Project Management and Software Development Methodologies in South Africa

**H.L Strydom**

 **orcid.org/0000-0002-2362-6327**

Supervisor: Prof. Neels Kruger

Co-supervisor: Mr. Ricus Warmenhoven

Examination: 17 October 2022

Student number: 31597793

Table of contents

[Chapter 1 Introduction 1](#_Toc116823347)

[1.1 Introduction 1](#_Toc116823348)

[1.2 Problem Statement 1](#_Toc116823349)

[1.3 Aims and Objectives 2](#_Toc116823350)

[1.4 Provisional Chapter Division 2](#_Toc116823351)

[Chapter 2 Literature Review of methodologies 3](#_Toc116823352)

[2.1 Introduction 3](#_Toc116823353)

[2.2 Project Management and Software Development Methodologies 3](#_Toc116823354)

[2.2.1 Project Management Methodologies 3](#_Toc116823355)

[2.2.1.1 PRINCE2 Methodology 4](#_Toc116823356)

[2.2.2 Software Development Methodologies 7](#_Toc116823357)

[2.2.2.1 DevOps 7](#_Toc116823358)

[2.2.3 Both Project Management and Software Development Methodologies 8](#_Toc116823359)

[2.2.3.1 AGILE Methodology 8](#_Toc116823360)

[2.2.3.2 WATERFALL Methodology 10](#_Toc116823361)

[2.3 Summary 12](#_Toc116823362)

[Chapter 3 Case Studies 13](#_Toc116823363)

[3.1 Introduction 13](#_Toc116823364)

[3.2 Retro Rabbit – Company A 13](#_Toc116823365)

[3.3 Entelect – Company B 14](#_Toc116823366)

[3.4 SAPCONET – Company C 15](#_Toc116823367)

[3.5 ANDILE Solutions – Company D 15](#_Toc116823368)

[3.6 Signify Software – Company E 16](#_Toc116823369)

[3.7 IsoMetrix Software – Company F 17](#_Toc116823370)

[Chapter 4 Case Study Comparison 18](#_Toc116823371)

[4.1 Introduction 18](#_Toc116823372)

[4.2 Company Specialisation 18](#_Toc116823373)

[4.3 Company Employee that completed questionnaire 18](#_Toc116823374)

[4.4 Predominant Software Development Methodology 19](#_Toc116823375)

[4.5 Predominantly Project Management Methodology 19](#_Toc116823376)

[4.6 Difference between SDM and PMM 19](#_Toc116823377)

[4.7 COVID-19 Impact 20](#_Toc116823378)

[4.8 Success and Failures 20](#_Toc116823379)

[Chapter 5 Reflection and Conclusion 21](#_Toc116823380)

[5.1 Introduction 21](#_Toc116823381)

[5.2 Most used Project Management and Software Development Methodologies 21](#_Toc116823382)

[5.3 COVID 19 Impact 22](#_Toc116823383)

[5.4 Interesting Finds 22](#_Toc116823384)

[5.5 Future Recommendations 22](#_Toc116823385)

[Bibliography 23](#_Toc116823386)

List of Tables

[Table 1 - Provisional Chapter Division 2](#_Toc116823328)

[Table 2 - PRINCE2 Principles 4](#_Toc116823329)

[Table 3 - PRINCE2 Themes 5](#_Toc116823330)

[Table 4 - PRINCE2 Processes 5](#_Toc116823331)

[Table 5 - Company Specialisation 18](#_Toc116823332)

[Table 6 - Employee Role 18](#_Toc116823333)

[Table 7 - SDM Questionnaire results 19](#_Toc116823334)

[Table 8 - PMM Questionnaire results 19](#_Toc116823335)

[Table 9 - SDM and PMM Difference 19](#_Toc116823336)

[Table 10 - COVID Site Impact 20](#_Toc116823337)

[Table 11 - COVID General Impact 20](#_Toc116823338)

[Table 12 - Online Success and Failures 20](#_Toc116823339)

List of Figures

[Figure 1 - DevOps Architecture 7](#_Toc116823340)

[Figure 2 - SCRUM Methodology 8](#_Toc116823341)

[Figure 3 - SCRUM Life Cycle 9](#_Toc116823342)

[Figure 4 - Waterfall Methodology Phases 11](#_Toc116823343)

[Figure 5 - Waterfall Phases Explained 11](#_Toc116823344)

[Figure 6 - COVID Impact Chart 20](file:///C:\Users\hanos\OneDrive\Desktop\ISE%20Individual%20Assignment\31597793_ISE_Assignment.docx#_Toc116823345)

[Figure 7 - PM and SDM Charts 21](#_Toc116823346)

List of abbreviations

|  |  |
| --- | --- |
| **Abbreviations** | **Definition** |
| CEO | Chief Executive Officer |
| CIO | Chief Information Officer |
| DevOps | Development-to-Operations |
| GITO | Government Information Technology Officers |
| GRC | Governance, Risk management, and Compliance |
| ICT | Information and Communications Technology |
| IT | Information Technology |
| PMM | Project Management Methodology |
| PRINCE2 | PRojects IN Controlled Environments |
| SDM | Software Development Methodology |

# Introduction

## Introduction

This research project seeks to highlight the most used Project Management and Software Development Methodologies in the South African IT job market. To prove this a questionnaire will be sent out and case studies will be reviewed to get a better insight into what real businesses are using. There will also be determined what changes COVID-19 has imposed on these businesses.

## Problem Statement

One of the primary objectives of every organization is to generate revenue, and in order to generate revenue, they must achieve a competitive edge over other businesses. Unfortunately, external changes will make it challenging for any business to meet its needs. Changes in the external environment, such as COVID-19, are driving technical innovation and compelling enterprises to innovate, adapt, and overcome these obstacles.

COVID-19 is an infectious disease caused by the SARS-CoV-2 virus, and it is transmitted by small liquid particles distributed by coughing, sneezing, or even breathing (WHO, 2020). Lockdowns were enacted worldwide, and businesses were closed for an extended period of time. These businesses and organizations had to find a method to continue their operations in an online environment. It is challenging enough for CEOs, CIOs, and GITOs to effectively manage Information and Communications Technologies and develop a sustainable ICT environment that is conducive to human and social needs.

Because COVID-19 altered how businesses operate and how managers oversee development teams, this study will highlight the most prevalent Project Management and Software Development Methodologies in the South African IT employment market as compared to the international market.

In order to find more information on these management and development methodologies, a minimum of five companies will fill out a questionnaire, giving more insight into the matter.

Questionnaire Link: <https://forms.office.com/r/LEhmz6sqBz>

## Aims and Objectives

The aim is to highlight the following company differences:

* Size of the company
* Type of software projects they complete
* Project Management and Software Development Methodologies
* Success and Failures

The goal of this research project is to make conclusions about the most prevalent project management and software methodologies in the IT job market, why they work or do not work, and future suggestions, considering the influence of COVID-19.

## Provisional Chapter Division

The following Table 1, depicts the provisional chapter division on the subjects that will be discussed:

Table 1 - Provisional Chapter Division

|  |  |
| --- | --- |
| **Chapter 1** | Introduction |
| **Chapter 2** | Literature review on types of software development methodologies |
| **Chapter 3** | Overview of Case Studies |
| **Chapter 4** | Comparison of the Case Studies Information |
| **Chapter 5** | Reflection and Conclusion |

# Literature Review of methodologies

## Introduction

There are a variety of available Project management and software development methodologies. Before discussing the approaches, a clear definition of Project Management Methodologies and Software Development Methodologies is required:

Project Management Methodology:

* Project management methodologies, also known as PMM can be seen as a set of approaches, guidelines, tools, templates, and techniques that may be utilized to manage any team (Pace, 2019).

Software Development Methodology:

* Software development methodologies are a collection of rules and guidelines that are adhered to throughout the software development process (Machiridza, 2016). It can also be seen as a set of processes that are iteratively followed to successfully complete the project (ur Rehman, 2017).

Examining both Project management and software development approaches reveals a significant distinction between the two. Software development methodologies are used to successfully complete a development project, whereas project management methodologies are used to effectively manage a team. In section 2.2, project management and software development methodologies will be discussed.

## Project Management and Software Development Methodologies

In the following sections, different project management and software development methodologies will be discussed. It is important to note that some methodologies can be used explicitly for project management and other explicitly for software development, but some methodologies can be used for both. The methodologies that will be discussed have been selected because they are the same methodologies that are being used by the companies that are the focus of the case studies.

### Project Management Methodologies

Project management methodologies are used by project managers to manage a team of developers and other team members, to ensure the successful completion of projects.

#### PRINCE2 Methodology

PRINCE2 is a methodology that stands for “Projects IN Controlled Environments” (Wideman, 2002), and is a framework that divides projects into smaller, more manageable pieces called “Stages”. PRINCE2 has been around for about 30 years (ILXGroup, 2022). The project life cycle is managed by the seven processes of PRINCE2 (Malsam, 2021).

PRINCE 2 is very flexible and scalable according to AXELOS (2020) and provides a step-by-step guide to managing a project.

It is essential to know the structure and basic workings of this methodology to successfully use it in project management. This methodology has seven Principles, seven Themes, and Seven Processes provided by AXELOS (2020) in the PRINCE22 guide.

##### PRINCE2 Principles

These principles provide a framework of best practices for all participants in a project:

Table 2 - PRINCE2 Principles

|  |  |
| --- | --- |
| **Principle** | **Description** |
| Continued Business Justification | There must be a justifiable reason to start a project. An important document is the Business case. This document is used throughout the life cycle of the project |
| Learn from Experience | It is important to learn from all the projects worked on. Learning past mistakes is very important to avoid making the same mistakes in future projects |
| Roles and Responsibilities are defined | During a project, members can take on more than one role, and even share rolls |
| Manage by Stages | Using the PRINCE2 methodology, the project is divided into smaller parts called stages. After each stage is finished in the life cycle, the project plan is updated |
| Manage by Exception | To put it plainly, this is how much authority each project member has in their area. This ‘authority’ is called tolerance and can be adjusted if exceeded |
| Focus on Products | The quality of the deliverables must be good |
| Tailor to suit Project Environment | The PRINCE2 methodology must be tailored to fit the specific project |

##### PRINCE2 Themes

Several questions need to be answered throughout the project management process to successfully manage a project. The following themes will aid in answering the questions of why, who, what, how, what if, impact, and where are we now.

Table 3 - PRINCE2 Themes

|  |  |  |
| --- | --- | --- |
| **Themes** | **Description** | **Question Answered** |
| Business Case | Linked to the business justification principle. Answers the question of why the project is important. | Why? |
| Organisation | Linked to roles and responsibility principle. Answers the questions of who has what role in the project. | Who? |
| Quality | Linked to focus on product. Answers the question of what the quality is of the project. | What? |
| Plans | Answers the question of how the goal of the project is achieved | How? |
| Risk | This theme is about identifying, assess and control uncertain events that may occur during a project. | What if? |
| Change | The question is answered of what impact the change has on the project and how to handle these changes | Impact? |
| Progress | The project progression needs to be tracked, in order to stay on track to achieve the project goal of delivering the solution in time. | Where are we now? |

##### PRINCE2 Processes

PRINCE2 is a process-based project management methodology. A process is a systematic series of activities meant to achieve a certain goal. The following processes provide a set of activities that are required to deliver a successful project.

Table 4 - PRINCE2 Processes

|  |  |
| --- | --- |
| **Processes** | **Description** |
| Starting a project | A purpose for the project needs to be clear, contributing to the scope of the project |
| Directing a project | This is the whole process from the beginning to the end of a project |
| Initiating a project | At this stage, the project manager how the performance targets will be managed |
| Controlling a stage | The project manager's responsibility is to divide the project into smaller, more manageable stages |
| Managing product delivery | This is more about the communication between the managers and delivering deliverables |
| Managing a stage boundary | The project manager and the stakeholders review every stage |
| Closing a project | Decommission the project |

##### Strengths (KnowledgeHut, 2022)

* Easy to stay on track
  + One of the goals of a successful project is to deliver the project on time. Using PRINCE2, project is divided into smaller and more manageable stages, that makes it easier to accomplish in time.
* Good Quality and Best Practice
  + After each stage, the manager and stakeholders decide whether or not the outcomes are fulfilled. Using PRINCE2 along with a governance framework such as COBIT19 or ITIL, ensures best practice.
* Reliable
  + This is a very important advantage, because it plays a huge part in the project question of is there a methodology that is applicable for the next three to five years. PRINCE2 has been around for around 30 years, and according to PRINCE2.com, 88% of professionals said that this methodology helped them in their managing career (ILXGroup, 2022).

##### Weaknesses

* Documentation
  + Although PRINCE2 allows for good quality projects, this methodology has much documentation along with the project life cycle (KissFlow, 2021).
* Difficult without training and guidance
  + In order to apply PRINCE2 in a project, proper training and certification need to be done; this can be expensive and time-consuming (ILXGroup, 2022).

### Software Development Methodologies

Software development methodologies are used when working on artefacts or projects. Software development methodologies are followed to ensure the development of the artefact is a success, and satisfies the clients needs.

#### DevOps

DevOps, also known as ‘Development-to-Operations”, is a practice that combines processes of Development and Operations (Ebert *et al.*, 2016), meaning DevOps consists of a single team that is in charge of development, testing and all operation processes (Gokarna & Singh, 2021). This helps teams to continuously deliver quality software, while reducing miscommunications between two teams (Ebert *et al.*, 2016).

DevOps can be broken down into four phases that needs to be followed in order to be successful: Plan, Develop / Test, Deploy, and Operate. These four phases fit into a larger DevOps architecture as depicted by Sharma and Coyne (2015) in Figure 1.

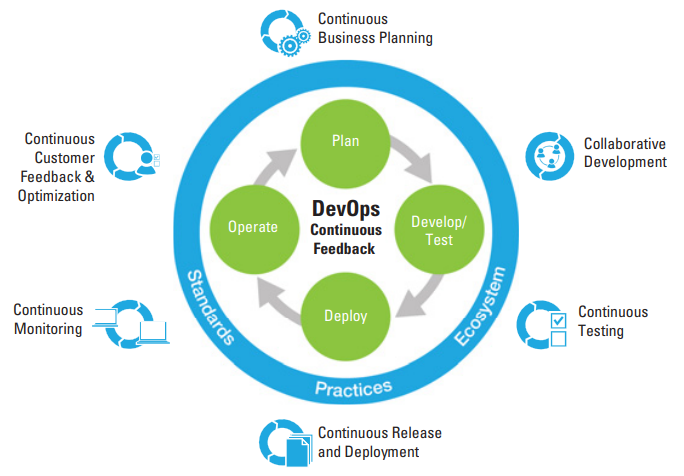


Figure 1 - DevOps Architecture

##### Strengths

* Fast development and deployment of programs
* Improves customer experience and satisfaction
* Simplifies collaboration
* Better productivity and team engagement due to collective responsibility

##### Weaknesses

* Not many DevOps professionals
* Technological infrastructure cost is high

### Both Project Management and Software Development Methodologies

#### AGILE Methodology

Much like PRINCE2, projects are divided into smaller, more manageable pieces, called prints. The Agile methodology is a method of managing projects by dividing them into smaller, more manageable pieces called prints. Constant communication with stakeholders and continual improvement at each level are required.

There are different types of Agile methods and frameworks such as SCRUM, extreme project management, adaptive project management and dynamic project management (Cervone, 2011).

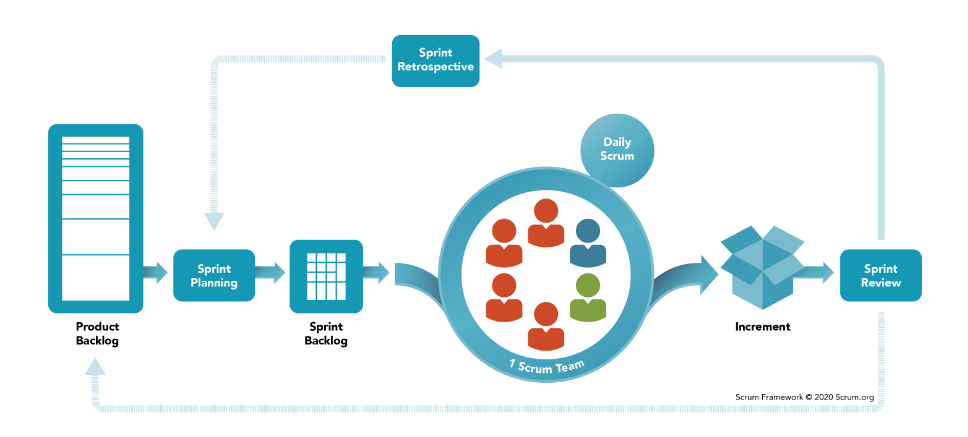


Figure 2 - SCRUM Methodology

A SCRUM master is responsible for upholding the values and principles and hence assuring the success of the project.

There are six SCRUM principles serve as guidelines to follow the SCRUM methodology. The following are the six SCRUM principles as described by Wrike (2020).

1. Empirical Process Control
   1. SCRUM processes are ruled by transparency, inspection and adaption.
2. Self-Organisation
   1. SCRUM teams should manage their own tasks and solve problems independently
3. Time-Boxing
   1. A certain amount of time is set out for each objective
4. Value Based Prioritisation
   1. Product backlog items are continuously updated based on value and importance
5. Iterative Development
   1. Objectives are consistently reviews and revised
6. Collaboration
   1. Most SCRUM teams frequently work together, and daily meetings are held to ensure everything is going according to plan, and to resolve any problems.

Agile is a very useful methodology for when the requirements can change through the development process, and follows four values:

1. Individuals and interactions over processes and tools
2. Working software over comprehensive documentation
3. Customer collaboration over contract negotiation
4. Responding to change over following a plan

These 4 values are met by following the SCRUM life cycle as depicted in the figure belowe:

Diagram

Description automatically generated

Figure 3 - SCRUM Life Cycle

The agile software development methodology is different from more traditional methodologies, because the requirements can change throughout the life cycle, and developers can go to previous phases of the life cycle without starting over (Al-Saqqa *et al.*, 2020).

##### Strengths

Most, if not all the following strengths are the same as the principles of the agile methodology. However, for this study, only a few strengths will be named (Shahir *et al.*, 2008):

* Changes are welcome
  + In the Agile Methodology, changes are welcome because the project and product change depending on the user's feedback.
* Meeting stakeholders and client needs
  + After every print, the stakeholders and customer give feedback allows the stakeholders to be happy and participate in the project life cycle. This helps the goal of delivering the project in scope.
* Iterative and Incremental development
  + Help to deliver working increments of the project frequently. This helps with quality insurance.
* Rapid Development
  + Another strength is that projects are usually done faster by using the agile methodology. They are helping the goal of delivering a project in time.

##### Weaknesses

Weaknesses in the agile methodology are not uncommon; these following are possible weaknesses when using the agile Methodology (Shahir *et al.*, 2008):

* Communications
  + One of the principles states that one of the main communication methods is face-to-face. This can be difficult in some projects, especially with COVID making more and more projects online.
* Customer Participation
  + Even though customer and stakeholder participation can be considered as a strength, it can also be a weakness if the customer or stakeholders do not want to be present all of the time.
* Documentation
  + Although much documentation can be considered a weakness, like in PRINCE2, a lack of documentation, such as with Agile, can be appalling, making it a lot harder for new developers joining the project later on

#### WATERFALL Methodology

Unlike the Agile Methodology, the waterfall methodology is a sequential or linear approach to project management. The project is divided into phases, and these phases are complete after one another, usually with the sign-off by stakeholders (Sherman, 2015). The waterfall methodology was established in 1970 and is still being used in practice today (Leeron Hooray, 2022). It is predominantly employed when a project's requirements are well-defined and the likelihood of significant changes are minimal (Dursun & Goker, 2022).

There are six phases in this methodology, namely Requirements, Design, Implementation, Testing, Deployment and Maintenance (Laoyan, 2021). Each phase needs to be completed before going on to the next phase, and the only way to revise a previous phase is to restart the flow.

Diagram

Description automatically generated

Figure 4 - Waterfall Methodology Phases

|  |  |
| --- | --- |
| Waterfall Phases Explained | |
| Requirements | This phase is about understanding the project scope and definition. |
| Design | More in-depth view of the scope and requirements, and an overall architecture is designed. |
| Implementation | Parts of the project are developed and are integrated into the next phase. |
| Testing | All the units developed in Phase 3 are integrated into the system after testing. |
| Deployment | Once the product is functional, the product is released to the stakeholders or customers. |
| Maintenance | Modifications are made afterwards if defects are discovered or when the stakeholders have new requests. |

Figure 5 - Waterfall Phases Explained

##### Strengths (Sharma, 2021)

* Deadlines
  + Seeing that the project is divided in specific phases, each phase has specific deadlines, making sure the project will be delivered in time.
* Ease of Use
  + The normal project life cycle and its phases is easy to understand. New developers can join during the development and be brought up to date quickly.
* Easy to manage
  + As a manager, it is easy to manage such project, because there are specific goals and deliverables, that won’t change after Phase 1.

##### Weaknesses

* Changes
  + After Phase 1, where a scope is defined, and moves to Phase 2, the scope cannot be revisited and changed.
* Little stakeholder and client interaction
  + The only phase where stakeholders are involved is stage 1. There is a bigger chance that the stakeholders will be unhappy with the end product.

## Summary

Choosing a methodology for either Project Management or Software Development all depends on the requirements of the clients or the type of business. Some methodologies are specifically for project management such as PRINCE2, and some methodologies are specifically for software development such as DevOps.

For project management, PRINCE2 is a good project management methodology when the manager wants a strong management structure and wants a clear methodology for risk assessment.

For software development, DevOps is a good methodology, when you want to speed up the development process and decrease the risk of miscommunications.

Although there is a difference between project management and software development, there is an overlapping methodology. Both project management and software development can use the same methodologies such as the Waterfall methodology and Agile Methodology.

When the requirements are set in stone, and not subject to change, a Waterfall methodology would work well, but when the business is continuously working with the clients and shareholders, the Agile methodology may be more applicable.

This may sound good on paper, but is it true in practise? Did COVID-19 have an effect on the Project management and Software development methodologies companies follow? The following Chapter, different case studies will be reviewed to get a better understanding of the methodologies used in business, and what effect COVID-19 possibly had.

# Case Studies

## Introduction

The interviewees were from different types of businesses, and each employee had a unique function inside their own organization. The companies vary in terms of both their size and the kind of projects that they work on a daily basis. The companies that will be reviewed is Retro Rabbit, Entelect, SAPCONET, ANDILE Solutions, Signify Software and IsoMetrix Software.

During this Chapter pseudonyms will be used to ensure employee privacy. A short overview of the company will be given where the following will be addressed:

1. Methodologies used
2. Whether there is a difference between PMM and SDM
3. Where they worked before, during and after COVID
4. The impact of COVID
5. Success and Failures in regard to productivity, collaboration, communication, work balance and security.

## Retro Rabbit – Company A

Retro Rabbit is a medium-sized company with 100 to 500 employees. They are located in Pretoria, South Africa, in Wapadrand. The firm was established in 2004 with a focus on software development and the creation of software solutions for clients. It is a lively company and doesn’t resemble typical traditional companies.

The employee that was interviewed and asked to fill out the questionnaire is Employee A, a junior developer at Retro Rabbit.

Company A use the Agile methodology as both Project Management and Software development, more specifically the SCRUM method. This supports the answer of Employee A that they do not think there is a different function between Project management and Software Development Methodologies. Before COVID-19, Company A mostly worked on premise. During and after COVID-19 most of the work was done off premise. Employee A was of the opinion that COVID-19 has major impact on Project Management and Software Development. It had a positive effect on Software Development, but not Project Management. The employee also admitted that personal productivity did decrease.

The employee strongly agreed that COVID-19 has a significant impact on the technologies, governance and strategies the company used. Some challenges the employee faced was communication and collaboration. It was very difficult for employees to build relationships and effectively communicate in an online environment. Work life balance was difficult to handle for the junior developer, but managing distractions was not so difficult. Although COVID-19 has some drawbacks on the company, the company found some success in their security. Company A were well equipped to handle any security threats while working from home, and the employees were skilled enough to handle any threats, even though they were working from their personal devices. Employee A made it clear that the role of a team leader can be very impactful on how the teams operate.

## Entelect – Company B

Entelect is a large enterprise, employing more than 1000 employees. The headquarters are located in Melrose Arch in Gauteng, South Africa. They also have branches in Amsterdam and London. The company was founded in 2001 and specialise in software engineering to deliver world-word class solutions to a diverse range of industries. It is a more conventual company, that takes a more structured approach to project management. The employee that was interviewed and asked to fill out the questionnaire is Employee B, an intermediate developer at Entelect.

Although company B believe there is a difference between Project Management and Software Development methodologies, they use the Agile methodology for both Project management and Software development, more specifically the SCRUM method. Company B worked on premise before COVID-19, off premise during COVID-19 and mostly off premise after post COVID-19. COVID-19 had a positive effect on project management and software development, as well as the manner in which they were conducted.

Employee B strongly believed that COVID-19 had an impact on governance and the strategies within the company, and that COVID did not have a positive impact on the culture, maturity and operations. The employee also believes there was no impact on the technological infrastructure and architecture within the organisation. Some drawbacks the company experienced during COVID was that employees could not effectively build relationships with other members, and distractions were difficult to handle while working on an online environment. Even though it was difficult to build relationships, the team members were still able to effectively communicate, collaborate with other teams, and had a positive impact on productivity. The security sector of this company was not severely impacted COVID, because the company was well suited to deal with the security threads, and therefor the security protocols dit not change substantially. This could also be largely due to the fact that the employees did not use their own personal devices, and the company devices has anti-spyware installed.

## SAPCONET – Company C

Although SAPCONET is a relatively small company with less than 100 employees, they form part of a larger company, groupelephant, that employs more than 1000 employees. SAPCONETs headquarters are located in Woodmead in Gauteng, South Africa. The company was founded in 2006, and they specialise in IT Consultation. The employee that was interviewed and asked to fill out the questionnaire is Employee C, a Project Manager at SAPCONET.

This company generally do not follow any Software Development Methodologies, but when they do, they use the Waterfall methodology for both Project Management and Software Development. The company worked on premise before COVID, and mostly off premise during and after COVID. The employee strongly believed that COVID had an impact on the organisation, and the way they conducted Project Management and Software Development. Both Project Management and Software development had a positive impact.

The technologies used, governance and strategies were impacted by COVID. Some were positively impacted such as Technology architecture and infrastructure, where other such as culture and maturity were negatively impacted.

Teams could effectively communicate and collaborate with other teams, and it was easy to handle work-life balance, although it was difficult to manage all the distractions while working in an online environment. Security was also not a big problem for Company C, seeing they were well prepared to deal with threats that could arise while working from home. Employees were not trained to prevent any security risks, but the project manager believed they were skilled enough to deal with any threats. The employees used the companies devices equipped with anti-spyware software, and security audits was done once a quarter. The project manager made a statement that they are still currently working from home, and that requires them to have stricter project management than before.

## ANDILE Solutions – Company D

ANDILE Solutions is another small company with less than 100 employees. Their headquarters is located in Rosebank in Gauteng, South Africa. They also have other branches in Mauritius, Netherland and the United Kingdom. The company was founded in 2008 and they specialise in IT consulting and IT services relating to financial services and central banks. The employee that was interviewed and asked to fill out the questionnaire is Employee D, a Lead Developer at ANDILE Solutions.

This company believe there is a separation of function and duty between Project Management and Software Development methodology. The company uses AGILE SCUM and DevOps as their preferred Software Development methodologies and the Agile methodology for Project Management. COVID 19 did not have an impact on the way they conducted project management and it could be because of the reason that they were mostly working off premise before, during and after COVID, meaning they were used to an online working environment.

Company D believed that that there was an impact on the technological infrastructure, but technologies were not the most significantly impacted due to COVID. It was determined that there was no impact on the governance and strategies of the organisation, and that culture, operations and services all had a positive impact due to COVID.

The employee admitted that personal productivity was negatively impacted, and that it was not easy to handle work-life balance, partly due to the possible distractions while working from home. Working in an online environment has been a positive experience though, and teams could effectively communicate and collaborate with each other, making it possible to easily build relationships, albeit it be online. Another success the company had was that there was no major impact on the security of the company, because the company was well suited to deal with any security threats while working from home. The employees are skilled enough and had additional training to prevent any cyber-attacks. The employees used company issued devices, with cybers security tools and anti-spyware installed.

## Signify Software – Company E

Signify Software is a small company with less than 100 employees. Their headquarters is located in Centurion in Gauteng, South Africa. The company was founded in 1999, making it a more traditional business. They specialise in human resource management software and e-learning development. The employee that was interviewed and asked to fill out the questionnaire is Employee E, a junior developer at Signify Software.

According to employee E, the company does not believe there is a separation in function and duty between Project Management and Software Development Methodologies. Company E uses different Software Development Methodologies for different types of projects they are working on. The three main methodologies used for SDM is Waterfall, Agile (Scrum) and DevOps. For Project Management they use Agile, seeing as DevOps is used only for Software Development as mentioned in Section 2.2.2. COVID 19 did have an impact on the company and the way they conducted Project Management. The employee believes that COVID 19 had a positive impact on the way they conducted Software Development. The company worked on premise before COVID, off premise during COVID, and then went back to the premise after COVID.

COVID 19 did not have an impact on company E’s technological architecture, nor on the technological infrastructure. COVID had a significant impact on the processes they follow within their teams. According to employee E, the company’s governance and strategies stayed the same, and were not impacted at all. COVID 19, had a negative impact on their culture, operations and services within the company. The employee struggled with distractions when working in an online environment, but still managed to have a work-life balance.

The company could still collaborate and communicate effectively with different teams, but it was difficult to build relationships in an online environment. The company was well suited to deal with security threats that presented themselves due to working in an online environment. This was a relief for this employee seeing the company experienced an increase in cyber attacks during COVID 19. Although the employees used their own devices while working from home, they had training making them skilled enough to deal with the cyber threats. Their personal computers also had cyber security tools and anti-spyware software to prevent any cyber threats that may arise. The employee also added that they used multi-factor authentication for an additional security measure.

## IsoMetrix Software – Company F

IsoMetrix Software is a medium sized company that employs between 100 and 500 employees. They are situated in Johannesburg, South Africa. They also have other branches in the United States, Canada, Australia, and the United Kingdom. The company was founded in 2002, and specialise in risk management software development, and providing state of the art solutions for ESG, EHS and GRC management. The employee that was interviewed and asked to fill out the questionnaire is Employee F, a Senior Manager at Isometrix.

Company F used Agile (Scrum) for their Software Management and the Waterfall or Agile methodology for Project Management. This Senior Manager believes there is a difference between Project Management and Software Development Methodologies. COVID 19 had an effect on both Project Management and Software Development, but it was mostly a positive impact, allowing them to be more productive individually and as a team.

Technological architecture and infrastructure were severely impacted by COVID 19, and the employee believed that COVID has the most significant impact on both the technology that was used within projects, and the people working on these projects. The culture, maturity, operations and services were positively impacted due to COVID. There are a few factors that were not positively impacted, such as the work-life balance, and this could be due to the distractions the employees had whilst working in an online environment. Despite these distractions, the teams could still collaborate and communicate effectively with different teams and build strong relationships while working in an online environment. The company was equipped well enough to deal with any cyber threats that was increasing during COVID 19. The employees used their own devices that had cyber security tools and anti-spyware installed. The employees were also trained, allowing them to be skilled enough to deal with any security threats.

# Case Study Comparison

## Introduction

The following sections are the analysis and results obtained from the questionnaires, interviews and case studies. The companies will be referenced as Company A to Company E. This data will be used to make conclusions and inferences in the following Chapter.

## Company Specialisation

Table 5 - Company Specialisation

|  |  |  |
| --- | --- | --- |
| **Company** | **Company Name** | **Company Specialisation** |
| A | Retro Rabbit | Software development and the creation of software solutions for clients |
| B | Entelect | Specialise in software engineering to deliver world-word class solutions to a diverse range of industries |
| C | SAPCONET | IT Consultation |
| D | Andile B.V. | IT consultation and IT services relating to financial services and central banks |
| E | Signify Software | Human resource management software and e-learning development |
| F | IsoMetrix Software | Risk management software development, and providing state of the art solutions for ESG, EHS and GRC management |

## Company Employee that completed questionnaire

Table 6 - Employee Role

|  |  |
| --- | --- |
| **Company** | **Employee Role** |
| A | Junior Developer |
| B | Intermediate Developer |
| C | Project Manager |
| D | Development Lead |
| E | Junior Developer |
| F | Senior Manager |

## Predominant Software Development Methodology

Table 7 - SDM Questionnaire results

|  |  |
| --- | --- |
| **Company** | **Predominant Software Development Methodology used** |
| A | Agile (Scrum) |
| B | Agile (Scrum) |
| C | Waterfall |
| D | Agile (Scrum), DevOps |
| E | Waterfall, Agile (Scrum), Dev Ops; |
| F | Agile (Scrum) |

## Predominantly Project Management Methodology

Table 8 - PMM Questionnaire results

|  |  |
| --- | --- |
| **Company** | **Predominant Project Management Methodology used** |
| A | Agile Methodology |
| B | Agile Methodology |
| C | Waterfall Methodology |
| D | Agile Methodology |
| E | Agile Methodology, Waterfall Methodology |
| F | Agile Methodology, Waterfall Methodology |

## Difference between SDM and PMM

Table 9 - SDM and PMM Difference

|  |  |
| --- | --- |
| **Company** | **Is there a separation of function and duty between IT PM and the SDM?** |
| A | No |
| B | Yes |
| C | Don’t follow an SDM |
| D | Yes |
| E | No |
| F | Yes |

## COVID-19 Impact

Table 10 - COVID Site Impact

|  |  |  |  |
| --- | --- | --- | --- |
| **Most work was done…** | | | |
| **Company** | **On premise before COVID** | **On premise during COVID** | **On premise after COVID** |
| A | Strongly Agree | Strongly Disagree | Strongly Disagree |
| B | Strongly Agree | Strongly Disagree | Disagree |
| C | Strongly Agree | Strongly Disagree | Strongly Disagree |
| D | Disagree | Strongly Disagree | Disagree |
| E | Agree | Strongly Disagree | Agree |
| F | Disagree | Strongly Disagree | Disagree |

Table 11 - COVID General Impact

Chart, bar chart, funnel chart

Description automatically generated

Figure 6 - COVID Impact Chart

## Success and Failures

Table 12 - Online Success and Failures

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Company Online Successes or Failure in the eyes of the employee** | | | | | |
| **Company** | **Company Productivity when online** | **Collaboration with teams** | **Communication between teams** | **Work balance** | **Security when working online** |
| A | Success | Failure | Failure | Failure | Success |
| B | Success | Success | Success | Success | Success |
| C | Success | Success | Success | Success | Success |
| D | Failure | Success | Success | Failure | Success |
| E | Success | Success | Success | Success | Success |
| F | Success | Success | Success | Failure | Success |

# Reflection and Conclusion

## Introduction

In Chapter 4, some of the main differences between these companies were highlighted. Only data relevant to this study were compared in the previous chapter, to come to the conclusions that will be discussed below. It is important to note that six companies were chosen in South Africa, with different sizes and specialities to get a broader understanding of which methodologies are prominent across the country.

## Most used Project Management and Software Development Methodologies

By looking at the case studies in Chapter 3, and some of the questionnaire results in Chapter 4, one can clearly see the preferred Project Management methodology in South Africa is the Agile methodology. This could be largely in part due to the advantages explained in Chapter 2. Other methodologies were also encountered such as the Waterfall methodology, that are found in more traditional organisations.

The most used Software development methodology in South Africa was also the Agile methodology, more specifically the SCRUM method. Other methodologies were also used such as DevOps and waterfall. Company C stated that they do not generally follow any Software Development Methodologies, and therefore they used the Waterfall methodology for both Project Management and Software Development.

Chart, pie chart

Description automatically generated

Figure 7 - PM and SDM Charts

## COVID 19 Impact

COVID 19 clearly had a large impact on the companies. Not only on individual productivity, but also on the team productivity. Four out of the six employees said their personal productivity decreased. This could be due to the fact that most of the companies worked in an online environment during COVID, which they were not yet comfortable with. Five employees stated that the company’s productivity did not decrease, and this could be largely due to the fact that five out of the six companies did not have any problems communicating and collaborating with each other. It was interesting to see that most companies data were very close to each other in regard to the impact of COVID 19, as well as the positive and negative impacts thereof.

Although COVID 19 had a large impact on the companies, the data suggests that they found more successes than failures when working in an online environment, especially when it comes to company security. The successes and failures can be view in Table 12.

## Interesting Finds

There are clearly dominant Project Management and Software Development methodologies that are used in South Africa. It was an interesting find that most of the companies said that there is a difference between Project Management and Software Development methodologies, yet they chose the same methodology for both. Another interesting find was that both Junior Developers were the only employees that believed there are not a separation of function and duty between Project Management and Software Development Methodologies, whereas all senior employees, and those in management believe there is a separation. Security threats increased throughout COVID, but the companies were more than prepared to handle any threat that may arise. COVID 19 had a large impact on the companies, but nothing the companies couldn’t handle. Some personal productivity decreased, but for the most part the company productivity increased. This could be due to the Project Management methodologies such as the Agile methodology, that is used the most in both Project Management and Software Development, seeing as one of the advantages is that changes are welcome. Not only in scope and requirements, but also in the environment that the managers manage, and the developer develop.

## Future Recommendations

For any future studies, I recommend gathering more information on not only which project management and software development methodologies were used, but specifically why they chose these methodologies.

Bibliography

Al-Saqqa, S., Sawalha, S. and AbdelNabi, H. 2020. Agile software development: Methodologies and trends. *International Journal of Interactive Mobile Technologies,* 14(11).

AXELOS. 2020. Prince2® project management certifications Date of access: 2022/10/11 2022.

Cervone, H. F. 2011. Understanding agile project management methods using scrum. *OCLC Systems & Services: International digital library perspectives*.

Dursun, M. and Goker, N. 2022. Evaluation of project management methodologies success factors using fuzzy cognitive map method: Waterfall, agile, and lean six sigma cases. *International Journal of Intelligent Systems and Applications in Engineering,* 10(1):35-43.

Ebert, C., Gallardo, G., Hernantes, J. and Serrano, N. 2016. Devops. *IEEE Software,* 33:94-10.

Gokarna, M. and Singh, R. 2021. Devops: A historical review and future works. (*In* 2021 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS): IEEE, p. 366-371).

ILXGroup. 2022. What is prince2. <https://www.prince2.com/zar/what-is-prince2>

KissFlow. 2021. Prince2 methodology in project management – a complete overview

KnowledgeHut (2022) 'Prince2 certification: Advantages and disadvantages'. Available at: <https://www.knowledgehut.com/blog/project-management/prince2-certification-advantages-and-disadvantages>.

Laoyan, S. 2021. Everything you need to know about waterfall project management. <https://asana.com/resources/waterfall-project-management-methodology> Date of access: 2022/10/12 2022.

Leeron Hooray, C. B. 2022. What is waterfall methodology? Here’s how it can help your project management strategy

Machiridza, M. 2016. Misalignment challenges when integrating security requirements into mobile banking application development.

Malsam, W. 2021. What is prince2? Principles, aspects, roles & processes. <https://www.projectmanager.com/blog/prince2-methodology>

Pace, M. 2019. A correlational study on project management methodology and project success. *Journal of Engineering, Project, and Production Management,* 9(2):56.

Shahir, H. Y., Daneshpajouh, S. and Ramsin, R. 2008. Improvement strategies for agile processes: A swot analysis approach. (*In* 2008 Sixth International Conference on Software Engineering Research, Management and Applications: IEEE, p. 221-228).

Sharma, L. 2021. Waterfall model

Sharma, S. and Coyne, B. 2015. Devops for dummies. For dummies United States of America: John Wiley & Sons, Inc.

Sherman, R. 2015. Project management

ur Rehman, U. 2017. Using agile software methodologies for dynamism of requirement and project success: A case study (netsol technologies cmmi-5)*.* COMSATS Institute of Information Technology Lahore. -

WHO. 2020. Coronavirus disease (covid-19). <https://www.who.int/health-topics/coronavirus#tab=tab_1> Date of access: 2022/10/11 2022.

Wideman, R. M. 2002. Comparing prince2® with pmbok®. *AEW Services, Vancouver, BC, Canada*:13-16.

Wrike. 2020. What is the scrum methodology? <https://www.wrike.com/scrum-guide/scrum-methodology/> Date of access: 2022/10/12 2022.