on the market. Often in IT development, conditions favouring a particular software development (e.g. Waterfall, RUP, Scrum) are not well understood. (4)

Many researchers conducted their research to identify critical skills for IT project management. Several essential skills are listed by Matos and Lopes(5); directing, managing, and information seeking.

3.1.1 Failures in IT Project Management

It would be naïve to assume that all projects that are using project methodologies will be completed successfully.

Any project's failure can be given by three main issues: uncertainty, volatility, and unknowns. (6) Many experts are divided over the complete definition of failure and success in project management. The majority agrees that success is equated to achievements, such as on-time and on-budget delivery. On the other hand, failure is described as a privative, respectively, the absence of success. (6)

Many sources reference the Standish group and their findings regarding project failure. In their report (7), the Standish group focused on large IT projects stated that larger IT projects are more likely to fail than smaller IT projects. The survey identified the budget as the primary variable causing the failure in one-quarter of the sum of IT projects' failures with a budget of over \$350,000. The same report concluded that from all studied projects, 31 per cent completely failed, 52 per cent partly failed, and 16.2 per cent of projects were successful. This study defined success as having been completed within the budget, completed on time, and all functionalities delivered. (7)

Another study done by Hughes, Dwivedi & Rana defined the following factors that can cause projects failure; breakdown in the relationship between external contractor and organisation, inadequate project sponsorship, poor business case and weak financial management, poor staff performance, insufficient audit and post mortem process, size and complexity of the project, poor project management, poor requirements and scope management, poor communication, poor change management. (8)

Case Study – The UK e-Borders Project Failure

In 2003, the Home Office commenced the E-Borders project. This project was supposed to a modern and efficient immigration control model in the UK. In 2007 it had been decided that the project was to be executed by Raytheon Systems.

However, the project was terminated due to the Home Office dissatisfaction with how the project was being implemented.

In his case study on this failed project, Adam Adami accounts for its failure to survive in its ecosystem's conditions, fail to execute the delivery process and exhibit poor project management practice. (9)

3.1.2 Pillars of Successful IT Project

As mentioned above, the Standish Group (7) defines success in a project, completing a given project at a cost equal to the allocated budget, finished within the deadline, and completely delivering required functionalities.

In his article (10), Joslin quotes Cooke-Davies, who -according to the article-makes the distinction between project success measured against the project's overall objectives and accomplished through the use of the project's output. Project management success is measured at the end of the project against success criteria, such as those relating to internal efficiency, typically cost, time, and quality.

Success in Project Management is among the fields that are frequently discussed in Project Management. Many studies had examined a wide range of projects to pinpoint success factors. Adzmi and Hassan use the term Critical Success Factors (CSF)(10) when discussing the variables influencing the resulting success. The essential variables that affect any given project are; project management, human, organisational, process / technical complexity, quality and top management. (10)

Project management success factors had been categorised into the following categories.

- The first one is project management competence, which covers the project manager's competence and project team competence.
- The second category is organisation competence, which comprises of organisation's structure, culture, atmosphere and overall competence.
- The last category is the project management methodologies, tools, and techniques. This last category includes methodologies in project management, software and tools, (10) and will be the main focus of this thesis.

Different article(11) categorises four groups of success factors for IT projects.

- Managing strategy and stakeholders, which covers clarity of projects' objectives, minimalization and stabilisation of projects' scope, support of executives.(11)
- Mastering technology and content. This group involves access to Standardized, proven software technology and user involvement to shape the solution. (11)
- Building team and capabilities. This team should involve an experienced project manager, a qualified and motivated project team, a sustainable mix of internal and external sources. (11)
- Excelling at project management practices. This can be achieved by using proven methodologies and tools and/or creating reliable estimates and plan together with being appropriately transparent about the project. (11)

3.1.3 Budgeting and Cost Management in IT projects

McKinsey & Company published their findings of Success factors and core beliefs in managing large technology-enabled programs. They studied a total of 3,607 projects, 88% of which were software type projects. Their findings suggest that nearly 2 out of 3 projects face a cost over-run (64% of studied projects). In their root cause analysis, they identified four key dimensions that explain most project failures.

- The first cause was labelled as missing focus, which was assigned to unclear objectives and lack of stakeholder's alignment.
- The second cause was content issues, which was explained by shifting requirements and/or technical complexity.
- Another reason was skills issues, which resulted from the unaligned team and/or lack of skills.
- The last specified cause was "Execution issues" because of either unrealistic schedule, lack of operational planning or a combination of both. (12)

Bloch, Blumberg, Laartz, authors of an article based on McKinsey & Company findings, describe assessing "black-swan risk". Black Swans are in project management term used to describe unexpected events with a severe consequence.

McKinsey illustrates those Black Swans on a graph chart. He is depicting them in four distinctive patterns.

- Early black swan, which means that as soon as the vendor is conducted, costs quickly escalate. Early black swan encountered about 17% of examined failed projects.
- Typical black swan, which means that during specification costs cost triple and are stable afterwards. Typical black swan encountered about 58% of examined failed projects.
- The inverse ugly duckling means that the project seems like it will achieve success; however, costs escalate at the development phase. Inverse ugly duckling encountered about 8% of examined failed projects.
- Starving black swan means that the budget is cut continually during the project, most likely economic failure. Starving black swan encountered about 17% of examined failed projects.

3.1.4 Negative effects on project budget

The project's budget needs to be well-defined. During a project life cycle, events that can jeopardise ongoing projects might occur. If the management failed to successfully define and follow the project budget, this might lead to the project's abandonment. (8)

Project methodologies include a detailed description of budget definition and maintenance. Those guidelines are described more in detail in later chapters of this thesis.

In his study, Kieran Conboy (13), creates a table comparing the outcomes of four anonymous projects. Two of them used Scrum/XP as their development method, and two use Method ALPHA, which is not a defined methodology.

Project A, which lasted for 19 months and used Scrum/XP methodology, finished with 12% under its originally defined budget. In comparison, Project D, which also lasted for 19 months, finished 320% over the budget and was developed under Method ALPHA.

Similar cases are for projects B and C, where project "B" lasted for 30 months and finished 4% under its original budget. Project C lasted for 32 months and ended up going 223% over its original budget. (13)

3.1.5 Team Welfare in Project Management

Employee Welfare refers to the overall level of their employee's life enrichment and happiness. According to Lalitha and Priyanka (14), welfare helps to keep employee morale and motivation. Patro (15) states that the reason behind providing employee welfare is to "create efficient, healthy, loyal and satisfied labour force for the organisation."

The PMBOK does not mention Team Welfare per se, but it talks about team morale. According to this guide, the project manager's task is to develop and improve team morale. More specifically, they say that among the objectives of team development belongs; "Improving feelings of trust and agreement among team members to raise morale, lower conflict, and increase teamwork." (1)

Team welfare can be negatively affected if the workload is too large. The oversized workload can lead to idle time for work items and the need for team members' multitasking. The longer the overload lasts, the more negatively affected is the team. (15) Eneh talks about the term "staff welfare package", which includes "salary, leave, a reward for outstanding performance, promotion, verbal encouragement, kind words/actions, pension, gratuity, and seasonal gifts." (16) Their research confirms that poor employee welfare will lead to "low production and negatively affected the customer service and satisfaction." Together with "a lack of worker commitment and the attendant low productivity." (16) This information is also supported by what Laurie Hughes, Dwivedi & Rana write that poor team dynamics will also negatively affect individual performance their commitment. (8)

3.2 Traditional Project Management

Traditional project management (TPM) methodologies are well established, have been used for a long time in project management and set the base for the evolution of more modern methodologies.

Handzic, Meliha Bassi, Antonio say about TPM that a consolidated way to manage a project guarantees that the job will be done on time, under budget, and as per client specification. (17)

Examples of TPM could be PMBOK, Prince 2 and SIX SIGMA. (17). PMBOK and Prince 2 will be the focus of this and later chapters.

PMBOK defines project management as “the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements”.(1)

Prince 2 offers an extended but similar definition. They write that “project management is the planning, delegating, monitoring and control of all aspects of the project, and the motivation of those involved, to achieve the project objectives within the expected performance targets for time, cost, quality, scope, benefits and risk.” (3)

TPMs represent a model of a traditionally structured multi-phase project. The tasks are processed sequentially. Only when one development step is completely done, the next one is started.(18)

TPMs acknowledge CSF's, and to achieve success in the project, they aim to reduce the risk. They do so by establishing a firm set of rules for the project managers and their team to meet project objectives. They take on the guide's role, describing steps to be followed throughout all project phases in the project life cycle.

3.2.1 Start of Project

Among shared aspects of the TPMs in the project's concept and start are represented to the head of a company or the clients requesting the project by “Business plan” (3). This achieves the introduction and establishment of the complete information set regarding the project and its structure. Many TPMs consider this step as a preliminary step that is finished before the project's real start. During this step, the

team is established and announced, project phases are created and reviewed, and different risks and issues are analysed. (17) TPMs use techniques to analyse threats and risks before the first step of the project lifecycle. PMBOK, for example, uses SWOT analysis to identify the degree to which organisational strengths offset threats and risks and examine opportunities that can help overcome organisational weakness. (1) Prince2 recommends using PESTLE analyses for risk breakdown. (3)

3.2.2 Project Reporting

Projects under TPM require establishing a reporting system. PMBOK describes reporting system as “Facilities, processes, and procedures used to generate or consolidate reports from one or more information management systems and facilitate report distribution to the project stakeholders.” (1) K. Wysocki states that there are five types of project status report: current period, cumulative, exception spotlight, and variance. (2)

3.2.3 Project Performance Measures-Earned Value Analysis

To measure project management performance, TPMs use Earned Value Analysis (EVA). Prince 2 advocates to use of EVA in progress control. (3) PMBOK presents a table containing abbreviation for each part of EVA, the name of that abbreviation, its lexicon definition, description of usage, an equation for calculations using different EVA abbreviations variables and interpretation or results of those equations. (1) Wysocki comments about the fact that those equations included in PMBOK represent only the past. However, he points out that they can be used for extrapolated future predictions.

Moraes and Laurindo (19) wrote a study concerned about the relationship between the information technology (IT) project performance and the project management maturity of an organisation, and after researching a survey with 185 responders, they concluded that “organisations with superior maturity present superior performance in

their projects and different maturity dimensions have distinct impacts on IT projects performance” (19)

3.3 PMBOK and Prince2

PMBOK (Project Management Body of Knowledge) and Prince2 (Projects In Controlled Environments) are among the most popular methodologies for developing any form of an IT project.

Both of those two methodologies need to be adjusted to each project, and it is individual needs. Matos and Lupes offer an example in their article, saying that PMBOK does not intend to give an exact tutorial on working with the techniques or using any of the tools described. (5) Prince2 functions similarly because its application needs to be scaled for the individual project's requirements.

The PMBOK was created by the PMI (project management institute) (1) to guide project managers on their way to successfully finished projects. It stands as a detailed framework that describes essential areas of knowledge generally recognised as good project management practices. PMBOK notes that for achieving full effectiveness of managing the project, the project manager and the project team must understand the application area and the project environment and have at least an advanced level of soft skills and general management knowledge. (5)(1) Prince2 is based on experience on thousands of projects that an experienced individual contributed with comprehensive project management knowledge. (3) Prince2 is standardly used by both the public and private sectors. It is mainly focused on business and the organisational structure.

3.3.1 Structure in Prince2 and Structure in PMBOK

Prince2 takes the practical approach and is focused on Business Case and Product. To complete the projects, they offer 7 Themes, 7 Processes, 7 Principles and 35 Activities. They are defined as “aspects of project management that must be addressed continually” (3) PMBOK, on the other hand, is more comprehensive and focused on the customer’s requirements. This methodology offers guidance via 10

Knowledge Areas, 5 process groups and 47 activities. They are defined as “a complete set of concepts, terms and activities that make up a professional field, project management field, or area of specialisation” (1) (20)

However, there are many similarities and topical overlapping in those “categories” the methodologies offer. For example, the first two processes in Prince2 (Starting up and Directing) could be, to some degree, found in the Initiating process group in PMBOK.

3.3.2 Comparing PMBOK with Prince2

Karaman and Kurt created a table where they detailly describe differences between PMBOK and Prince2. (20) According to this table, Prince 2 and PMBOK methodologies differ in many areas. Even though the goal is the same (to help manage successful projects), each methodology offers a different approach. By the very definition, PMBOK is a standard guide, and Prince2 is a structured PM methodology. Matos and Eurico say that each methodology defines the project differently. PMBOK thinks about the project as “a temporary endeavour undertaken to create a product, service or result singular.” The Prince2, on the other hand, would define a project as a “management environment created to deliver one or more business products according to a specified business case.” (5)

Prince2 is more practical and prescriptive than PMBOK and is mostly focused on critical areas of the project. It peaks in perspective and describes how its practices should be used, often accompanied by practical examples.

PMBOK is, in comparison with Prince2, rather descriptive, offers a detailed description of the techniques and is rich in theoretical information. (5)(20)(1)(3)

3.3.3 The role of a project manager in PMBOK and the role of a project manager in PRINCE 2

The role of the project manager is understood differently in both methodologies. PMBOK assumes the project manager to be someone with responsibility for meeting goals. For Prince2, the project manager is someone who is always responding to the project board. Thus, the project manager was given authority over the project, but a

larger proportion shares responsibilities with the project board, providing oversight.
(5)(20)

3.3.4 Project Team Roles in Prince 2

Prince2 instructs the fulfilment of roles in the project team. Those roles are listed and described below. (3)

- The Project Board is an indispensable role in every Prince2 project that needs to be filled since the board takes on authority and has all the responsibility for the project. This role will be the one accountable for the success or failure of the project's outcome. The project direction and delegation (using Prince2 methodology) comes from the project board. The Project board needs to provide sustainable support to the project manager and be the link for communication with both the project team and external stakeholders. (3)
- The project manager is running the project on behalf of the Project board. Prince 2 elects the manager as a person who is responsible for all the work with this methodology. The project manager manages the project itself and manages the team manager and the project support. In case of a lack of a team manager in the project, the project manager will take on this position's responsibilities. (3)
- The team manager has the responsibility for the production of products that the project manager allocated. (3)
- Executive supports senior users and senior suppliers. The executive keeps the project focused on achieving its objectives within the project life cycle. (3)
- A senior user is a person responsible for specifying users needs and represents their interest. (3)
- A senior supplier is responsible for representing team members who are in charge of designing, facilitating, procuring and implementing the project products. (3)
- Change authority is the one permitting and authorising change requests. (3)

3.3.5 Project Team Roles in PMBOK

PMBOK describes the project team in similar detail; however, the idea of the roles slightly differs. PMBOK understands the project team as a “group of individuals from different groups with specific subject matter knowledge or with a specific skill set to carry out the work of the project.” (1)

PMBOK (just like Prince2) lists the names of the positions in the project team. Those positions, together with their description, are listed below.

- Project management staff are people who are performing activities required by the project. Examples of those activities are; scheduling, budgeting, administration...(1)
- Project staff are people who are carrying out the work of project creation. (1)
- Supporting experts are developing (and executing) the project management plan. (1)
- User or Customer Representative are tasked to advise on requirements and validate the acceptability of the project’s results. (1)
- Sellers sometimes referred to as suppliers, vendors, contractors... are presented as external companies who provided necessary project components. (1)
- Business partner members are assigned to make sure the project is properly coordinated. (1)
- Business partners are just like Sellers are external companies. Business partners provide specialised expertise to the project. (1)

3.3.6 Project Budgeting and Project Cost Management in Prince2 and PMBOK

Includes the processes involved in planning, estimating, budgeting, and controlling costs so that the project can be completed within the approved budget.” (1) PMBOK assigns managing project costs following processes; Plan cost control, estimate costs, Determine budget and Control cost. PMBOK provides a graph chart where the

processes are depicted and their inputs, tools, techniques, and outputs. PMBOK devotes some of its subchapters to describe in great detail all of the information depicted in the mentioned graph. (1)

Prince2 includes budget in the plan section and processes section and talks about budgets as follows;” Time and cost budgets, including provisions for risks and changes”.Prince2 often emphasises the need for a change budget, which is meant as “The money allocated to the change authority available to be spent on authorised requests for change.” (3)

According to Prince2, the costs are calculated in the project plan. The project plan is “A high-level plan showing the major products of the project, when they will be delivered and at what cost.” (3)

Prince2 does not offer such a detailed description of the process of cost establishment as PMBOK. Yamami, Ahriz, Souad, Mansouri, Khalifa, Qbadou, Mohammed, Illousamen and Hossein write in their article that PMBOK wins over Prince2 with their provided range of useful tools. However, Prince2 allows a better understanding of the comparison of benefits with costs. (21)

3.4 Agile Project Management

In 2001, practitioners created the Agile Manifesto for Software Development, which stood behind the proposition of many agile methods, practices, and tools used today. (22) Principles that were introduced in this manifesto cover and ensure “fast, frequent, consistent, and continuous delivery of working software; encouraging effective communication; and self-organising teams.” (23)(22)

Agile project management incorporates a change in the project's development and encourages project managers to do the same for their managing style. This kind of process management is mainly known for its ability to respond to change while maintaining profitability. (22)(24)

Azanha, Batista, and Argoud, in their case study, write that the agile approach is suitable for the project with a dynamic environment where a constant change is to be expected, which fits the best for the IT development projects. (24)

The use of agile methods is increasing in its popularity. In 2015 Serrador and Pinto conducted a study that showed that from 1386 projects, 6% of them were utterly using agile methods, and 65% of them had some agile component. The same study concluded that the project's success was directly related to the agile approach positively. (24) (25)

Agile project management still aims to complete the same objectives as any other project management (managing the teams, customer relationships, risk management, maintaining project timeline and budget); however, agile approaches those tasks uniquely. The variable with the most considerable change was the role of the project manager and project team. (26)

3.4.1 Self-managed teams

One of the key elements of Agile project management is the principle of self-managed teams. Those teams use simplified tools (preferably) known by members of other teams working on the project. Self-managed teams should have autonomy when deciding on tasks performing and sharing the project leadership. (22)(27)(24)

Unlike Traditional Project Methodologies, Agile does not specify exact roles in its project. Souza, Melo and Amaral, quote Hoda (28), who conducted a study involving 58 agile practitioners from 23 software organisations and identified the following roles;

- At the beginning of the project, a mentor helps other team members using agile methods. (27)(28)
- The coordinator represents the team and manages the expectations of its clients. (27)(28)
- The translator is a communicating link between business (clients) and technical (team) parts of the project. (27)(28)
- Champion represents the team before the senior management and obtains support for the team. (27)(28)
- Promoter promotes the project to the clients and assures engagement in the dialogue between team and client. (27)(28)

- Terminator identifies threats among other team members who could be a danger to the team and connects with the senior management regarding their transmission. (27)(28)

3.4.2 Budgeting with Agile Project Management - SABP

There is no exact prescribed way of handling the budgeting issue with agile project management. However, Vierlboeck, Gövert, Trauer and Lindemann (29) describe the proposed budgeting process for Agile they call “The Structured Agile Budgeting Core Process” (SABP), which consists of different sub-processes that resulted from the various solutions to the discrepancies.

The first step of SABP is a model called Multi-Level Budgeting (MLB): Level Structure. MLB splits development into levels chosen based on the product itself, on the organisational structure or a combination of both. (29)

The second step of SABP is the Agile Responsibility Model (ARM), which contains interdisciplinary units that share mutual accountability towards the development. Nevertheless, at the same time, particular responsibilities (including budgeting responsibility) are shared among each stakeholder’s entity. (29)

The third step of SABP is Multi-Level Budgeting (MLB): Budget Structure, which suggests that the budget would be assigned to the upper level and derive the budgets from lower levels. Authors of this model say that since budget by definition requires economic factors, this step will also include necessary outside inputs. The upper-level budget stands as a restriction to the levels below; however, lower-level budgets remain flexible, as the upper-level budget does not dictate or delegate those budgets. This allows for flexibility to work with changes but adds an aspect of required predictability.

The fourth step of SABP is a model called Extended Partial Budgeting Process (exPBP) and consists of the Modifiability Assessment Process (MAP) and PBP. ExPBP serves for allocating resources. Each level conducts this model individually. This model allows for flexible allocation (based on forecasts) of resources and enables an overlaying budget.

MAP is a result of Modifiability, Assessment, Integration, Monitoring and Review.

Ploder.

Dilger and Schöttle created a theory called “Beyond Budgeting”.(30). The idea of beyond budgeting was born in reaction to “ the often as static and old fashioned assumed integrated way of classical budgeting”.Its goal is not to improve but to eliminate budgeting with the classical approaches.

This framework consists of three dimensions.

- Time
- Number of Solved requirements
- Certainty about the budget situation

3.4.3 SCRUM

Many authors of articles who are talking about agile mention Scrum. Sliger, in his report, warns not to believe in the misconception that Agile is Scrum. It is true that Scrum one of the agile methods; it is not the sole framework used for agile projects. (31)

Schwaber, one of the authors of Scrum, refers to Scrum as a framework and not methodology, since unlike methodology that provides prescribed solutions, Scrum provides structure but does not dictate how to do specific practices. This leaves space for the team to decide what to do in their situation. (31)

There are several Agile approaches for software development. Pardo-Calvache, Chilito-Gómez, Viveros-Meneses, and Pino identified and described the following available models of Scrum (32).

- Scrum of Scrums – Used for larger projects, where each team is divided into sub-teams and selects its ambassador, which allows for better team management. (32).
- Scrumconix - Sprint Zero and Sprint one to N. The Sprint Zero Scrum serves to educate teams into the whole project. The Backlog of the product is proposed in this Sprint using ICONIX artefacts. Coding and testing then take place in sprint one to N. (32).
- LeSS defines framework Less and framework LeSS Huge. Less is a framework that can manage up to 8 teams, each with 8 members. LeSS Huge can manage larger teams with more members. A single Product Owner manages all teams, and all

teams have a single Product Backlog defined. There are two parts of planning for each Sprint. One part is for the team level, the other for the project level (32).

- Nexus Defines a framework for approximately 3 to 9 teams. All the teams share the same Product List. This framework defines its own Nexus Sprint backlog. This Backlog aims to support the transparency of teams' development during their Sprints (32).
- Safe covers three levels; teams, programs and portfolios. Team level accustoms Scrum with XP engineering practices. Agile Realise Train is a concept defined for the program level. This concept is comparable to the Sprint of team level. Planning at the portfolio level defines large development initiatives (32).

3.5 Agile vs Traditional Project Management

Traditional Project Management methods have both the advantage and the disadvantage of being well established and having a firm set of rules that project managers are prescribed to follow. This, while delivering a secure and clear path for many projects, presents a limit for IT project management that, for its varied and ever-changing nature, requires a more flexible and adjustable approach delivered by Agile methodologies. (33)

In their article, Ahmad, Soomro and Naqvi created a table comparing Agile with Traditional Project Management. According to this table, Agile project management is more people-oriented than Traditional Project Management, which is oriented towards processes, commands, and control. (33)

To compare Traditional and Agile, Wysocki (2) describes differences between traditional and agile projects, project managers and teams. Compared to well defined and documented traditional projects, agile projects are at risk because of the increased uncertainty. (2) However, Fernandez and Fernandez note that agile projects benefit from the flexibility that allows them for easy adjustments. (33)

A traditional project manager's goal is to reduce risk and preserve the constraints of time and money. On the other hand, in agile projects, the "managers" are focused more on delivering products rather than adherence to process. (2) (33)

Thanks to the well-defined steps and requirements, the work can be distributed between junior members to well-experienced members. Agile projects need to have their

team members well-motivated and committed to the common cause since they bare broader responsibilities towards the project progress. (2) (33) The Traditional Project Management Methods (TPM) have an advantage in this segment when it comes to more significant projects. It can work with the teams not being at the same location; however, Agile provides limited support by having the team members be at the same location, preferably. (34)

When planning a project scope, TPM will focus on its development from the very start. Since Agile is using Sprints, those projects will have short time scopes. (33) Nevertheless, since TPM has the scope planned from the start, having requirements (which might not have been considered at the beginning of the project) added by the user results in negative addition of development time and expense. (34) In agile, the team performing testing and coding continuously and constantly receives feedback from the product owner. The agile team regularly assesses project scope and not just at the beginning. Team members learn from their past mistakes and the product owner's feedback and implement this new knowledge into a new scope assessment. This makes the project more flexible and reduces the negative effect of changes and new implementations. (33)

Sekgweleo, who compares Agile and Traditional System Development Methodologies (34), concludes that since all software development projects are different, it would be unwise for the development team responsible for choosing a suitable software development methodology throughout different projects. According to him, both traditional and agile methodologies have their limitations that can negatively affect the software development project if not chosen wisely and with regards to the project needs and requirements.

Fernandez, in their article, add that “ Becoming equipped with different approaches to project management will allow project managers to match better the characteristics of the project at hand.” (35) Sekgweleo and Fernandez came to matching conclusions that a proper match between the project and the methodology is a crucial step to a successful project. (34) (35)

4 Practical Part

4.1 Research

4.1.1 Objectives of the work

During the document study, it was found that most articles discussing the topic of project success were considered from the outside perspective, especially from the point of view of stakeholders.

The practical part of this study will focus on questioning the team members who worked on any IT project under some of the selected project management methodologies (PMBOK, Prince2, Agile methods) and finding the factors that are considered crucial for project success by the team members.

This practical part aims to identify what the team members consider essential for project success, their opinions on selected project management methodologies, and their views about project management methodology's effect on the project team's welfare.

This research's partial goal is to identify a statistical difference between team members' responses with experience with the position of project managers and team members who do not have such experience.

4.1.2 Research methods

A questionnaire was constructed for this work's needs, which asked individuals about their relationship to selected project methodologies. The factors that, in the eyes of the team members, influence the project's final success. For the questionnaire to be valid, all respondents must have been part of at least one IT project and work in the IT-sphere.

The questionnaire was distributed to large enterprises with at least 250 employees or more.

4.1.3 The questionnaire

The questionnaire was distributed online via a sharable link. Responses for the questionnaire were collected in a period of 18.01.2021 to 18.02.2021. The expected number of responses was 40, but the final number of filled questionnaires was 47, out of which 1 answer had to be dropped, for the respondent did not fit into the required criteria of working in IT.

The questionnaire was separated into three parts. The first part served to identify the respondent's profile by asking about their IT experience, the number of projects they had been part of, the position they worked on most projects and their self-rating of their general knowledge on project methodologies.

In the second part of the questionnaire, the respondents selected whether they have any experience working on selected project methodologies: Prince2, PMBoK and Agile methods. They were to rate the overall experience on a scale of 1 to 5. Where 1 was the worst and 5 the best. There was also an option to write down their opinion about the methodologies, but those results will not be included in the final analyses for lack of responses.

The third part consisted of the Likert Scale on which respondents rate aspects that affect IT projects' outcome and choose to agree or disagree with team welfare statements.

4.2 Respondents profile

Years of Experience working in IT.

To find respondents' seniority, a scale of years of experience with 5 years intervals was created. In this group of respondents, 48% selected that they have over 15 years of IT experience. The second-largest group of 20% had 5 to 10 years of experience. The third-largest group of 15 % of total respondents had 10 to 15 years of experience working in IT. The second smallest group of 11% of respondents had 1 to 5 years of experience, and the smallest group of 7% had less than 1 year than experience.

Level of IT experience / Level of IT knowledge

Respondents were to self-evaluate their general knowledge of information technologies on a scale 1 to 5, with 1 being the elementary (worst) knowledge and 5 the advanced (best) knowledge.

The largest group formed out of 39% of respondents would rate their knowledge as score 4/5. The second-largest group of 33% believes themselves to have 5/5 score in IT knowledge. Then 26% of respondents consider themselves to have 3/5 score in IT knowledge. Only 2% think they have elementary experience with a score of 1/5. No respondents selected a 2/5 rating of their knowledge.

Level of PMM experience / Level of PMM knowledge

Respondents were asked to self-evaluate their general knowledge of project management methodologies on a scale 1 to 5, with 1 being the elementary (worst) knowledge and 5 the advanced (best) knowledge.

The largest group formed out of 41% of respondents would rate their knowledge as score 3/5. The second-largest group of 26% believes themselves to have 4/5 score in PMM knowledge. Then 22% of respondents consider themselves to have 5/5 score in PMM knowledge. The second smallest group of 9% of respondents chose the second smallest rating of their PMM knowledge of 2/5 and the remaining 2% with 1/5 elementary knowledge.

Experience with the position of Project Manager

Even though the questionnaire was distributed to a random sample of IT employees, the results concluded that 48% of respondents have some experience with the position of Project Manager and 52% have no experience with Project Manager position and worked on other IT positions, an example of which include but are not limited to; Software Architect, Tester, Team Manager, Developer, Operational Manager and Process Analyst.

Overall, respondents' profile

Combining all responses in the first section, a final table was formed. This table is separated by the years of experience in working in IT.

Table 1 Overall respondents' profile

<i>Years of experience</i>	<i>Average IT knowledge</i>	<i>Average PMM knowledge</i>	<i>The average number of Projects</i>	<i>PM experience</i>
Less than 1 year	2,3	2,0	2,3	0%
1 to 5 years	3,2	3,0	11,0	20%
5 to 10 years	3,9	3,6	20,9	56%
10 to 15 years	4	4,14	34,5	71%
15 and more years	4,45	3,72	58,36	50%

The table shows averages of IT knowledge, PMM knowledge and the number of projects for precise interpretation of overall profiles.

This interpretation allows us to see an increase in averages in relation to years of experience. One interesting exception arises in a group "10 to 15 years" and "15 and more years" in the category of average PMM knowledge, where the average is higher for the group "10 to 15 years". The higher percentage of PM experience can explain this.

4.3 Ratings of selected Project Methodologies

Prince 2

Respondents were asked to rate Prince 2 on a scale of 1 to 5, with 1 being the worst mark and 5 the best. Respondents were also asked to leave the field blank in case they have no experience with the methodology.

Results show that 48% of total respondents have no experience with this methodology. The largest percentage of respondents with no experience with Prince 2 (53%) have over 15 years of experience working in IT. Also, 73% of respondents who have no experience working with Prince2 have no experience with the Project Manager's position.

Out of the group with experience with this methodology, 42% rated it 4/5, 21% rated it 3/5, and 21% rated it 2/5. Rating 5/5 gave this methodology 13% of people who had experience with it, and 1/5 rating gave it remaining 4% of respondents.

PMBOK

Respondents were asked to rate PMBoK on a scale of 1 to 5, with 1 being the worst mark and 5 the best. Respondents were also asked to leave the field blank in case they have no experience with the methodology.

Results show that 48% of total respondents have no experience with this methodology. Also, 63% of respondents who have no experience working with PMBoK have no experience with the Project Manager's position.

Out of the group with experience with this methodology, 31% rated it 3/5, 19% rated it 5/5, 19% rated it 4/5 and 19% rated it 2/5 and 1/5 rated it remaining 13%.

Agile Methods

Respondents were asked to rate Agile methods on a scale of 1 to 5, with 1 being the worst mark and 5 the best. Respondents were also asked to leave the field blank in case they have no experience with the methodology.

A significant difference compared to previous methodologies comes in the percentage of respondents with no experience working with this methodology, 13% out of total respondents. Also, 33% of respondents with no experience with Agile methods have no experience with the Project Manager's position.

Out of the group with experience with this methodology, 45% rated it 4/5, 28% rated it 5/5. 18% rated it 3/5, and the remaining 10% rated Agile methods 2/5. A total of 0% of respondents who have experience with Agile methods gave them a rating of 1/5.

Overall Rating of Project Methodologies

Combining all responses in the second section, a final table was formed. This table is separated by the years of experience in working in IT.

Table 2 Overall Rating of Project Methodologies

<i>Years of experience</i>	<i>Average Rating of Prince 2</i>	<i>No experience with Prince2</i>	<i>Average Rating of PMBoK</i>	<i>No experience with Pmbok</i>	<i>Average Rating of Agile</i>	<i>No experience with Agile</i>
Less than 1 year	N/A	100%	N/A	100%	4,0	30%
1 to 5 years	4,0	60%	3,5	60%	3,8	0%
5 to 10 years	3,4	44%	3,0	56%	4,0	11%
10 to 15 years	3,6	29%	3,3	43%	4,0	14%
15 and more years	3,2	45%	3,0	73%	3,8	14%

This table clearly shows Agile methods as the best-rated methodology throughout all categories and identifies it as the most known method.

Category “Less than one year” lacks clear interpretation for a high percentage of people with no experience with selected methodologies.

Category “1 to 5 years” on average voted Prince2 as the best methodology; however, 60% of respondents in this category had no experience with Prince 2. The opposite case is with the Agile method, where 0% of respondents had no experience with the category, and Agile received an average rating of 3,8 out of 5. This category had a general tendency to give a higher rating to selected project methodologies.

In the category “5 to 10 years”,, the highest average score of 4/5 received Agile, and only 11% of respondents in this category had no experience with this methodology.

In category “ 10 to 15 years”,, the highest average score of 4/5 received Agile, and only 14% of respondents in this category had no experience with this methodology.

Overall, this category had the highest knowledge of selected project methodologies, which can be again because of Project Managers' high representation in this category.

In the category “15 and more years”, the highest average score of 3,8/5 received Agile, and only 14% of respondents in this category had no experience with this methodology. This category had a general tendency to give lower scores to selected methodologies.

The second table was created to describe respondents’ opinion regarding selected PMMs and their experience with the Project Manager position.

Table 3 Relation of respondents’ opinion and their experience with PM position

<i>Experience with PM position</i>	<i>Average Rating of Prince 2</i>	<i>No experience with Prince2</i>	<i>Average Rating of PMBoK</i>	<i>No experience with PMBoK</i>	<i>Average Rating of Agile</i>	<i>No experience with Agile</i>
Yes	3,6	27%	3,5	50%	3,7	18%
No	2,9	67%	2,2	79%	4,0	9%

Results show similar phenomena regarding Agile methods among IT employees and their general knowledge of Agile. Respondents generally have less experience with PMBOK. Respondents who have no experience with the PM position tend to give significantly lower rates to methodologies other than Agile.

4.4 General Project Outcome

Respondents were asked to choose which of the following statements best described IT projects' general outcome in their own experience.

Results show that 35% of total respondents have an overall positive experience with projects outcome, where; the majority of projects were delivered on time **and** within their original budget. Then 26% of respondents have experienced issues with completing projects within the estimated time frame because their general experience is that; the majority of projects were delivered within their original budget **but not** on time.

Negative experience with project outcome had 20% of respondents since they reported that generally, majority of projects were **not** delivered on time **and** were over their original budget. The last category making 11% of respondents, reported that the majority of projects were delivered on time **but not** within their original budget. Seeing that this was the smallest group was surprising since most IT projects had problems keeping within their original budget according to the document study and past research.

The remaining 7% of respondents chose not to respond and selected the “Other” option.

Table 4 General Project Outcome

<i>General outcome</i>	<i>Percentage</i>
Majority of projects were delivered on time AND within their original budget	35%
Majority of projects were delivered within their original budget BUT NOT on time	26%
Majority of projects were NOT delivered on time AND were over their original budget.	20%
Majority of projects were delivered on time BUT NOT within their original budget	11%
Other	7%

4.5 Aspects influencing project success.

In the third section of the questionnaire, respondents were asked to rate aspects influencing project outcome on a scale of 1 to 5, 1 meaning the weakest influence and 5 the strongest. The following aspects were chosen as aspects positively influencing project success.

- Using a project methodology for an IT project is beneficial for me as a member of the project team.
- The project methodology is a crucial factor that decides the success of a project.
- Project manager qualification
- Team qualification
- Adequate project methodology
- Realistic goals and objectives
- Realistic project budget
- Adequate software tools

A scoring method was used to calculate each aspect's total score by multiplying given marks with a number of respondents and adding them all together.

The following table shows the aspects positively influencing projects success. The table is organized from the highest score (the most influential) to the lowest score (the least influential).

Table 5 Aspects positively influencing projects success

Aspect	Total Score
Realistic goals and objectives	213
Team qualification	198
Project manager qualification	190
Realistic project budget	188
Adequate software tools	174
Adequate project methodology	149

“Realistic goals and objectives” had gained the highest score of 213. The most frequent mark for this aspect was 5, which was given by 70% of total respondents.

The least influential aspect was “Adequate project methodology”, with a score of 149. The most frequent mark was 3 given by 43% of total respondents.

The following aspects were chosen as aspects negatively influencing project success.

- Poor project management
- Insufficient project funds
- An insufficient audit during project life phases
- Overwhelming size and complexity of a project
- Poor communication between team members

The following table shows the aspects negatively influencing projects success. The table is organized from the highest score (the most influential) to the lowest score (the least influential).

Table 6 Aspects negatively influencing projects success

Aspect	Total Score
Poor communication between team members	215
Poor project management	181
Overwhelming size and complexity of a project	176
Insufficient project funds	168
Insufficient audit during project life phases	135

“Poor communication between team members” had gained the highest score of 215, making it the highest aspect in total. The most frequent mark for this aspect was 5/5, given by 74% of total respondents.

The least influential aspect in total is “Insufficient audit during project life phases”, with a score of 135. The most frequent mark for this aspect was 3/5 (43%).

4.6 Differences between aspect rating: Project Managers and Non-Project Managers

This practical part's partial goal is to identify whether respondents with PM experience answer differently about aspects influencing project success than respondents without PM experience.

4.6.1 Hypothesis- Aspects influencing Project Success.

H0: $MR_1 = \dots = MR_k$

H1: $\text{not}(MR_1 = \dots = MR_k)$

**MR=mean rank*

H1: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the influence of aspect “Project manager qualification” over project success.

H2: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the influence of aspect “Team qualification” over project success.

H3: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the influence of aspect “Adequate project methodology” over project success.

H4: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the influence of aspect “Realistic goals and objectives” over project success.

H5: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the influence of aspect “Realistic project budget” over project success.

H6: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the influence of aspect “Adequate software tools” over project success.

H7: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the influence of aspect “Poor project management” over project success.

H8: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the influence of aspect “Insufficient project funds” over project success.

H9: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the influence of aspect “Insufficient audit during project life phases” over project success.

H10: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the influence of aspect “Overwhelming size and complexity of a project” over project success.

H11: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience, regarding the influence of aspect “Poor communication between team members” over project success.”

Hypothesis testing

For hypothesis testing, the Kruskal-Wallis test was used to test the statistical significance of the difference between two mean ranks. This test was used because Kruskal Wallis uses the data values' rank and determines whether there is a statistically significant difference between medians, which is an appropriate measure because of the questionnaire's ranking nature. Primary data used for this research were two groups of independent and ordinal variables required for this test.

$$H' = \frac{12}{n(n+1)} \sum \left(\frac{R_j^2}{n_j} \right) - 3(n+1)$$

$$H = \frac{H'}{1 - \text{correction}}$$

Equation Kruskal Wallis test statistic

Hypothesis were tested under α value: $\alpha = 0,05$.

Results are summarized in tables 7 and 8.

Table 7 Summarized results-Positive Aspects

Positive Aspect	H0	Mean Ranks	P-Value	H-Value	Chi-Square Value
Realistic goals and objectives	accepted	equal	0.6234	0.2411	3,8415
Team qualification	accepted	equal	0.1432	2.1428	3,8415
Project manager qualification	rejected	not equal	0.00425	8.1736	3,8415
Realistic project budget	accepted	equal	0.6234	1.1685	3,8415
Adequate software tools	accepted	equal	0.7019	0.1465	3,8415
Adequate project methodology	accepted	equal	0.2697	1.2182	3,8415

Table 8 Summarized results-Negative Aspects

Negative Aspect	H0	Mean Ranks	P-Value	H-Value	Chi-Square Value
Poor project management	accepted	equal	0.9908	0.0001329	3,8415
Insufficient project funds	accepted	equal	0.2248	1.4733	3,8415
An insufficient audit during project life phases	accepted	equal	0.324	0.9727	3,8415
Overwhelming size and complexity of a project	accepted	equal	0.8077	0.05927	3,8415
Poor communication between team members	rejected	not equal	0.01737	0.01737	3,8415

4.7 Aspects influencing team welfare

Respondents were asked to choose whether they agree, somewhat agree, (are) not sure, somewhat disagree and disagree with statements regarding the effects of project methodologies on team welfare.

The statements were as follows:

Statement 1: Using project management methodologies helps allocate a sufficient amount of work between team members and limit the oversized workload.

Statement 2: Project methodology has a positive effect on team morale.

Statement 3: I prefer to work on projects under a specific project management methodology because they are less stressful than projects with different methodology.

Statement 4: I avoid working on projects under a specific project management methodology because they are more stressful than projects with different methodology.

For statements 3 and 4, respondents were asked to fill in the name of methodology in case they agree with the statement. Since the number of respondents who filled the name of methodology was small, this information will not be included in this thesis.

4.7.1 Results regarding the statements over the influence of project methodology over team welfare

Statement 1	
Opinion	Percentage
Disagree	0%
Somewhat disagree	15%
Not sure	15%
Somewhat agree	54%
Agree	15%

Table 10 Statement 1 Results

Statement 2	
Opinion	Percentage
Disagree	4%
Somewhat disagree	9%
Not sure	33%
Somewhat agree	30%
Agree	17%

Table 9 Statement 2 Results

Statement 3	
Opinion	Percentage
Disagree	11%
Somewhat disagree	20%
Not sure	26%
Somewhat agree	30%
Agree	4%

Table 12 Statement 3 Results

Statement 4	
Opinion	Percentage
Disagree	37%
Somewhat disagree	17%
Not sure	26%
Somewhat agree	11%
Agree	2%

Table 11 Statement 4 Results

This practical part's partial goal is to identify whether respondents with PM experience answer differently about project methodologies effect on team welfare compared to respondents without PM experience.

The same test (Kruskal-Wallis) was used to compare opinions about the effect of project management methodologies on team welfare.

4.7.2 Hypothesis - Effect of project management methodologies over team welfare.

H1: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the statement “Using project management methodologies helps to allocate sufficient amount of work between team members and limit oversized workload.”

H2: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the statement “Project methodology has a positive effect on the team morale.”

H3: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the statement, “I prefer to work on projects under a specific project management methodology because they are less stressful than projects with different methodology.”

H4: There is no statistical difference between the mean rank of respondents with PM experience and respondents without PM experience regarding the statement “I avoid working on projects under a specific project management methodology because they are more stressful than projects with different methodology.”

Hypothesis testing

Hypothesis were tested under α value: $\alpha = 0,05$

Results are summarized in table 9.

Statement	H0	Mean Ranks	P-Value	H-Value	Chi-Square Value
Statement 1	accepted	equal	0.6953	0.1534	3,8415
Statement 2	accepted	equal	0.9211	0.009823	3,8415
Statement 3	accepted	equal	0.6712	0.1802	3,8415
Statement 4	accepted	equal	0.2615	1.2606	3,8415

Table 13Welfare hypothesis testing

Results show no statistically significant difference between respondents' mean rank with PM experience and respondents without PM experience regarding all the statements.

5 Results and Discussion

This chapter consists of result interpretation, comments of respondents who participated in the questionnaire, discussion regarding key findings from chapter 4 and explanation of what they mean for this thesis's objectives. Finally, this chapter contains a comparison with literature research and results from the practical part.

5.1 Results

5.1.1 Ratings of selected Project Methodologies

Respondents were asked to rate selected project management methodologies; PRINCE 2, PMBOK and Agile methods based on their previous experience.

Agile rating and comments of respondents

The results of this section show that the most known and most popular method used is Agile. Additional comments in the questionnaire show that some respondents prefer projects led under Agile methods, namely Kanban and Scrum. One respondent further specified, *“Most of the projects I have worked on were Agile projects (Scrum, Kanban). I would not want to work on projects under different guidelines. Agile projects best adapt to ever-changing user requirements, funding changes and changes in collaborating systems”*. When asked to more specify their experience with Agile, one respondent wrote, *“Agile means you have to work every day; it is not for all, it can be the very painful finding”* Different respondent said, *“ Yes, most managers would choose to go for Agile when in reality they are micromanaging, which is different. I think it definitely works if you have responsible colleagues and a strong, trusted team.”* Another responded explain their rating of agile as 3/5 *“We tried to apply agile methodology internally on several projects even when the project was externally (from the sales and customer point of view) managed as a waterfall process (strict deadlines, price and scope agreed before the project started). My experience is very similar to what I wrote about PRINCE2. No matter which methodology is chosen, what really matters is how people work together in the team. In many cases, the agile methodology did not bring any extra benefit comparing to old fashion processes.”*

Prince2 rating and comments of respondents

The second most known from the selected methodologies was Prince2. This methodology was rated worse than Agile but better than PMBOK by the respondents who had any experience with the methodology. One respondent who rated this methodology 4/5 said about Prince2 the following *“We are not able to use 100% of this methodology, but it is a good framework and with clever updates we are using successfully on our FTFP projects.”* A different respondent who rated Price2 3/5 and who previously commented on Agile methods said about Prince2: *Most of our projects were done using "Prince2 like" methodology. My experience is mixed. At the end it depends on the personality of the project manager and team members. If PM is good and knows his/her job well the work with this process is good too. If PM is bad (or customer relationship is bad) than the process itself does not make it better. It is mostly about people how they work together.”*

PMBOK rating and comments of respondents

PMBOK was the least known and rated as the least popular by respondents who had any experience with the methodology. Only one comment was submitted about this methodology by a respondent who rated PMBOK 5/5 and commented the following: *“Most of the projects were managed by the PMBOK methodology adapted to internal guidelines, which I co-authored.”*

Respondents who do not have experience with the PM position have a higher tendency to rate Agile with higher rates than PMs.

With PM respondents, the difference between Agile and Traditional project management methods is not as significant as the difference between Agile and Traditional project management methods in respondents that do not have experience with PM position.

Comparing findings from “Ratings of selected Project Methodologies” with literature review

Agile methods' popularity corresponds with many articles used in a literature review that focused on Agile methods. For example, Ahmad, Soomro, Naqvi write in their article, *“Agile software development models are iterative and incremental nature approaches & become popular in the software information industry.”* (33) In regards to traditional project methodologies, which in this research were placed below Agile, they say *“traditional models can stay inefficient & ineffective as the business requirements are not*

tangible.” (33) Regarding the higher ratings of Prince2 over PMBOK, Karaman and Kurt, in their study, write that “PRINCE2 is preferable for small size IT projects; whereas PMBOK is preferable (or needs to be utilized) for the IT projects with high client commitment, large and complex project teams, high level of outsourcing, comprehensive contracts and high level of stakeholder engagement.”(20) They also write that “PRINCE2 covers managing product delivery activities from the perspective of the project team.” And Organizational Process Assets and Environmental Factors are better integrated with processes at PMBOK.” (20). This also corresponds to this research findings since the respondents were project team members, and thus it makes sense for them to give higher ratings to a methodology that is focused on the perspective of the project team.

5.1.2 General Project Outcome

This research shows that respondents' general experience with project outcome was positive with completing projects on time and within budget. The largest percentage of respondents stated that projects were delivered on time and within the project budget. The most common issue was with delivering projects on time, and budget came in second place. This was surprising since the literature review stated that staying within the project budget was an issue for IT teams. Standish group, in their report, stated that “The average across all companies is 189% of the original cost estimate. The average cost overrun is 178% for large companies, 182% for medium companies, and 214% for small companies.”(7) Regarding time overruns, they stated that only 13,9% of companies have under 20% time overruns. A different study (12) stated that 64% of IT projects face cost overrun and 78% face schedule overrun, which corresponds to this research results. (12)

5.1.3 Aspects influencing project success.

The positive aspect that had received the highest rating in its influence over project success was “Realistic goals and objectives” One respondent left a comment about his experience with IT project, saying, “ *There has to be stakeholder agreement on the requirements and adequate and stable funding.*”. The lowest score regarding the positive aspect had received “Adequate project methodology. One respondent in a different part of the questionnaire, where respondents were asked about their takeaways from the previous project, wrote:

“Manual work. No investment was made on automation; hence when the project got bigger, there were a lot of problems and frustration that could had been avoided.”

The negative aspect that had received the highest rating and the same time aspect received the total highest rating was “ Poor communication between team members.”

To further support this finding, one respondent wrote, *“Continuous communication, can-do attitude and having fun developing are really important for the success.”* Another respondent in the same section wrote this about communication *“It is important to set the communication matrix correctly and stick to the system approach”*.

The lowest score regarding negative aspects and the lowest score received “ Insufficient audit during project life phases”.

A study by Hughes, Dwivedi and Rana (8) places “Insufficient audit and post mortem” as a high ranking aspect influencing project success- however they consider different stages identified in the pre-project stage. In the same study, the aspect “Poor project management” is rated similarly in this research in the pre-project stage; however, its importance is increased in later stages. Interestingly enough, poor communication, which was rated as the most influential aspect of this research, was rated as a “middle-ranked” aspect in the study mentioned before. (8)

5.1.4 Aspects influencing team welfare.

The majority of respondents (54%) somewhat agree that using project methodologies has a positive effect on workload distribution.

The total majority are not sure (33%) whether project methodology would positively affect team morale; however, the sum of “ somewhat agree and agree” (30% + 17%) is more extensive than the sum of “ somewhat disagree and disagree” (4% + 9%).

Statements 3 and 4 focused on the question of methodology preference. However, since previous parts of this research revealed that most respondents have experience mainly with Agile, there is no clear conclusion from those two statements. It could be worth pointing out that most respondents do not have an evident discomfort with project methodologies and would mostly choose not to work on one specific methodology because the methodology is a cause for stress increase.

Since positive welfare is increased with the limitation of work overload (14) and since most respondents agree that project management methodology helps decrease work overload, it can be deduced that project management methodology can help increase team welfare.

5.1.5 Comparing responses of Project Managers and Non-Project Managers

From all selected aspects, including both project success topic and team welfare topic, only “Project manager qualification” and “Poor communication between team members” showed statistically significant differences in respondents' responses with project management experience and respondents without this experience.

No such statistically significant difference was found in responses regarding team welfare. The overwhelming majority of “no statistical difference” means a good sign towards overall equality between team members in IT projects in those topics and problems.

“Project manager qualification” was rated with higher scores by respondents who worked as project managers.

The same case occurred with them, especially with the aspect “ Poor communication between team members”. Only 9% of respondents who had experience with project manager position rated this aspect differently than 5/5.

6 Conclusion

This thesis's main objective was to compare traditional project management and agile project management methodologies applied to IT projects. This objective was achieved in a literature review with chapters dedicated to describing and comparing traditional project management and agile project management methodologies and in the practical part.

This research identified Agile methods as the most used methodology among the respondents and the highest-rated compared to Prince2 and PMBOK. Lesser number of respondents had any experience working with Prince 2 than with Agile, and those who had experience with Prince 2 gave it overall a lower rating than Agile. PMBOK had the least number of respondents who had experience with this methodology and overall received the lowest rating.

One of the goals of this thesis was to evaluate the impacts of methodologies on the project budget. The practical part of this thesis showed that the most known and most popular methodology is Agile. The literature review of this thesis mentions some approaches for Agile budgeting projects. However, one respondent comments, “ *With Agile approach neither scope nor budget are set in stone and projects are never finished. Most of the projects delivered some value to the users. It is fair to say that most times people underestimate the effort and therefore cost/resources required.*” A possible recommendation for future research is to find specific aspects of success for Agile projects and evaluate them with a new scale, different from original measures of success; budget and on-time delivery.

This research partially aimed to identify what aspects influence project success in the eyes of team members.

It was found that the aspect regarded as the most influential was “setting realistic goals and objectives for the project”. In the majority of aspects, there was no statistical difference between means of respondents, depending on whether they had previous experience with the position of a project manager or not.

The aspect with the highest scoring that could negatively influence project outcome was “poor communication between team members”. Interestingly enough, in this case, there was a statistically significant difference between respondents' responses with previous experience with the project manager position and respondents without the experience. The conducted analysis showed that respondents with project management experience had a

higher tendency to rate this aspect 5/5 over respondents without experience as a project manager.

Regarding the effect of project methodologies on team welfare, most respondents believed that using methodology would positively affect work distribution, which regarding the literature review, has a positive effect on team welfare. However, no significant results were found regarding the preference of project methodologies.

The rating of aspects influencing project success should be considered by project managers and team managers in future projects when focusing on a project plan, especially on ensuring that the right method for team communication is used and preventing information loss.

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7 Appendix

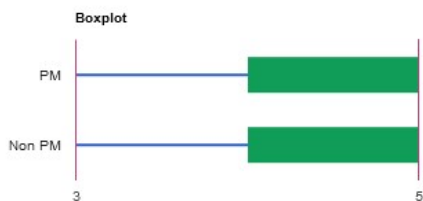
7.1 Results interpretation for Kruskal Wallis test

7.1.1 Realistic Goals and Objectives

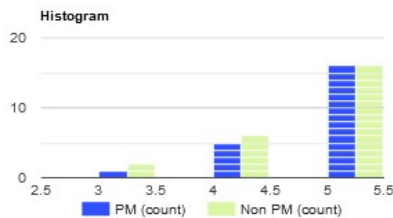
The p-value equals 0.6234.

For $\alpha = 0,05$ H_0 is accepted. The chance of type I error, rejecting a correct H_0 , is too high: 62.34%. The test statistic H equals 0.2411, which is in the 95% region of acceptance: (0: 3.8415). The mean ranks of all groups assume to be equal. In other words, the difference between the mean ranks of all groups is not big enough to be statistically significant.

Graph 1 Realistic Goals and Objectives Boxplot



Graph 2 Realistic Goals and Objectives Histogram

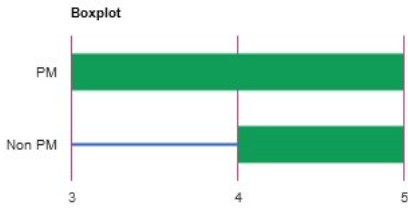


7.1.2 Team Qualification

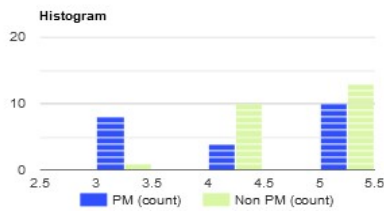
The p-value equals 0.1432.

For $\alpha = 0,05$ H_0 is accepted. The chance of type I error, rejecting a correct H_0 , is too high, 14.32%. The test statistic H equals 2.1428, which is in the 95% region of acceptance: (0: 3.8415). The mean ranks of all groups assume to be equal. In other words, the difference between the mean ranks of all groups is not big enough to be statistically significant.

Graph 3 Team Qualification Boxplot



Graph 4 Team Qualification Histogram



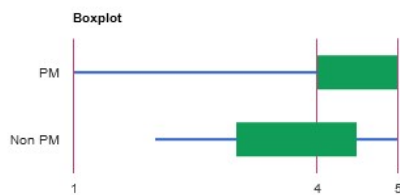
7.1.3 Project manager qualification

The p-value equals 0.00425. For $\alpha = 0,05$ H_0 is rejected. The chance of type I error (rejecting a correct H_0) is small: 0.43%. The test statistic H equals 8.1736, not in the 95% region of acceptance: (0: 3.8415).

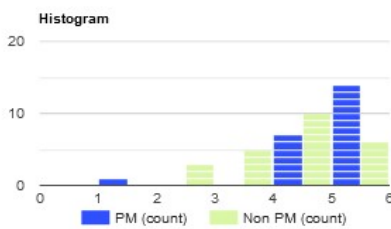
The difference between the mean ranks of some groups is big enough to be statistically significant.

When selecting a value from both groups, one group has a higher probability of containing the higher value than the other.

Graph 5 Project manager qualification Boxplot



Graph 6 Project manager qualification Histogram



7.1.4 Realistic project budget

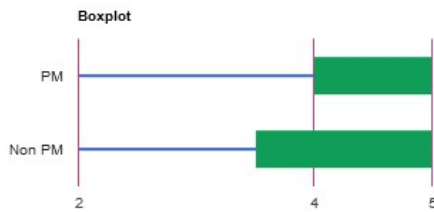
The p-value equals 0.2797. For $\alpha= 0,05$ H_0 is accepted.

The chance of type I error, rejecting a correct H_0 , is too high: 27.97%.

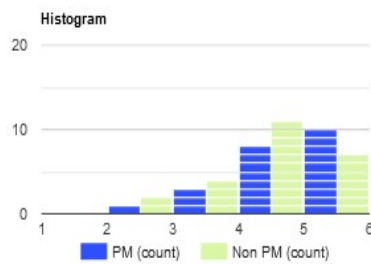
The test statistic H equals 1.1685, which is in the 95% region of acceptance: (0 : 3.8415).

The mean ranks of all groups assume to be equal. The difference between the mean ranks of all groups is not big enough to be statistically significant.

Graph 7 Realistic project budget Boxplot



Graph 8 Realistic project budget Histogram



7.1.5 Adequate software tools

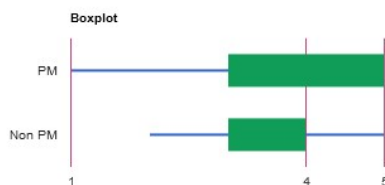
The p-value equals 0.7019. For $\alpha= 0,05$ H_0 is accepted. The chance of type I error, rejecting a correct H_0 , is too high: (70.19%).

The test statistic H equals 0.1465, which is in the 95% region of acceptance: (0: 3.8415).

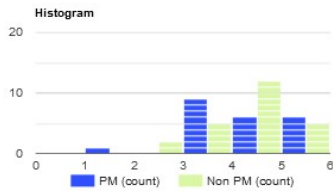
The mean ranks of all groups assume to be equal.

The difference between the mean ranks of all groups is not big enough to be statistically significant

Graph 9 Adequate software tools Boxplot



Graph 10 Adequate software tools Histogram



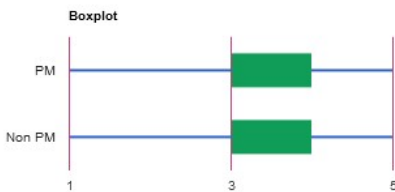
7.1.6 Adequate project methodology

The p-value equals 0.2697.

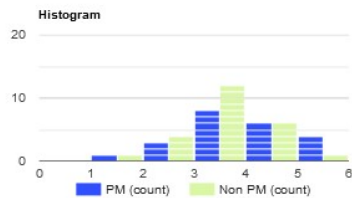
For $\alpha= 0,05$ H_0 is accepted. The chance of type I error, rejecting a correct H_0 , is too high: 26.97%. The test statistic H equals 1.2182, which is in the 95% region of acceptance: (0: 3.8415). The mean ranks of all groups assume to be equal.

In other words, the difference between the mean ranks of all groups is not big enough to be statistically significant.

Graph 11 Adequate project methodology Boxplot



Graph 12 Adequate project methodology Histogram



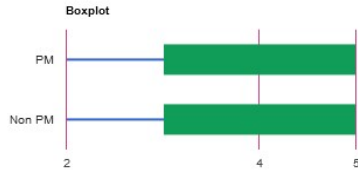
7.1.7 Poor project management

The p-value equals 0.9908.

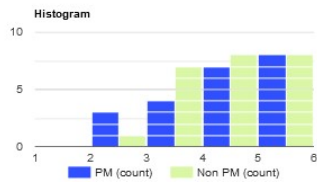
For $\alpha= 0,05$ H_0 is accepted. The chance of type I error, rejecting a correct H_0 , is too high: 99.08%. The test statistic H equals 0.0001329, which is in the 95% region of acceptance: (0 : 3.8415). The mean ranks of all groups assume to be equal.

In other words, the difference between the mean ranks of all groups is not big enough to be statistically significant.

Graph 13 Poor project management Boxplot



Graph 14 Poor project management Histogram



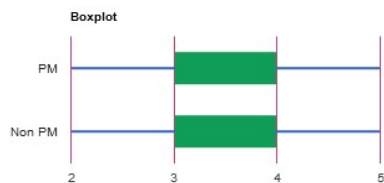
7.1.8 Insufficient project funds

The p-value equals 0.9908.

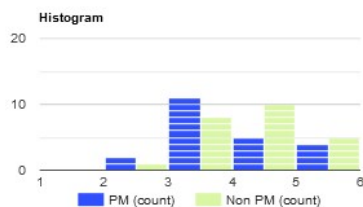
For $\alpha = 0,05$ H_0 is accepted. The chance of type I error, rejecting a correct H_0 , is too high: 22.48%. The test statistic H equals 1.4733, which is in the 95% region of acceptance: (0: 3.8415). The mean ranks of all groups assume to be equal.

In other words, the difference between the mean ranks of all groups is not big enough to be statistically significant.

Graph 15 Insufficient project funds Boxplot



Graph 16 Insufficient project funds Histogram



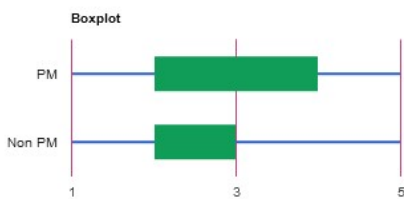
7.1.9 An insufficient audit during project life phases

The p-value equals 0.324.

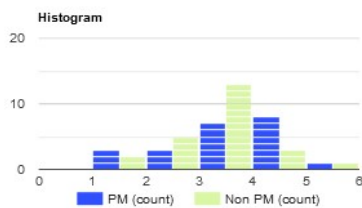
For $\alpha= 0,05$ H_0 is accepted. The chance of type I error, rejecting a correct H_0 , is too high: 32.4%. The test statistic H equals 1.4733, which is in the 95% region of acceptance: (0: 3.8415). The mean ranks of all groups assume to be equal.

In other words, the difference between the mean ranks of all groups is not big enough to be statistically significant.

Graph 17 Insufficient audit during project life phases Boxplot



Graph 18 Insufficient audit during project life phases Histogram



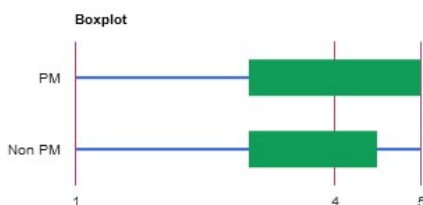
7.1.10 Overwhelming size and complexity of a project

The p-value equals 0.8077.

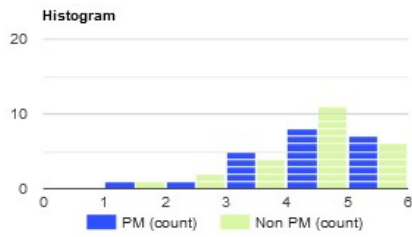
For $\alpha= 0,05$ H_0 is accepted. The chance of type I error, rejecting a correct H_0 , is too high: 80.77%. The test statistic H equals 0.05927, which is in the 95% region of acceptance: (0: 3.8415). The mean ranks of all groups assume to be equal.

In other words, the difference between the mean ranks of all groups is not big enough to be statistically significant.

Graph 19 Overwhelming size and complexity of a project Boxplot



Graph 20 Overwhelming size and complexity of a project Histogram



Poor communication between team members

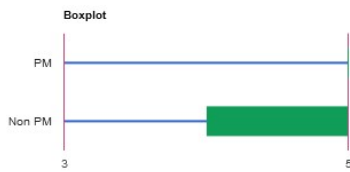
The p-value equals 0.01737.

For $\alpha = 0,05$ H_0 is rejected. The chance of type I error is small: 0.01737 (1.74%).

The test statistic H equals 5.6585, which is not in the 95% region of acceptance: (0 : 3.8415). Some of the groups' mean ranks consider to be not equal.

In other words, the difference between the mean rank between groups is big enough to be statistically significant.

Graph 21 Poor communication between team members Boxplot



Graph 22 Poor communication between team members Histogram

