MASTER'S THESIS ASSIGNMENT

I. Personal and study details

Student's name: **Aktay Maral** Personal ID number: **505975**

Faculty / Institute: **Masaryk Institute of Advanced Studies**

Department / Institute: **Institute of Public Administration and Regional Studies**

Study program: **Innovation Project Management**

II. Master's thesis details

Master's thesis title in English:

Feasibility in Applying Agile Project Management Methodologies

Master's thesis title in Czech:

Proveditelnost použití agilních metodik řízení projektů

Guidelines:

The object of research: Design and Construction Industry
The subject of research: the process of adopting and transforming companies from the traditional to the agile methodology
Purpose of the research: implementing agile in the construction industry, by layout possible solutions that can ease the adoption process. Research questions: What are the benefits, challenges, and other important ingredients for moving to agile?

Bibliography / sources:

1. Carmichael, A. Anderson, D. (2016). Visualizing the Workflow. Essential Kanban Condensed. LeanKanban Uni Press.
2. Cobb, M. (2015) The Project Manager's Guide to Mastering Agile. John Wiley and Sons Inc, Hoboken
3. Highsmith, J. and Fowler, M. (2001). The Agile Manifesto.
4. Hussain Emam; Muhammad Ali Babar; Paik Hye-young; Using Scrum in Global Software Development: A Systematic Literature Review; 4th IEEE International Conference on Global Software Engineering; 2009.
5. Hussain, M. Nouri, Sabah. (2012). A Literature Review Exploring Challenges and Solutions When Implementing Agile. Department of Computer Science and Engineering, University of Gothenburg.
6. Rubin. M. (2013) Essential Scrum. A Practical Guide to the Most Popular Agile Process. Pearson Education Inc. Amm Arbor, Michigan. ISBN-13:978-0-13-704329-3
7. Chan, F. Thong, J. (2011). Acceptance of agile methodologies: A critical review and conceptual framework. Department of information systems. Hong Kong University of Science and Technology.

Name and workplace of master's thesis supervisor:

Ing. Lucie Plzáková, Ph.D. Masarykův ústav vyšších studií ČVUT v Praze

Name and workplace of second master's thesis supervisor or consultant:

Date of master's thesis assignment: **09.12.2022** Deadline for master's thesis submission: **27.04.2023**

Assignment valid until: _____

Ing. Lucie Plzáková, Ph.D. Supervisor's signature	doc. Ing. arch. Vladimíra Šilhánková, Ph.D. Head of department's signature	prof. PhDr. Vladimíra Dvořáková, CSc. Dean's signature

III. Assignment receipt

The student acknowledges that the master's thesis is an individual work. The student must produce her thesis without the assistance of others, with the exception of provided consultations. Within the master's thesis, the author must state the names of consultants and include a list of references.

25. 01. 2023
Date of assignment receipt

Student's signature

DIPLOMA

THESIS

Feasibility in Applying Agile Project Management Methodologies To Building Design and Construction Industry

STUDY DEGREE PROGRAMME

Innovation Project Management

THESIS SUPERVISOR

Ing. Lucie Plzáková, Ph.D.

Maral

Aktay

2023

AKTAY, Maral. Feasibility in Applying Agile Project Management Methodologies To Building Design and Construction Industry. Praha: CTU 2023. Diploma thesis. Czech Technical University in Prague, Masaryk Institute of Advanced Studies.

MASARYK
INSTITUTE
OF ADVANCED
STUDIES
CTU IN PRAGUE

Statement

I declare I have accomplished my final thesis by myself and I have named all the sources used in accordance with the Guideline on ethical preparation of university final theses.
I have no relevant reason against using this schoolwork in the sense of Act No. 121/2000 Coll. on Copyright and Rights Related to Copyright and on Amendment to Certain Acts (the Copyright Act).

In Prague, 16.08.2023 Signature: 

Acknowledgement

I would like to acknowledge and give my warmest thanks to my supervisor Mrs. Lucie Plzáková who made this work possible. Her guidance and advice carried me through all the stages of writing my project. I would also like to thank my committee members for letting my defines be an enjoyable moment, and for your brilliant comments and suggestions, thanks to you.

Abstract

During the past few decades, fundamental changes have taken place in project development, planning, and execution. This has taken form with embracing new techniques such as various agile project management methodologies to develop products, instead of using the traditional waterfall project management methodology commonly used today. Using agile has been very successful as a large portion of the IT world has integrated it within their companies. Unfortunately, professional fields such as the building design and construction industry have remained mostly with the traditional methods impacting the projects in terms of cost, scheduling, and other project elements that can benefit from the advantages found in agile methodologies.

This thesis paper will research and illustrate what is involved with the process of adopting and transforming companies from the traditional to the agile methodology, and will explain the benefits, the hardships, and other components relevant to illustrate what needs to take place in order to implement agile in the construction industry, as well as layout possible solutions that can ease the adoption process.

Key words

Agile project management; traditional waterfall project management; project planning; project execution; building design and construction industry; information technology; schematic design, design development; construction documents; programming; MEPs; request for information, request for qualification, request for proposals, bidding.

Content

Introduction

With over 8 years of experience as a civil engineer, I have encountered an array of challenges spanning the gamut of building design and construction. These challenges have invariably revolved around project management methodologies, team dynamics, and the operational framework of the company. In a rapidly evolving global landscape, where the advent of novel technologies is an everyday occurrence, I am steadfast in my conviction that the construction industry—the quintessential bastion of project management—must embrace transformative methods and technologies.

In an era characterized by perpetual innovation, it becomes imperative for industries to evolve in tandem with the technological zeitgeist. The construction sector, as an embodiment of project management principles, is no exception. My belief hinges on the potential of novel methodologies and technologies to not only invigorate the industry but also to rectify its persistent challenges. By harnessing the power of innovative tools, the construction landscape can undergo a paradigm shift, yielding profound benefits such as streamlined processes, enhanced efficiencies, and reduced errors, especially at the pivotal design stage.

The primary objective of my study is to elucidate the feasibility and efficacy of implementing novel project management methodologies, specifically the Agile methodology, within the context of the construction industry. This inquiry endeavors to shed light on the practical applicability of Agile methodologies, taking into account contemporary possibilities and envisaging both the merits and shortcomings associated with such adoption.

In delving into this investigation, I aim to delineate the pivotal criteria that necessitate fulfillment for the seamless assimilation of Agile methodologies within a construction company's operational framework. Through meticulous analysis, I intend to distill the essential prerequisites and conducive conditions that underpin the successful infusion of Agile practices.

Furthermore, this study aspires to offer a comprehensive assessment of the potential benefits and drawbacks inherent in the application of Agile methodologies within the construction domain. By engaging in a thorough exploration of real-world cases, anecdotal insights, and empirical data, I aim to furnish a comprehensive portrait of the dynamic interplay between Agile methodologies and the multifaceted landscape of construction projects.

Ultimately, this endeavor seeks to contribute to a nuanced understanding of how contemporary project management paradigms can be harnessed to enhance the efficiency, adaptability, and overall effectiveness of construction processes. Through a meticulous analysis of the theoretical foundations, practical implementations, and contextual considerations, I endeavor to equip stakeholders in the construction industry with the knowledge required to make informed decisions regarding the adoption of Agile methodologies.

This dissertation serves as a comprehensive exploration into the metamorphosis of standard project management methodologies, transmuting them into a hybrid, flexible format. This format has the capacity to imbue project teams with the agility to nimbly respond to changes, cultivate a cadre of consummate professionals, and forge a synergistic framework for coordinated endeavors. The crux of this transformation revolves around the harmonious fusion of time-tested principles with cutting-edge technologies.

Furthermore, I endeavor to elucidate how this hybrid methodology transcends the conventional strictures, fostering an environment of adaptability and innovation. Through empirical analyses and cogent case studies, I will demonstrate the tangible value of this approach—how it catalyzes the realization of successful projects, augments team cohesion, and minimizes setbacks inherent to the traditional methodologies.

Commonly today, the process for planning and executing such projects takes shape in the traditional project methodology or also known as waterfall. I think at many times this process becomes slow, inefficient, and costly due to communication and coordination issues resulting this project execution structure. Also the traditional project execution processes are potentially adapting to the rapid changes in technological developments and other components that change rapidly and influence the way in which architects plan buildings, and other elements regarding the assembly of buildings such as new construction techniques. I believe as many variables occur around the project's environment, so does projects processes should adjust accordingly in order to improve its efficiency.

Another reason that building design and construction projects can be at times inefficient, are due to large teams involving dozens of different consultants and stakeholders. This creates a bulky communication flow which can lead to slower progression, and potential problems during the execution of the project's implementation, as each task is developed in a slower manner, delaying progression substantially.

Some claim that building design and construction project are too complicated to adopt Agile methodologies, but an example of an industry that implement complicated projects that use Agile nevertheless, is the Information Technology world. Software development is also complex and involves many stakeholders, but the Information Technology world still uses agile project management techniques such as the Scrum methodology. By doing so, the team structure is changed and ultimately simplified to ensure better operation through the planning and development phases. The hierarchy is also minimized and the steps needed to communicate with the relevant stakeholders is becoming simpler, creating better team workflow and shorter tasks required for progress (in Scrum there are three project staff elements instead of potential countless types of stakeholders within a typical large team: the scrum master, product owner which deals with the client, and team which is considered a single collaborative unit).

In summary, this dissertation unfurls as an homage to the potential inherent in modernizing the construction industry's project management ethos. By embracing change, harnessing emerging technologies, and refining existing methodologies, we have the opportunity to engender a renaissance in construction—a future where every brick laid

resonates with the precision and harmony characteristic of a technologically empowered age.

The ensuing chapters will embark on a comprehensive exploration of extant literature, directed towards assimilating the practical application of agile project methodologies in the context of software development projects. By dissecting the merits, demerits, and intrinsic components that define Agile, an enhanced comprehension of its operational intricacies will emerge. This inquiry is poised to facilitate a profound comprehension of how to extrapolate these methodologies into projects, ushering in more streamlined processes. The overarching objective is to illuminate the potential of Agile within the realm of building design and construction projects. Additionally, this endeavor seeks to distill insights into the transformational journey from traditional project management paradigms to the agile project management paradigm.

Through the meticulous analysis of pertinent literature reviews, the discourse will unveil the multifaceted advantages intrinsic to the assimilation of Agile methodologies. Concurrently, it will discern the scope and feasibility of integrating this paradigm within architectural projects. An empirical investigation is also conducted, scrutinizing the operational dynamics of a design company that champions Agile methodologies within project management.

The ensuing analysis is primed to delineate the spectrum of possibilities, while also unmasking the nuanced pros and cons entwined with the Agile approach. The interview with the company's CEO will furnish an invaluable vista into the company's transformative voyage towards the adoption of Agile methodologies. This concerted study is poised to be instrumental in furnishing the company with the fundamental knowledge necessary to navigate the design and construction process, engendering marked efficiency gains.

By traversing through this comprehensive exploration, a tapestry of insights will unfurl, guiding both theoretical understanding and practical implementation, ultimately charting a trajectory towards more efficacious building design and construction endeavors.

Subsequent examination delves into the research trajectory of a project company currently immersed in a transformative journey. Under the astute guidance of the Chief Operating Officer (COO), strategic determinations have been made to recalibrate the modus operandi of the project team. This recalibration encompasses the infusion of Agile methodologies, including Scrum, Kanban, and the tenets of Self-Organizing Teams, into the fabric of management practices.

TEORETICAL PART

1. Agile Project Management and it`s evolution

1.1. Problem Statement and Justification

In the past years agile has become a very popular methodology for project implementation in companies. However, changes mostly relate to the Information Technology industry. In order to provide a better understanding what is involved in such transformation, two topics will be reviewed regarding Agile adoption. The first topic relates to common issues and problems that occur by adopting agile from the Information Technology industry: as most empirical content and lessons learned can be extracted from this industry. These different case studies mentioned include information of countless companies have adopted this system already and a good deal of information exists to learn from their process changes and adoption.

The second topic studied is relating to the issues that can occur when adopting agile in non IT companies, and mapping out what are the fundamental differences between the fields (if there are any). This should be important to understand and answer if it is possible to transform into Agile, due to the fact that this project management methodology has created vast advantages in the Information Technology world leading to many benefits such as cost reduction, better team work, improved firm culture that created speed efficiency in planning and executing project processes. As the majority of the specific information exists on Information Technology companies adopting agile, this will allow to map the challenges and issues involved, and analyze how the adoption process can influence and impact processes in the building and design and construction industry through critical thinking.

The following chapters will deal with the different issues that can occur while transforming from the traditional project management into the agile processes. As it requires a major fundamental cultural change in a company, it will be important to chart in advance what will be the issues that can possibly inhibit from such a change to occur. Understanding potential issues, will enable to create a layout of the proper measures can be charted and pinpointed to assure the success of such reforms.

The main focus ultimately is figuring out how to adopt the Agile project management structure in the building design and construction projects. This research paper will not explain how to directly implement agile to a specific project mentioning its required characteristics and processes as projects tend to vary highly from one another, and too many variables are involved making this attempt impossible. Instead, the following chapters will elaborate on the issues involved in a more holistic way. This will help create a general understanding of the potential issues involved with the adoption process, and will enhance the understanding if such issues can even be solved, and if so, what would be their

remedies (or potential ones). Discussing the problems will allow to understand whether this is even possible, as well as provide the insight needed to take such decisions.

1.2. Agile Manifesto

During the 1990s, agile methods have been gaining popularity in the software development field and have become highly prevalent after the formation of Agile Manifesto in 2001. Agile Manifesto states four values and twelve principles of agile software development. The core values are:

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

- Agile Manifesto, 2001

Based on iterative and incremental development model as a response to changing needs and early expected deliveries, agile is characterized by orientation towards people, frequent customer collaboration, fast development cycles that are short and light, time-bound delivery, and inspect and adapt. There are many methods with each having its own practices and vocabulary under agile that share the same principles and philosophy. Twelve principles that were brought forth by the manifesto based on the core values described earlier are as follows:

1. Customer Satisfaction: Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.

2. Welcome Change: Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.

3. Frequent Delivery: Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.

4. Work Together: Business people and developers must work together daily throughout the project.

5. Motivated Individual: Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.

6. Face-to-face conversation: The most efficient and effective method of conveying

information to and within a development team is face-to-face conversation.

7. Working Software: Working software is the primary measure of progress.

8. Sustainable pace: Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

9. Technical Excellence: Continuous attention to technical excellence and good design enhances agility.

10. Simplicity: Simplicity is the art of maximizing the amount of work not done and is essential.

11. Self-organizing team: The best architectures, requirements, and designs emerge from selforganizing teams.

12. Continuous inspect and adapt: At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.

Despite of sharing same principles, agile does not share a universal definition. Agile methods are stated by researchers as a set of practices created by experienced software developers which constitutes multiple methods under its umbrella. Extreme Programming(XP), Scrum, Dynamic Systems Development Method (DSDM), Crystal Methods, Feature-Driven Development (FDD) and Adaptive Software Development. Each of the method loosely provide a framework to work with and are mostly open for implementation per organization needs. There was a time when Lean Software Development was considered a method under agile and many still do not distinguish among the two. Most literature however accept the difference between agile and Lean and motivate recent idea of industry to implement Lean practices in addition to XP or Scrum.

1.3. Challenges of implementing the Agile in the organization

This chapter includes the review two literature reviews involving the adoption and adaptation of agile. The first literature review named Agile Method Implementation, written by Sabah Nouri and Mohammed Hussain (2012) from the University of Gothenburg, Sweeden, explores challenges and solutions that can occur when implementing Agile. Hussain and Nouri are interested how adopting agile impacts the company both on the organizational level, as well as the individual and team level. In the review Hussain elaborates on the challenges involved with adopting this method, and also proposes several solutions. In order to investigate these two elements, Hussain listed various articles and

conducted his study based on nineteen prime sources which he found most relevant for these topics.

Hussain defines six challenges that involve agile adoption and adaptation as the project development and execution methodology:

1- Transferring the bulky traditional project management into a fast pace quick iterations based project cycles that agile includes. This is relevant especially when a company a transforms its processes and adds new project process techniques, yet still needs to keep the industry standards. This level of balance is difficult to achieve and is still being experimented in many companies. The integration process can be applicable to different elements in the project such as software integration, team cooperation and coordination with various stakeholders. This would allow to define in a more clear manner the differences in the two project management methodologies and which applies to which component in the project, and other elements that can rise due to this system transformation. Meaning, focus on project specifics to propose their solutions would allow to better define the approach needed to solve these challenges.

2- The challenge relates to the business processes of projects. Where in the traditional method the basis for project layout are contracts, and specific scheduling such as main deliverables on certain dates, in Agile, these components have minimal influence. In addition, it is not just formal project procedures that have to be fundamentally different, but also operational behaviour of the team members. In Rubin's (2013) Scrum book, the team member will have to be much more motivated, open minded, have the capability to improvise and become flexible to different project issues that would occur, and become a 'generalist' and not necessarily a specialist which is common in the traditional project methodology setting. The agile team member is not the typical team member which receives daily tasks , completes them, and awaits to the project manager to receive additional tasks anymore. Instead, it requires the team member to operate in a dynamic environment where changes occur all the time, tasks get modified and the team member will have to adapt these quick changes, find a solution, and deal with the issue at hand.

3- This challenge deals with the individual involved in agile adoption. One of the fundamental differences between the traditional project methodology and the agile methodology, is the way the team is structured and operates. As an example, the project manager in Scrum Agile methodology is not really existing. The team is self governed and tend to complete the tasks based on their own decisions based on consensus and agreement. Well, there is the Scrum Master and the Product Owner which help prioritize tasks by listing the sprints (the content in which the iteration cycles will be structured on, and will listed what needs to be completed), but eventually, the team conducts the work and tasks internally as Rubin (2013) illustrates. Another issue is the need to change the workspace configuration to adopt the Agile culture in a more successful manner. Meaning, cubicles and other individualistic typical corporate layouts are contradicting the essence of Agile, and would require a workplace layout and structuring configuration to be able to accommodate the communal setting that would spark innovation, and cooperation.

4 - The forth challenge deals with communication issues that can arise when adopting Agile. In the traditional method every correspondence is formal and documented. This takes form via the RFI process, e-mails, meeting minutes, change orders, etc: every element in the traditional project management is documented and is used for legal purposes if needed. In Agile, the communication is based on "informal" ways in order to speed up information flows, thus, enhance the project's speed. These fundamental differences can lead to tracking issues and confusion when implementing Agile for a team not used to such system.

5- The fifth challenge deals with management issues resulting the implementation of Agile when attempting to build the trust and moral values between the clients and the project team. Hussain also explains about the hardships in creating stakeholder involvement, as Agile requires much more client participation during the project's process compared to the traditional methodology. Another managerial challenge that can occur regarding stakeholder relationships, is managing the teams through long distances, where a project team can be scattered across different locations. These elements can help create a sense of lack of hierarchy, which can potentially lead to scheduling and coordination issues.

6- The last challenge is the cultural adaptation that can occur when trying to implement a new methodology within a company. Procedures, processes, and methods of working can develop over decades. Implementing a new project planning and execution structure can be difficult for some employees. This can vary with communication differences and other procedures that might be problematic when dealing with different colleagues at the firm, and also different stakeholders relating projects.

The second literature review studied is named "A Systematic Literature Review on Agile Project Management" written by Sumsunnahar Sheuly (2013), for Lappeenranta University of Technology. After explaining the different methods and techniques that exist within the Agile project management processes, Sheuly briefly mentions the main concepts that allow Agile project management to become advantageous to a company.

The first advantage explained is the enhancement of communications through improvement of the team's operation. This involves making the teams self managing, instead of individuals receiving tasks via the project manager which can sometimes take some time until decision is made. Also, the project's execution structure and scheduling changes from the planning towards an end result, towards relying on short increments including many trial and error cycles, allowing for less planning and ultimately, more quicker development leaps that allow for more iterations and product progression compared the traditional method. This impacts the product substantially as it allows for more creative thinking and development during planning. This is great characteristic for an innovative project that the final outcome may not be known necessarily. Rubin (2013) explains that Agile minimizes the overall risk involved during the project's development phases, as it increases chances the product will work successfully by allowing for more

testing, along with a stricter cooperation between the project team and the client, improving the product's desired result.

Sheuly continues to elaborate on different Agile methodologies. In terms of the literature review, Sheuly (2009) created selection and filtering procedures to reflect the most relevant data in order understand the content in order to derive beneficial relevant conclusions. The overall data is derived from a selection of forty four articles that were searched through various scholarly search engines, and that fit the criteria. The references included different industry reports, empirical data, and different research conducted to understand Agile's influence on different factors of the company environment such as team efficiency, adoption outcomes, etc. Thirteen articles were selected that are analyzing the introduction and adoption phase of agile into companies.

Although Sheuly may refer to software or IT related companies, the lessons learned are relevant to any industry as all projects involve some commonalities such as communication, teamwork structures, company cultures, technology adaptation in projects, project implementation processes etc. These elements can increase the chances for Agile adoption. The summary in the literature review explains how adopting Agile have improved overall client relationships by creating better communications and collaboration.

As the information presented in the literature review helped to understand benefits within the agile adoption process, Sheuly has not explained enough regarding the requirements of individuals within the teams involved in agile. This includes their personal attributes such as their communication skills, interpersonal skills, and motivation required in Agile: all that can impact the successful implementation of such method. This element will be elaborated in the following chapters.

Sheuly recommends for future research to analyze how separated work environments with multiple teams can operate with efficiency in the Agile model, meaning what happens when multiple teams collaborate from different geographies. This problems he discusses about will be outlined with potential solutions in mind, and will be examined in detail in the following chapters. Another issue lacking sufficient understanding is the return of investment figures that will help provide empirical data that can assist decision makers when adopting Agile and comparing it with the traditional method. I assume Sheuly did not find this valuable data as private companies keep this information private for obvious reasons. Even though I might not find any resources, I do not believe this information is critical to analyze, as countless companies have clearly profited and became more efficient from Agile as they transformed their company culture and structure to accommodate such system. Such failure would cause these companies to return to their source operational methodology. Sheuly concludes that more elaboration is required regarding the challenges and issues that occur when adopting Agile from a waterfall based system. Following chapters will discuss and illustrate this topic in detail.

1.4. Proposed Solution Approach

The proposed solution for the challenges presented in the two literature reviews is broken into two areas of focus. One would be to propose six solutions for the six challenges mentioned in the first literature review of Hussain, M. and Nouri, S. The second area of focus is to discuss the issues mentioned in the second literature review by Sheuly S. will help to understand the elements that can potentially problematic when adopting Agile.

1.4.1. First Literature Review

The solution of the first challenge mentioned: industry standards conflicts with Agile, is to assemble a creative team that can think out of the box from the beginning of the project in order to allow them to test, examine, and create a hybrid process between Agile and the traditional project systems. Because Agile will still be experimental and new for the company involved in the Agile adoption process, it is important to assemble people that are good in approaching new unfamiliar problems. This will help them learn, adapt, and solve issues involved with implementing Agile in a more efficient way. Once a single team will be successful, this will serve example to the rest of the firm, and eventually, will help reshape and train the company's culture to adjust its systems and operation.

For the second challenge: business processes conflicts with Agile, the solution should be a training program that will be developed and outlined in order to allow the team to adapt the new processes involved in Agile in a more delicate manner, gradual manner in the attempt to make the transformation process more successful. This mechanism should address all new elements introduced in the Agile process that does not exist in the traditional method such as user stories organizing the various tasks at hand through sprints (iteration cycles). Also, focusing on the differences of team member duties and tasks and the way it will be implemented, learning new communication procedures and other elements involved in Agile, and specifically Scrum which has fundamental characteristics that would be taken as example and this will be elaborated in the following chapters.

The third challenge: the human factor issues when adopting Agile, a unique hiring process should occur that will involve selecting highly adaptive people, with great team skills, and that are good in collaboration and communication. Elaboration on the selection process of the individuals that would take the first steps to help the cultural transformation into Agile (at least in the beginning of the process).They should be able to then lead the company into a firm wide change. In addition to the individual selection, elaboration should take place regarding the creation of a 'team' workshop, where the team will get to know each other through different challenges and fun tasks (outside the conventional workplace), where eventually, they will get to know each other in preparation for the project initiation. This factor of creating a better team that can interact in a more efficient manner, will help lead to successful project implementation.

The solution for the fourth challenge mentioned: communication issues when adopting Agile, is not by eliminating mandatory external communication channels that exist and that were created in the traditional project methodology. The reason is that in the building design and construction industry there is a pretty strict communication structure such as in different software that are in charge of facilitating different orders from the architect to the contractor, and help the construction team fit the design intent in the final assembly. Some of these became legal standards and are intertwined with legal contracts relating the project contracts which cannot be abolished.

Thus, disregarding these processes will definitely result with the failure of Agile implementation. However, communications in Agile are not worthless, far from that. The 'informal' standards in Agile should be elaborated in the following chapter, but mapping where in the project's process they should take place is crucial, as it cannot occur anytime and in every step in the project. The solution is to map the different communication routes in the types of projects that involve the building design and construction industry, and where the 'informal' routes can take place within the project's process. It is likely and will be elaborated in the following chapters, that internal coordination is the likely element to benefit from the Agile transformation of informal communications.

The solution for the fifth challenge: trust and moral value between team and client when adopting agile, this thesis argues against Hussain's claim of trust and moral issues arising in Agile methodology. The reason is that this challenge is not a unique element to Agile, but involves all project types. In every project trust should be obtained between all stakeholders (internal and external) through time and efficiency of the team. This could be enhanced through team-client visioning sessions, routine meetings, and maximizing communications as much as possible to allow for a relationship buildup creating good trust between the various relevant stakeholders. Regarding the stakeholder's involvement extent within the development process of the project, the clients tend to actually be positive with having a close relationship with the project team, at least in the architectural world. By creating from the beginning of the project, a culture of cooperation and client integration in the process, the product will be of better satisfaction to the client.

For the sixth challenge mentioned: cultural adaptation when adopting agile, there are several ways to deal with such a challenge, even if it means a partial solution. One option is to assure that the team that starts adopting Agile is not starting from scratch, and they are fully aware of the industry standards and are experienced with the traditional approach: this should be a hiring criteria for the team member’s qualification (at least for the first team involved in the adoption process and its implementation in the company). The first team that will take these first leaps will understand eventually how to create the balance needed between the traditional or Agile, to better integrate employers with this new project implementation structure.

The following chapters will go into depth into each of these challenges elaborated and will provide guidelines that would ultimately help to develop procedures. It is important to note that how projects will be structured and sequenced will not be listed as

a to do list as projects tend to vary from one another, but will provide insights regarding the processes and knowledge needed to create the first Agile team in the company, and allowing them to execute their first Agile project successfully.

1.4.2. Second Literature Review

The second literature review elaborates on different needs required for a successful implementation of agile. While some of these elements are mentioned in the six challenges mapped above, Sheuly (2013) elaborates on the general issues relating to Agile. As an example of the individualistic characteristics needed from and Agile team member. In this case, identification is needed to locate the prepossessed characteristics required for an Agile team member in order for Agile to work. A team member should be able to carry different tasks and have characteristics such as have a low ego, be able to work in a team, have the resourcefulness to solve problems, and be dedicated team members as it is vital for agile processes. Another example of a general issue raised is how to overcome the operation of teams working in different locations. As this happens in every project type and is not unique to Agile, this paper will disregard this element, as this is a general project coordination problem and is not unique when adopting Agile.

When identifying the differences between the two literature reviews, the first one lays out the specific challenges required to adopt Agile, and the second literature review helps to identify the general requirements that should mapped in order to help with applying Agile. The following chapters will further elaborate on these processes, and illustrate the data required in order to apply Agile in the non Information Technology field. Analyzing the date in the articles referenced in the literature reviews should allow to thoroughly elaborate and understand the elements needed to map to understand the difficulties and challenges in the Agile adoption process.

2. Research Methodology

2.1. Current Analysis

The previous sections illustrated through analysing two major literature reviews, what are the main challenges that are involved in adopting Agile methodologies in a company, and what are the hardships that are needed to overcome in order to successfully implement such transition. In addition to the challenges, the benefits that are involved from applying Agile in companies were exemplified through illustrating the enhancement and efficiency of the project's processes, planning, and execution(see problem statement, and literature review - analysis of related work chapters). After reviewing these different challenges the chapter of the proposed solutions propose ways to overcome these hardships, in order to allow for a better smoother adoption process of Agile.

2.2. Next Step and the Incorporation of Selected Methodology

As this paper deals with what is involved in applying the Agile methodology within the building design and construction industry, these are the methodologies that would be in focus would apply for the rest of the thesis:

- Compare existing methods.
- Analyze the implementation of the method in the company
- Propose agile methodology alternatives within the architectural process.
- Summary of findings and propose recommendation.

These following elements help to chart what is needed in the following chapters to enhance the thesis statement, and to supplement the content written thus far. The following sections will be supplemental to the current content written in previous sections: challenges, hardships, benefits of agile adoption.

2.3. Elaboration of the Methodology Sections

The first method of comparing existing methods that address the general area of thesis problem statement, will explain the architectural project process and pinpointing the flaws and problems in current architectural process with relation to traditional method. In order to understand what needs to be changed in the architectural process, a mapping and charting of the relevant parameters within the architectural project process will be illustrated, to allow to see what makes problems with regards of its implementation in the traditional method. By understanding the flaws of the architectural process, meaning, seeing what is existing will allow to see while some aspects are feasible in applying Agile methods in the architectural process.

The subsequent approach entailed conducting interviews with a company boasting over a decade of experience in design and construction. This investigation primarily revolves around engaging project team members and the pivotal Chief Operating Officer (COO) as the main interviewees. This inquiry delves into the intricacies of the analysis procedure employed to instigate a paradigm shift in management methodologies. It meticulously explores the timeline spanning the initiation of this transformation and the corresponding outcomes achieved by the project team. Moreover, a comprehensive understanding will be cultivated regarding the prerequisites essential for the triumphant assimilation of Agile tools within the operational framework.

The third method will be proposing Agile methodology alternatives in the architectural process (including Kanban and Scrum elements) : The creation of the hybrid as it fits to the architecture process. This section will support the thesis study as it would illustrate where the Agile methodologies can replace current flawed aspects within the architectural process. By creating a new hybrid, and explaining its structure, the paper will illustrate with great detail the sense of the new design process and its requirements, and will help support the thesis study of the feasibility in creating the Agile-traditional hybrid within the architectural project process.

The last methodology is the findings, and proposed recommendation for future work. This final chapter will include the findings and conclusions of the hybrid developed, and will include recommendations for future studies to create additional refinements in this new architectural process. This chapter will include generating result, conclusions, and future recommendation for additional research.

PRATCIAL PART

3. Construction management

3.1. Traditional Project Management Methodology

The building design and construction industry involves a highly layered process that is based contractual documents organized by the American Institute of Architects: an organization coordinating and promoting knowledge, industry standards, and other elements such as professional development resources, to enhance the value and overall stance of the profession in the United States of America. Even if these documents are not used by decision in various projects, they are essentially a guideline of procedures and offer the standards of project procession layout in the building design and construction projects. These include several phases which are commonly used in the industry today.

As an additional note, building design and construction project structures became so refined that it allows architects to be legally protected by hundreds of sections refined over intervals of ten years, involving architects, contractors, lawyers, and clients providing feedback of what should improve according to past events during projects, and where there were legal issues, now corrected to protect project stakeholders even further. This allows a comprehensible structuring and standardizing of this industry and is not likely to change. Thus, this chapter will not attempt to replace an irreplaceable process with Agile adoption, but will elaborate what current project structure flaws are. This will be done by elaborating what these project phases include, and essentially what are the problems seem in this process. Specific elements will be pinpointed and will be argued how they could be improved by Agile adoption, and what specific elements are problematic that impact cost, time, and quality in the current process.

This chapter will also deal with how and where Agile elements can replace existing project elements common to the building design and construction structure in order to make this process more efficient. This chapter will mainly focus on elements within the architectural point of view, as the process of designing and ultimately observing the construction process of buildings can impact the cost and schedule required for project completion, which agile could impact and modify to ultimately create a more efficient process.

By elaborating on the various phases involved in building design and construction projects as elaborated by The American Institute of Architects Contract Documents. (2007), this chapter will illustrate what involves in the project from the architecture profession and perspective, to help understanding the communications requirements and their different intensities required, in order to see how the traditional method impacts the process negatively. As Agile promotes the efficiency of communication flow between the stakeholders, knowing which parts of the process require Agile modification will be identified and clarified.

3.1.1. Phase One: Programming and Conceptual Design

In this initial project process, the architect will meet with the client and will try to retrieve critical information that will allow to understand the major building requirements, and the problems that need to be solved in order to eventually fulfill the client according to his or her wishes and needs. Basic data will be collected through interviews such as the program which is the building uses. An example of different building uses can be whether it be appropriated to retail, commercial, governmental, education, cultural, aviation uses, and others.

This phase involves a very minimal number of stakeholders: the client and the architect, and perhaps a minimal architect team to aid with this information gathering. As this phase is relatively intimate and requires introduction with the client, communication flow is highly efficient if the architect prepares for the data collection in an effective way. An efficient meeting in terms of connection with the client will mean that more personal information will be extracted, and would allow ultimately to have better data in order to proceed to the schematic design phase in ultimately create a better process ahead. As there is a direct link between the a minimal number of relevant stakeholders to a highly effective communication flow, with minimal interruptions and delays, there is good efficiency in this process and advancement towards progressing on project goals. Thus, there is no need to modify this current phase structure.

3.1.2. Phase Two: Schematic Design

The schematic design phase involves the elaboration of the general scope specified in the programming phase into further detail. From the information collected about the building's program, the building different uses and other components are connected through relationships architects put together, and the formulation of this allows the building's form to take place following an initial understanding which building component is located where according to its relationship with another other program. Essentially it is an initial diagram of the building will look like, with minimum information. It is the general masses put together according to their relationships. As an example, a hotel's corridor will lead to elevators and emergency staircases leading out of the building or the main lobby space. This will appear as a diagram in this phase.

The initial requirements extracted from the client are being formularizing into initial building drawings: plans, sections, elevations, axonometric view (3D angular) and more, and initial building systems are being chosen (steel, concrete, or wood structure, mechanical systems, etc). Through different form investigation techniques such as model building and 3D modelling investigations through software, the architects will proceed with a more thorough form investigation of the building form now that the program and building use list is established with a clear square footage count. In addition to the building's

parameters, the project's components are also being set at this stage with great detail. This includes a preliminary evaluation of the budget (hence choosing building systems accordingly), the schedule of the design, understanding the material procurement and delivery methods, choosing a contractor, and dealing with other elements required to establish the project. Also, by the end of this phase there will be a complete understanding of owner requirements regarding what is required from the building.

The Schematic Design phase involves in terms of communication additional interaction and information extraction between the client and the architect. In addition, there will be initial communication with core engineers mandatory for building construction: structural engineers, mechanical electrical and plumbing engineers (MEPs), under contract with the architect. Also there is an option of adding geotechnical engineers and civil engineers as needed, under the contract of the client.

As this phase is still initial and includes the slight elaboration of the building in terms of its conceptual characteristics, there is still a minimum requirement in terms of coordination with relatively low intensity. Also the design team of the architects still can involve a low number of people, as developing concepts for a building is applied better with small number of people in a team. Thus, the environment can be with a higher communication and more collaboration to encourage creativity. Additional hiring of team members usually start in the design development phase elaborated in the next section. As a conclusion for the schematic design, there is no need for integration of Agile adoption in this phase. There is relatively small amount of information that needs to be processed and analyzed, with relatively low number of stakeholders (small number of architects, client, core engineers). This structure allows for an efficient process that allows project progression through the current methodology.

3.2 Design Development

This phase is the further elaboration of what the building's components will be. This includes initial specifying of products used for building components according to the design intent, and design formulized in the schematic design phase. Also, specifying the different electrical, mechanical, plumbing, and structural systems that will be located in the building takes place in order to have better cost assessments in this phase. Also drawings from specialty consultants will allow for further elaboration of the systems that will be used, and that are required to be integrated within the building design required by the architects.

The consultant types used vary from project to project, but in large more complicated building projects, more systems will be needed to be installed requiring more project stakeholders to be involved. An example of such consultants are: survey teams, lighting consultants, acoustical consultants, cost consultants, theatre consultants, security consultants, code consultants, door hardware consultants, LEED consultants (high

performance building parameters to achieve a 'green building' status by the U.S. Green Building Council), and many others.

As coordination becomes more complicated as all these consultants become an integral part of the building design development process, communication flow becomes more complicated. Also, architecture teams tend to expand in order to be able to coordinate successfully the rising quantity of data required for integration within the building design.

Another important problematic element that exists in the pure traditional form of building design and construction projects relates to contractor involvement. Contractor is the stakeholder that ultimately procures the materials, and assembles the building. So it is important to understand that contractor's input from initial phases is critical in order to improve and create a more efficient process of the architects, related consultants, and engineers, through feedback and input based on experience in building assembly.

Although nowadays, in order to enhance project development efficiency and reliability there are some project methodologies that use contractors from initial phases such as the Guaranteed Maximum Price technique (add reference), typically in the pure traditional form and contract documents, the contractor will be integrated within the process only after the construction documents phase (see next section). This essentially blocks the contractor participation from the whole design process of the building until the construction drawings and specifications are sent for bidding.

As typically information becomes denser and requires more coordination through a larger number of stakeholders, there is room to integrate Agile elements within this process. Also, Agile would require to integrate some contractor presence within this phase to provide crucial input and advice for revisions of the drawings. This is crucial to save money through selection of better equipment, and enhancing constructability techniques of putting together building components during assembly, and advising on products more suitable in certain situations.

3.3 Construction Documents

The construction documents process deals with providing details to the product level and material specifications towards the procurements process that will be done by the contractor.

Drawings will be elaborated in the highest level of detail to allow the contractors maximum information needed to assemble the different areas of the building. Also, engineers will establish the system performance requirements and types that are needed in the building, all in order to allow the building to operate with the efficiency, with the quality and effectiveness that the contract documents subscribe.

3.4 Bidding

Once the contract documents are complete that include the drawings by the different trades (architect, structural engineer, mechanical engineer, plumbing engineer covering fire protection systems as well, electrical engineer, and related consultants), specifications, and other project manual related items, these will be sent to a bidding process. The contractors invited according to an Request For Qualification/Request For Proposal process, will receive the information and will be required to submit a pricing. Once this is reviewed, they will send back their bid offer, and eventually be selected to begin the procurement process and building construction.

This phase is merely formalities of selecting the contractor according to the different offers made. This is a short phase, which requires minimal interaction between the client, the architect, and the chosen contractor. After the contractor is selected the procurement process commences. Requests for Information (RFI) will be submitted by the contractor to the architect to clarify errors in the contract documents, or elements that could be refined. This process requires an extensive effort by architects to coordinate RFI solutions, as well as approve submittals which include all data, products, and materials samples that are conforming with the design intent set by the architects for the building.

3.5 Construction Administration

The RFI process continues in this phase in addition to submittals issued, requiring architects to have available staff to assure continuous supply of answers to avoid interruptions in contractor schedule. Also, and this varies by project to project, but the architect will visit the construction site not to inspect construction, but to assure construction is meeting design requirements (intent), and that there are no issues to be reported to the client. The architect acts as an 'owners agent' according to the contract documents. The team can be minimized in this phase compared to the construction documents phase, but there are still requirements which will require the team to work on with a relatively high intensity and communication between the stakeholders. Thus, due to RFI and submittal coordination that require a relative high communication intensity needs, there is room for Agile adoption elements, and will be elaborated in the next chapter (discussion).

3.6 Building Design and Construction Project Phases Communications Summary

Figure one below summarizes the communication requirements that occur in the traditional methodology when implementing a building design and construction project throughout the different phases. As summarized in previous sections, in the programming and schematic phases, there are minimal stakeholders and communications that are needed in order to get tasks done during these phases. In design development, construction documents, and some level of construction administration and bidding, the number of communication attempts that are needed in order to execute tasks, between a larger number of stakeholders impact the overall efficiency of the project's implementation. Thus, there will be an need to implement Agile adoption elements, in order to ease the workflow of these phases, and increase overall efficiency.

This will allow to eventually cut production time, improve communication and will inhibit double efforts which occur frequently in large teams where the individuals are not fully coordinated. Also it will allow eventually to lower costs and allow for more profit, as fee expenses can be lower with highly efficient workflow.

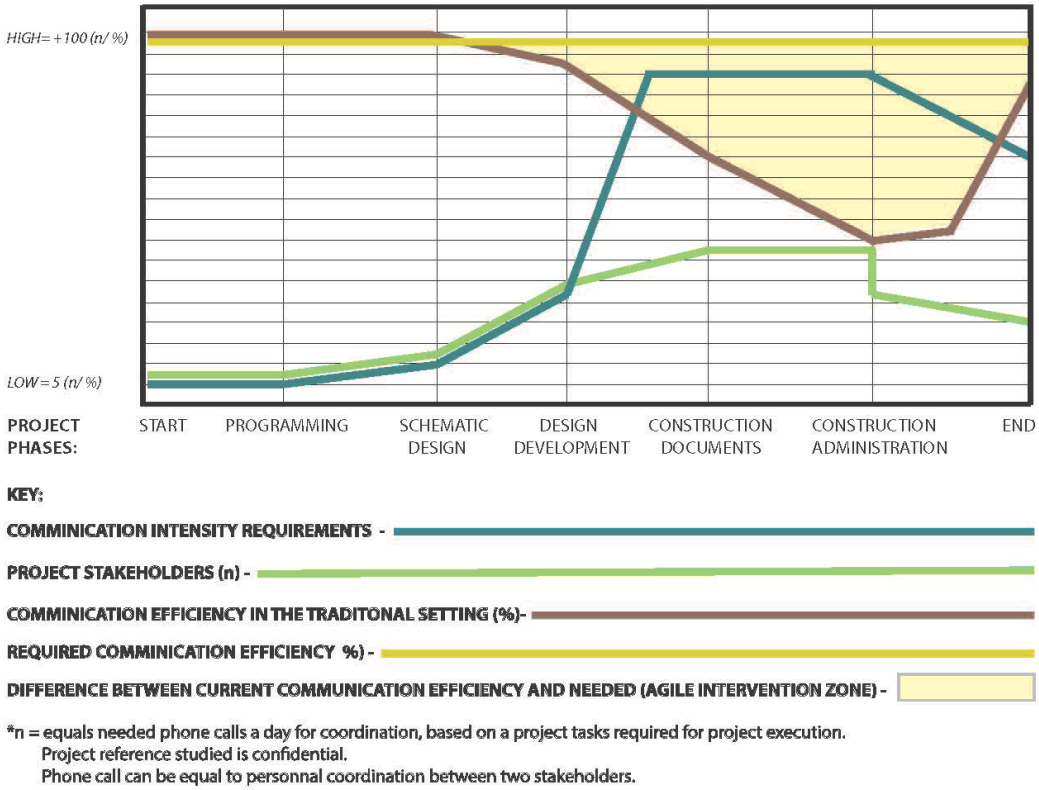

Figure 1-Moriel, R. (2017). Building Design and Construction Project - Summary of Traditional Project Methodology Communications During the Different Phases Common in the Industry.

The major reason this thesis paper argues that these phases become inefficient are because of the task workflow and process according to the traditional methodology, that are required in order to complete these phases. As illustrated in the figure one, and previous sections, the phases that require a larger amount of communication between many more stakeholders (architects, client, engineers, consultants, government officials, etc.), through short amount of time, become congested in large projects and inefficient. Thus, the area where there consists with a large difference between the communication efficiencies (current in the traditional setting, versus required in the diagram in the previous page), there will need to be Agile adoption to improve the current project structure. To further enhance the bulkiness of the phases which the efficiency drops, figure two below illustrates what is needed in order to carry out a single task during these phases with maximum deliverable and communication intensity, along with multiple stakeholders.

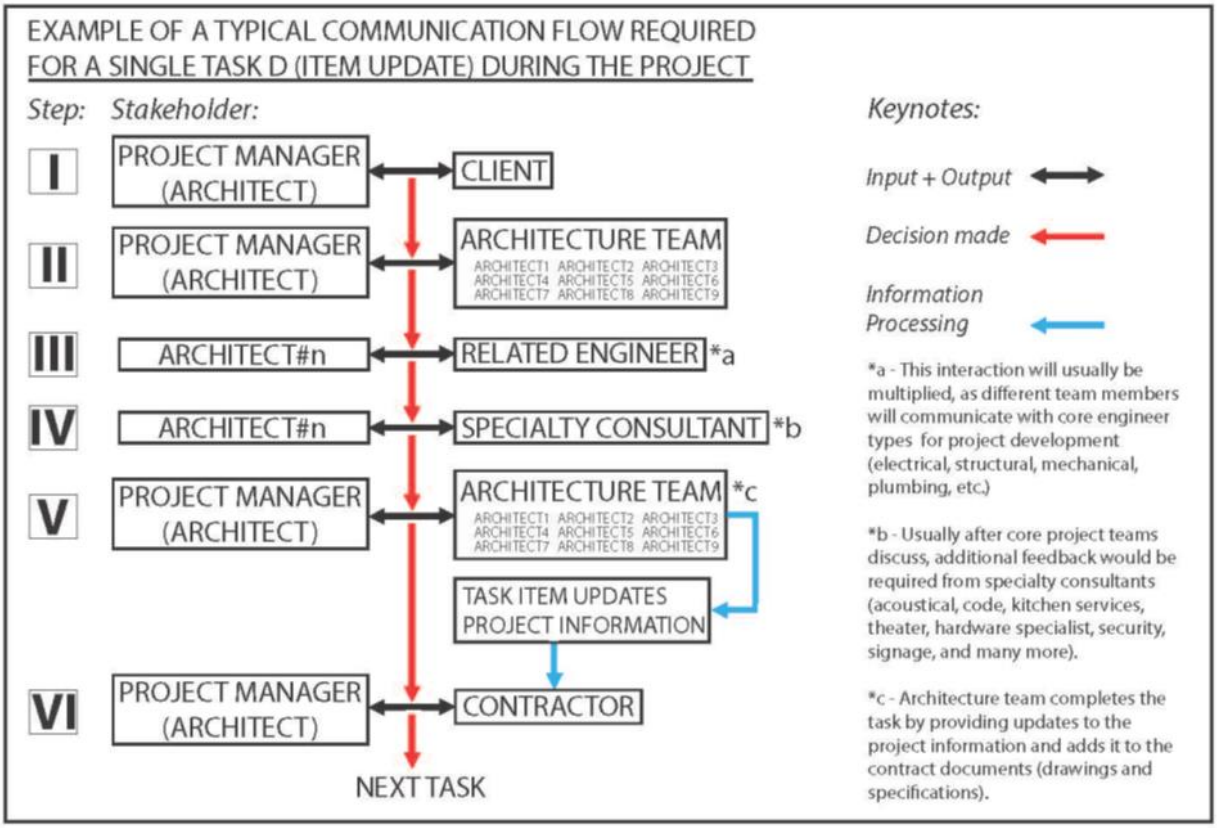

Figure 2- Moriel, R. (2017) Communication Flow required for a single task during one of the project's phases.

This is a common communication flow during the following phases: design development, construction documents, bidding and construction administration with

regards to the RFI and the submittal process, where a large communication effort is required with the contractors in order to provide the necessary answers required in the material procurement and construction processes.

This study shows the very long process that currently exists in order to achieve a successful completion in one task (common to large complex projects as the one analysed in this thesis paper). In these phases, there are typically hundreds or even more tasks that are required to complete the phases successfully. Thus, in the discussion chapter, this thesis study will offer solutions how to recreate the team structure through adopting different Agile techniques. This will be done in order to allow for a better more effective process that will save time, improve quality, and will save costs through cutting unnecessary work, and make effective communications required to complete tasks within the phases of the building design and construction projects.

4. Qualitative methodology – Interview

In conjunction with a comprehensive review of pertinent literature showcasing Agile implementation within organizations, a pivotal facet of my research involved a meticulous examination of design firms that have already embraced or are poised to adopt novel methodologies in their management practices. A cornerstone of this investigative endeavor encompassed in-depth exploration of case companies via interview-based analysis. This critical phase entails the collection of invaluable insights directly from individuals possessing firsthand familiarity and expertise within these organizations. Interviews, as a methodological approach, afford an avenue to delve into profound understanding, diverse viewpoints, and exclusive information that might remain concealed within public domains. This proactive engagement with primary sources enriches the research by offering an intricate comprehension of real-world scenarios and experiences, substantiating the broader analytical framework.

This research method allows us to obtain real-time data and enrich our analysis of the company's operations, culture, strengths, weaknesses, opportunities, and threats.
The purpose of this research is to gain an accurate and comprehensive understanding of the company's inner workings, as well as its position within the market and industry. By engaging with key stakeholders, employees, customers, and industry experts, we aim to paint a well-rounded picture of the company's current status and potential future developments.

Consequently, a selection was made of a Czech design firm boasting a decade and a half of prowess in conceiving civil and industrial undertakings. The ensuing sections shall proffer an exposé on the company's profile while expounding upon a meticulous dissection of interviews conducted with the company's Chief Technical Officer and the ensemble of adept designers under their purview. This analytical endeavor seeks to unfurl a comprehensive panorama of the company's ethos, operational modus operandi, and the firsthand insights gleaned from key figures instrumental to its design trajectory.

The individuals partaking in the interview process boast diverse expertise across various dimensions and magnitudes of construction endeavors. In pursuit of impartiality, a collective of 10 architects and the company's CEO were meticulously chosen. Moreover, a concerted effort was undertaken to ensure a demographically varied respondent pool, thereby mitigating potential biases. This diversification extends to multiple facets, including their roles within project teams, exposure to diverse project types and scales, and substantial involvement in project management activities. This deliberate selection strategy augments the integrity of the research, fostering a well-rounded and comprehensive analysis of the company's operations and the empirical data gleaned from the involved professionals.

Following the formulation of pertinent inquiries, an exhaustive examination of the gathered data was undertaken. The survey, systematically conducted, primarily delved into the realm of construction projects in their design phase. The subsequent meticulous data analysis revealed enhancements impacting project performance across a multifaceted

spectrum. The qualitative insights gleaned from the interviews, a pivotal facet of this research, substantiate the foundational investigation, enriching the analytical contours with firsthand experiential perspectives. This comprehensive synthesis of qualitative and quantitative methodologies contributes to a holistic understanding of the company's dynamics and accentuates the veracity of the preliminary research propositions.

4.1. Introduction of the case company

Year established: 2007
Type of organization: Private company
Type of Business: Design-construction company
No. of employees: 60
Professional services:

1. Project and cost management
2. Construction management
3. Technical supervision
4. Fit-out management, engineering
5. Consultation and due-diligence
6. Health and safety coordination

No. of employees on project team:
Recently completed projects:

1. Complete reconstruction of the shopping center
2. Construction (over CZK 300 mil.) of the new Solis low-energy and sustainable building.
3. Construction management on buildings with an area of more than 55,000 m2 from the foundation to the handover of the finished buildings to the tenants, including the installation of their technology and equipment.
4. Residential buildings

Organizational structure:

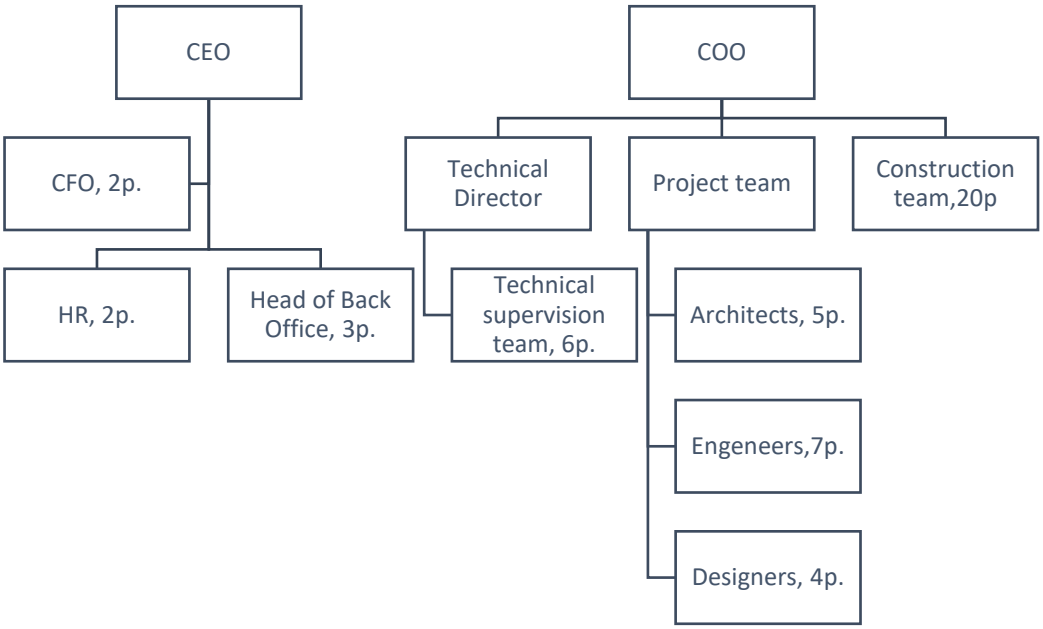

Figure 3. Organizational structure of company

In accordance with the aforementioned strategies, my unwavering attention was consistently directed towards the selected subject, underpinned by meticulous empirical inquiry. Given the expansive gamut of management and construction services offered by the company, a discerning choice was made to scrutinize a specific project team for in-depth analysis. This conscientious selection aligns with the research's objective of delving into the nuanced intricacies of the company's operations, thereby bolstering the overall comprehensiveness and accuracy of the investigation.

The project team plays a pivotal role in the project's inception, actively engaging in the initial stages involving refinement, stakeholder coordination, and processes conducive to the effective application of Agile principles and tools. A central element of this analytical endeavor involved garnering insights through targeted interviews with a select group of architects and engineers from the project team. In their capacity as influential trailblazers within the construction industry, they consistently strive to remain attuned to contemporary methodologies capable of enhancing the company's performance.

Driven by an ethos of embracing innovation, the company's Operations Director has emerged as a proactive advocate of change. This is evinced by the incorporation of the Scrum framework within construction projects during the design phase. This pioneering step illustrates that, through meticulous team preparation and organizational adaptability, the adoption of Agile methodologies can indeed be realized. This exemplifies a paradigm shift in the industry, accentuating that with requisite groundwork and a receptive stance towards transformation, Agile practices can be seamlessly integrated, revolutionizing conventional project management paradigms.

The conducted interview was structured into two distinct segments, each yielding valuable insights. The initial section aimed to ascertain the respondent's prior involvement in the business process transformation project team, discern their specific role therein, and

delineate their industry affiliation. Subsequently, a comprehensive assessment of pivotal parameters related to the project team was conducted, encompassing elements such as its dimension, employed project methodology, geographical disposition, and the project's ambit.

Transitioning to the second part of the survey, participants were solicited for their perspectives on a spectrum of project management practices. This phase encompassed diverse considerations, including the belief in the indispensability of a comprehensive project plan, the frequency of communication channels, preferences between the waterfall and iterative methodologies, among others. The intention behind this in-depth inquiry was to elicit nuanced viewpoints from the respondents, thereby facilitating a panoramic comprehension of the project team's dynamics and the varied perceptions that underpin its management practices. Through this comprehensive approach, the research gains a multifaceted understanding of the subject matter, ensuring a well-rounded exploration of the facets under scrutiny.

The survey's subsequent section delves into the participants' pre-transformation experiences, prompting them to reflect upon challenges encountered and their underlying causes prior to team restructuring. Participants are encouraged to elucidate the specific obstacles they confronted and articulate their motivations for these struggles. This phase aims to provide a retrospective examination, lending context to the subsequent transformations and identifying areas that necessitated improvement.

Concluding the survey, the final phase elicits respondents' impressions and assessments of the novel management and interaction paradigm introduced within the team. This valuable feedback unravels the efficacy of the implemented changes and highlights any perceptible shifts in team dynamics and operational outcomes. Such insights gleaned from this section offer a comprehensive evaluation of the transformation's impact and facilitate a qualitative gauge of the team's evolved state. By encompassing both the historical context and the current perspective, this survey holistically captures the trajectory of change and its tangible ramifications on the team's modus operandi and overall efficiency.

Each interview was held semi-formally within a company conference room.

4.2.Case company`s COO interview

Main objectives of the interview with the Operations Director were to get answers to the following questions:

1.Work experience, career growth and the number of years of work in this company
2. Difficulties that have arisen in projects before, their nature and impact on the project
3. How new management methods were introduced, analysis of the company
4. Positive and negative effects of the new project management method
5. Prerequisites for the introduction of a new method
6. Further development of project management

The participant in question possesses a wealth of expertise as a seasoned project manager, amassing over a decade's experience in the domains of design and construction.

With an extensive tenure exceeding four years at the case company, their insights serve as a valuable lens through which to juxtapose the company's historical trajectory against its present state. This temporal breadth enables a comprehensive assessment of the organization's evolution and the tangible impacts stemming from the implemented alterations in team management.

As expounded by the respondent, the company's initial situation was characterized by a notable degree of stability. A proficient team of experts was assembled, culminating in the successful culmination of projects. However, upon delving into management limitations, the respondent identified a conspicuous communication deficit among stakeholders. Consequently, this void led to recurrent disruptions amongst employees, impeding the adherence to project timelines. Delving into this issue with meticulous scrutiny, the respondent's analysis extended to the organizational framework and operational processes.

This incisive examination unveiled several gaps within the company's operational fabric. These gaps stand as pivotal focal points demanding attention and resolution, serving as the bedrock for targeted interventions aimed at enhancing overall efficacy and performance. By embracing such meticulous analysis, the research is poised to foster a comprehensive understanding of the intricacies within the company's operational ecosystem, thereby facilitating a pathway towards holistic improvements.

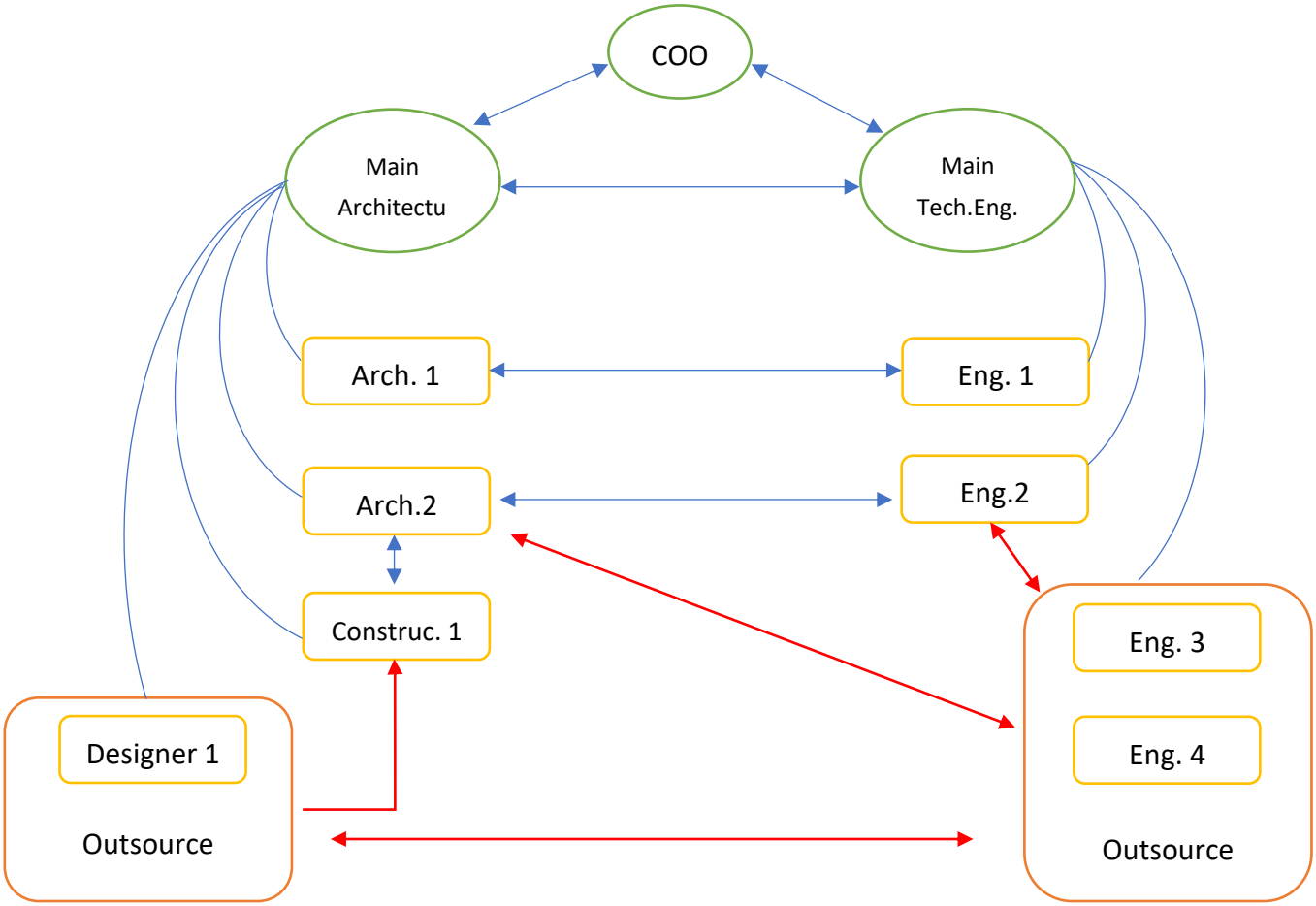

Figure 4. Working process within the project team of case company

As shown in picture the cohesion within the project team deteriorated, with discussions confined to a limited circle comprising the operational director, chief architect, and chief engineer of the technical section. Remaining team members engaged solely in the weekly general assembly, resulting in essential matters and resolutions being communicated verbally within the upper management circle. This setup hindered the involvement and proactive contribution of the predominantly youthful specialists in decision-making, consequently impeding their participation and initiative in the process.

For a newcomer or an engineer with over two years of experience, this operational approach hindered the ability to innovate, think creatively, and explore diverse solutions. It also somewhat diminished the sense of engagement in the project. Another notable issue arose from outsourcing a segment of the team's responsibilities to contract-based proficient experts who worked remotely. This physical separation and project-specific engagement frequently resulted in communication lapses between performers and in-house members. Consequently, project timelines were often compromised, and misunderstandings emerged in the decision-making process, leading to fragmented assignment of project segment responsibilities.

The third issue revolved around the absence of well-defined and easily comprehensible regulations governing the framework of organizational operations. Starting right from the project's initiation, the formulation of structured work timetables and the allocation of responsibilities among team members remained a conspicuous omission. Consequently, this lacuna contributed to both task redundancy and the inadvertent neglect of certain project components, culminating in a subsequent augmentation of the project's financial outlay.

During the initial phase of efforts aimed at enhancing the prevailing circumstances and addressing the core challenges within the Scope of Operations (SOO), a comprehensive strategy was devised. This strategy delineated a meticulously structured approach for the gradual execution of transformative measures, encompassing both the team dynamics and the overarching operational procedures. The outlined plan encompassed a methodical sequence of steps to effectuate a seamless transition, encompassing the requisite adjustments to team composition, interrelations, and the holistic workflow. This systematic implementation ensured a harmonious integration of the proposed alterations, thereby fostering an environment conducive to the amelioration of the SOO's overarching challenges.

Considering the aforementioned challenges, a pivotal imperative emerged to initiate the transformation process while adhering to the ongoing projects and maintaining the current team composition. To commence, a strategic decision was made to enhance the rapport between the team and the company's management. To facilitate this, a novel approach was adopted – the introduction of a thrice-weekly meeting cadence (commencing, midpoint, culmination). The meeting dynamics were revamped to elicit optimal outcomes. At the start of each week, the team collectively deliberated and formulated weekly objectives. Midweek sessions scrutinized interim progress, while week-end discussions synthesized achieved accomplishments. These gatherings pivoted away from manager-driven directives, evolving into a participatory arena where team members,

aligning with forthcoming goals, autonomously set deadlines and proposed efficacious strategies. This dynamic shift vested performers with proactive involvement, engendering accountability and thereby cultivating a fertile ground for ideation and initiative to flourish.

Through the utilization of interviews during the implementation of the revised weekly meeting structure, an evaluative framework was established to identify both the latent strengths and vulnerabilities within the team. Among these, a noteworthy concern was the reticence exhibited by certain employees in engaging with project planning; these individuals, accustomed to task-centric execution, exhibited prolonged adaptation periods. Furthermore, during the preliminary phase, a hesitancy to express perspectives and initiate cross-departmental communication was evident, predominantly noted among junior employees who were novices in issue resolution.

Subsequent scrutiny revealed another limitation: an ingrained skepticism among project managers regarding the chosen transformative trajectory for the Scope of Operations (SOO). This sentiment stemmed from a reluctance to deviate from familiar operational formats and a degree of distrust towards emerging professionals. These apprehensions were largely grounded in the inclination to maintain established procedures and a degree of uncertainty in embracing change.

In tandem with these insights, concurrent analysis was conducted on the company's overall functioning and ongoing research initiatives. This comprehensive evaluation not only facilitated a nuanced comprehension of the identified weaknesses and strengths but also contextualized them within the broader organizational landscape, augmenting the precision of targeted interventions for optimal outcomes.

A span exceeding two years following the initiation of the transformative endeavor, the Chief Operating Officer distinctly observes substantive shifts within the contours of the company's operational paradigms, coinciding with the collective growth of the team as consummate professionals. One pivotal advancement materialized in the harmonization between the design and construction factions, as well as fostering seamless interplay amongst stakeholders. The strategic infusion of scrum meetings assumed a pivotal role, yielding a marked improvement in communication among geographically dispersed team members. This refinement translated into swifter identification of queries and challenges that emerge during work progression, enabling timely interventions for resolution.

A heightened level of adaptability to unanticipated contingencies also crystallized within the team. This newfound nimbleness is underpinned by the provision to deliberate and address exigencies collectively, leveraging the combined expertise of personnel vested with the responsibility for distinct facets of the project. This transition has fortified the team's efficacy in managing unforeseen hurdles and cultivating an environment that encourages dynamic problem-solving through collaborative engagement.

In summation, this transformation engendered qualitative shifts beyond mere operational mechanics. It underscored the overarching growth of the collective professional acumen, invigorating team dynamics and augmenting the company's competitive edge. The evolution of communication strategies and adaptive practices aptly exemplifies the transformative potential inherent in embracing Agile methodologies, ushering forth a revitalized paradigm of operational excellence.

The transformative shifts witnessed among employees represent an unequivocal triumph, constituting a paradigm of qualitative enhancement for the company. Aligned with the Chief Operating Officer's strategic vision, the introduction of a platform for self-expression and the contribution of innovative solutions ignited a transformational journey for each team member. This trajectory towards metamorphosis has translated into heightened self-assuredness, an inclination towards initiative, and an augmented engagement in project endeavors. Notably, the reinforcement of team cohesion has been instrumental in expeditiously identifying and resolving challenges. In this transformative narrative, the COO has assumed a multifaceted role akin to that of a mentor and an expert resource, available to offer professional guidance and insights. This dynamic interplay has fostered an environment wherein the team feels empowered to seek counsel, effectively aligning expertise with execution. This transition has not only invigorated the overall work ethos but has also engendered a palpable ripple of innovation. The emergence of young professionals spearheading more efficacious strategies, infused with their zeal and dexterity, has invariably left a resonant impact on the company's upper echelons, evoking astonishment and commendation. In essence, this overarching evolution within the employee ecosystem has cultivated a conducive backdrop for continuous improvement and innovation. It underscores the potential for cultivating an empowered and forward-thinking workforce, all while reinforcing the pivotal role of visionary leadership in orchestrating such transformative journeys.

Evidently, drawing from the insights of the COO, the integration of Agile tools necessitates the team's perseverance in conjunction with meticulous coordination. However, it's noteworthy that the team's transformation journey remains an ongoing endeavor. The pursuit of optimized avenues for enhancing interconnectivity prevails, particularly in light of seamlessly integrating documentation and centralizing the database through a unified portal. For instance, the exigencies of the pandemic prompted the implementation of virtual meeting systems like Skype, a measure that has endured beyond the pandemic's immediate impact. In this regard, regular midweek meetings convene, accommodating team members who are either on business trips or actively engaged at project sites, connected virtually. This adaptability underscores the company's proactive approach to maintaining communication and cohesion despite geographical dispersal.

This adaptive strategy showcases the company's responsiveness in embracing digital platforms to transcend spatial barriers. This not only reflects a commitment to streamlining workflow but also signifies the synergy between agile methodologies and contemporary communication technologies. The pursuit of this hybrid approach demonstrates a shrewd melding of the principles of agility with the technological capabilities of today's digital landscape. This continued evolution, led by the COO's vision, holds the promise of yielding a more seamlessly integrated and interconnected operational framework.

Moreover, the COO has adeptly transitioned from a micro-management stance, relinquishing the need to oversee every intricacy of each project sprint, demand unwavering adherence to predetermined timelines, or meticulously devise a comprehensive production blueprint. Instead, a strategic shift has been executed. The COO

formulates overarching project objectives and key milestones, coupled with general target completion dates. Subsequently, specialized subgroups delve into meticulous planning, configuring sprint schedules, and autonomously delineating task allocations and deadlines. This empowerment nurtures a heightened sense of accountability and engenders intrinsic involvement in the project's fruition.

The segmentation of projects into more manageable subunits, coupled with the cadence of monitoring the project's trajectory at least twice a week, has elicited profound simplification and acceleration of the work process. This frequent review mechanism efficiently identifies discrepancies or voids, thereby averting last-minute revisions or supplementary expenses. Consequently, the temporal and financial integrity of projects is fortified, steering clear of avoidable alterations that could otherwise strain timelines and budgets. This diligence in due diligence stands as a testament to the company's unwavering commitment to project excellence and resonates profoundly with clients. The resulting transparency reaffirms customer trust and fosters a steadfast partnership grounded in mutual understanding and shared success.

Furthermore, the COO astutely recognizes a challenge stemming from this approach: instances where employees encounter difficulty in autonomously allocating projects due to varying levels of professional experience. In such scenarios, the prerogative to resolve this impasse invariably rests with the Chief Operating Officer.

While the delegated distribution of tasks and responsibilities empowers employees and enhances their sense of ownership, the complexity of some project allocations may necessitate a judicious intervention by the COO. In these situations, the COO's role evolves into that of a discerning arbiter, who, armed with both a panoramic vision of the project's requirements and an astute understanding of each employee's competencies, is equipped to make informed determinations.

This nuanced interplay underscores the balance between decentralization of decision-making and the strategic necessity for authoritative guidance. It is a manifestation of the COO's adaptive leadership, where the delegation of authority coexists harmoniously with an agile readiness to address exceptional scenarios. This duality not only reflects the COO's pragmatic approach but also enhances the overall organizational agility by ensuring that even in instances where autonomous distribution may falter, a calibrated resolution mechanism remains readily accessible.

Hence, predicated upon a comprehensive evaluation encompassing the merits and limitations of the ongoing transformational strategy, the Director of Operations elucidates a collection of pivotal benchmarks imperative for the efficacious integration of scrum meetings and the overarching principles underpinning Agile methodology:

1. Thorough Process Analysis and Project Insight: A foundational tenet involves a meticulous dissection of the company's operational frameworks, coupled with an innate understanding of its project intricacies. This diligence provides the groundwork for a streamlined adaptation of Agile practices, tailored to the organization's unique operational nuances.

2. Organizational and Personnel Preparedness: A pivotal prerequisite pertains to the alignment of both management and employees with the impending transformation. This entails judicious consideration of timing, occasionally necessitating supplementary training sessions to foster an adept assimilation of Agile concepts. The collaboration between readiness and education bolsters the enterprise's collective capability to navigate the evolving landscape.

3. Robust Team Collaboration Framework: Crafting a resilient model for collaborative work assumes paramount significance. Establishing a well-defined framework for team dynamics, coupled with the delineation of key performance metrics, augments accountability, and fortifies a shared trajectory towards project excellence.

4. Patient Embrace of Evolution: Acknowledging the temporal scope of transformation is elemental. The prolonged process of integration mandates a sagacious perspective, urging stakeholders to allow for a gradual metamorphosis, fostering a conducive environment for iterative adjustments and fine-tuning.

5. Financial Incentives for Excellence: Bolstering the commitment to effective project execution, financial incentives stand as a motivational cornerstone. Offering tangible rewards for exemplary project implementation incentivizes teams to proactively embrace Agile principles, thereby fortifying performance-driven outcomes.

In essence, these distilled criteria underscore the nuanced prerequisites for successful integration of Agile methodologies, each aligning cohesively to usher forth a holistic transition that harmonizes the organization's objectives with the dynamic paradigms of contemporary project management.

Envisioning the prospective trajectory of Agile methodology within the domain of construction and design, the outlook emerges as decidedly optimistic. This optimism is primarily concentrated within the realm of team management strategies, considering that the unequivocal application of Agile's flexible tenets within the realm of rigorously defined construction processes remains an intricate endeavor. A comparative analysis vis-à-vis the IT domain accentuates the distinctions that underscore this delineation. The IT landscape thrives on the malleability of electronic products, which facilitate prototyping, iterative testing, and seamless adaptation. In stark contrast, the multifaceted and tangible nature of the construction process imposes a unique set of challenges.

Amidst this reflection, an intriguing dynamic comes to the fore—the symbiotic evolution of technology and design processes. Here, the interviewee astutely observes the burgeoning pace of technological advancements that progressively streamline the design realm. Notably, the advent of Building Information Modeling (BIM) technology emerges as a game-changer. This software harnesses the potential to offer a comprehensive panorama

of projects, enabling stakeholders to navigate through intricately modeled structures in a three-dimensional format. This immersive visualization not only augments design precision but also engenders collaborative cohesion, where stakeholders can converge around a shared visual representation, fostering a profound alignment of project objectives.

While the application of Agile within the construction milieu remains nuanced, this discourse underscores the pivotal confluence of Agile's adaptive ethos and the burgeoning technological arsenal at the industry's disposal. It’s a reflection of the industry's adaptability in leveraging new technologies to catalyze evolution, while respecting the intrinsic complexities that define the architectural and construction realms.

4.3. Architect`s and engineer’s interview

The organizational structure of the company's design team entails the segmentation of personnel into subgroups aligned with specific project segments, each under the oversight of chief engineers or architects. Project allocation transpires among team members, with chief engineers shouldering the responsibilities of coordinating efforts, validating outputs, and culminating in definitive design resolutions. These subgroups encompass individuals with specialized expertise spanning a tenure of 2 to 6 years.

Throughout the interview process, particular emphasis was placed on evaluating team synergy, employee advancement within the organization, perspectives regarding the agile methodology, and the extent to which its application has contributed to collaborative efficacy and professional advancement.

The primary objective of the initial set of inquiries in the questionnaire is to amass the professional history of each respondent participating in the survey. Presented below are the open-ended queries designed to elucidate fundamental details concerning the subject matter:

1. Establish the age and occupational tenure of the respondent.
2. Elaborate on challenges encountered in prior projects.
3. Express a predilection for conventional project management via the waterfall approach or an inclination towards adopting modern, adaptable methodologies, accompanied by insights into tools employed in the professional domain.

As an integral component of the executed interview process, the previously stated inquiries were crafted to solicit information capable of discerning the identities of the respondents. Moreover, the responses to these queries facilitate the oversight of the diversity within the experience spectrum of the survey participants. Consequently, the trends in the acquired data possess the capability to mitigate deviations and circumvent potential biases. The interview engagement encompassed a cohort of 8 pivotal personnel, aged between 28 and 36, all possessing over 3 years of design-related expertise. Among

them, three held the designation of architects, two were designated as designers, and the remaining three were engineers.

Based on the gathered responses, a comprehensive examination was conducted, revealing that 6 out of 8 respondents actively endorse the managerial approach of transformation and have been engaged since its inception. Addressing the matter of challenges faced in prior projects, the participants have highlighted the subsequent points:

1. The presence of a rigid hierarchy intrinsic to conventional construction management organizational structures.
2. Occurrences of multitasking due to concurrent oversight of multiple projects, leading to workflow hindrance.
3. Challenges pertaining to stakeholder-team relationships.
4. Constrictions on operational boundaries impeding the ability of young professionals to manifest creativity.

Transitioning to the third segment of the survey pertaining to novel approaches to assembly and team administration implemented within the organization, participants have highlighted the ensuing favorable developments:

1. Enhanced inter-team communication.
2. Expedited decision-making processes.
3. The adaptable nature of meetings permits participation even when situated on-site or during business travel.

Another pivotal aspect of inquiry aimed at identifying the qualitative transformations experienced by the participants. Notably, within the sample of 8 respondents, 5 individuals attested to an elevated level of self-assuredness when engaging in decision-making processes. This exploration delves into the perceptible shifts in participants' confidence levels subsequent to the introduction of new managerial methods. The findings underline the impact of these strategies on individual decision-making skills and confidence within the organizational framework.

It is pertinent to highlight that the domain of design and construction operates within stringent regulatory frameworks, limiting the comprehensive integration of Agile methodologies into the entirety of the design and construction processes. However, the adoption of Agile principles within team management holds the potential to induce substantial enhancements in the company's production landscape. This consideration emphasizes the pragmatic approach of leveraging Agile principles selectively to catalyze transformative shifts in organizational productivity.

The forthcoming section presents a hybrid management approach, synthesizing insights from both the IT sector and the specific case company's experience. This methodology seeks to merge the best practices observed in the IT industry with the unique context of the case company, offering a tailored framework that harmonizes diverse elements for effective management.

5. Discussion and Recommendation - Hybrid Prototype

5.1. Comparing of traditional and agile methodologies

5.1.1 Waterfall or Traditional Project Methodology

Waterfall methodology, as expounded by Cobb (2015), constitutes a sequential and linear approach to project management. This method orchestrates a cohesive progression characterized by a series of well-defined phases, each tethered to specific objectives and deliverables. The overarching structure maps out the project's trajectory, choreographing a sequence wherein tasks are consecutively undertaken, completed, and then succeeded by subsequent tasks, perpetuating this organized continuum.

A foundational tenet within the traditional project management paradigm is the meticulous planning process, meticulously conceived before project execution. This prelude to action serves as a crucible for cultivating an exhaustive comprehension of project requisites and ancillary information requisite for seamless task execution across diverse phases. The fabric of this planning fabric is interwoven with comprehensive details—project requirements, milestones, and a calendar of pivotal dates—calibrated to ensure the project's measured advancement.

Integral to the effectiveness of this traditional approach is the meticulous structuring of the project's architecture, a premeditated endeavour designed to pre-empt and minimize risks. This strategic posture leverages the depth of planning to curtail the vagaries of unforeseen contingencies, proactively mitigating challenges before they morph into formidable obstacles. This assiduously cultivated structure harmonizes with the intricate choreography of phases, harmoniously culminating in the realization of a predetermined end-goal within a stipulated timeframe.

The traditional waterfall methodology's elegance lies in its orchestration of a well-ordered procession towards a fixed culmination. Yet, as with any paradigm, it is not without its limitations. Its steadfast adherence to a linear progression and comprehensive pre-planning could potentially render it less adaptable to the volatile shifts inherent to modern project landscapes. Despite this, the rigor and systematicity of the waterfall approach continue to resonate within contexts where predetermined outcomes, meticulous planning, and risk mitigation assume paramount importance.

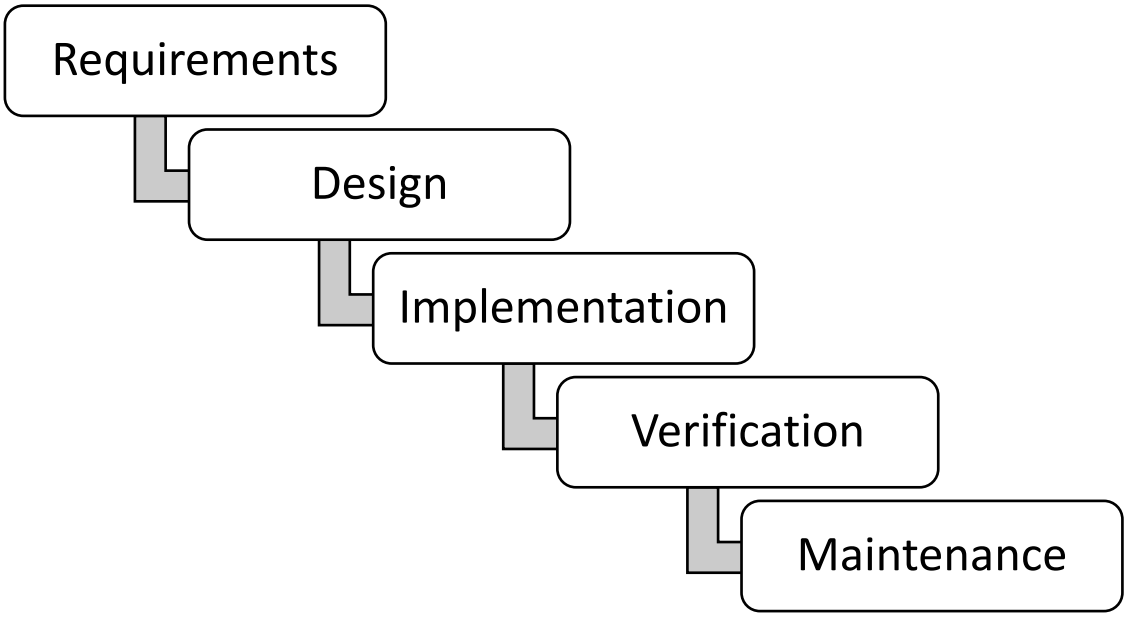

Figure 5- Waterfall management approach

Within the realm of project management, the landscape is frequently dominated by the omnipresence of the waterfall model—a methodology that places a pronounced emphasis on meticulous planning. This model often earmarks a substantial portion of the project's temporal trajectory, typically spanning 20 to 40% of its entirety, to be dedicated to the initiation and subsequent phases. The hallmark of this methodology lies in its methodical structure, orchestrating a choreographed procession through each phase. However, while this structure fosters discipline and strategic organization, it also carries inherent limitations.

The structured nature of the waterfall model, with its linear progression and predetermined sequences, introduces an element of rigidity. This rigid framework is essentially the pillar upon which the model stands, serving to delineate and advance the project step by step. However, the model's rigid character begets challenges when confronted with change, particularly in the context of content modifications.

The gradual unfolding of the waterfall approach, while facilitating systematic execution, does not readily lend itself to dynamic adaptation. The model's sequential and linear nature can inadvertently engender a friction against the integration of evolving requirements or client preferences that may emerge as the project advances. Consequently, situations wherein clients are grappling with uncertainty regarding their definitive aspirations for the project could be hampered by the model's predisposition for predefined outcomes.

In a rapidly evolving landscape where agility and responsiveness are increasingly valued, the waterfall model's structural integrity could at times be at odds with the ever-shifting dynamics of client needs and market exigencies. While its tenets endure and

remain efficacious within certain domains, its less malleable nature might warrant a critical assessment when applied to contexts characterized by fluidity and changeability.

In the realm of traditional methodologies, a pivotal project management tool manifests in the form of the Work Breakdown Structure (WBS). This stratagem involves decomposing the project into progressively detailed components, nested in a hierarchical architecture. This practice empowers stakeholders with a coherent overview while aiding the streamlining of project oversight. To enhance navigability, simplification is paramount—dividing the intricate fabric of the project into manageable components invariably promotes clarity and efficiency.

However, this conventional approach encounters obstructions when confronted with the dynamic demands of modern project management, wherein adaptability, swift response to change, and iterative evolution are prerequisites. In this context, the versatility and agility intrinsic to methodologies such as Agile serve as beacons of innovation. Agile's iterative cadence, coupled with its proactive embracement of evolving client needs, foster an environment of responsiveness—a pivotal trait for a landscape where transformative change is the norm. This paradigmatic shift is manifestly reflected in the ascent of Agile methodologies, which pivot from the meticulous planning of yesteryears toward a modus operandi that thrives on dynamic responsiveness, thereby equipping projects to effectively traverse the fluid contours of contemporary business environments.Such a hierarchical structure of the project can be represented in the form of a box diagram:

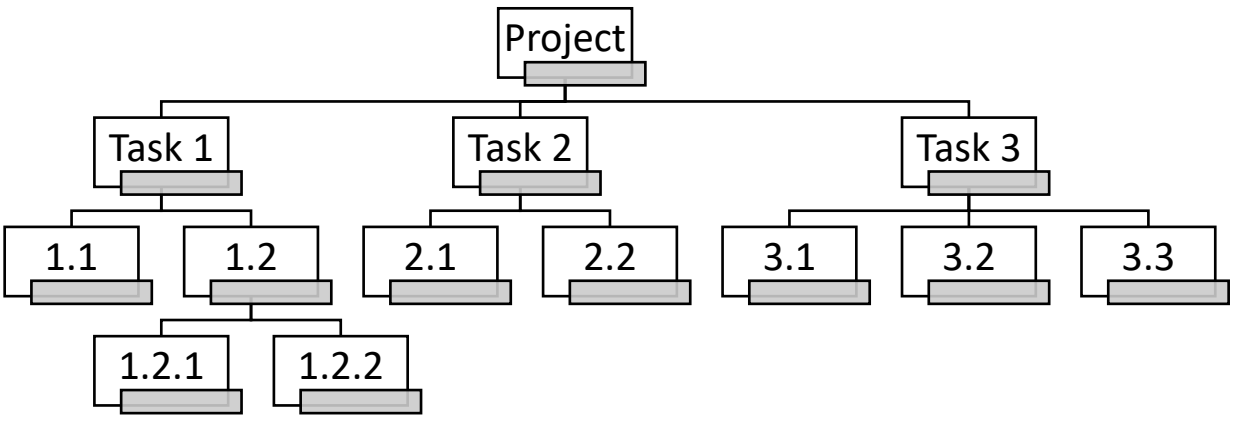

Figure 6- Work Breakdown structure

Segmenting a project into discernible components fosters expeditious resource allocation and confers distinct responsibilities upon individual team members. In modern project management, Gantt charts reign supreme, embodying principles that traverse the realms of theory and application. Tracing its lineage to the epoch of scientific management,

Henry Gantt pioneered a tool that adorns project progress in a distinctive diagram. Originally conceived to monitor shipbuilding endeavors, this tool has since evolved into a quintessential horizontal bar chart, emblematic of contemporary project management.

Central to the potency of the Gantt chart is its prowess in visually elucidating the status of each task. This graphical representation empowers stakeholders with an at-a-glance understanding of project progression. Moreover, the Gantt chart's utility extends to fostering meticulous project planning through template-based diagrams, thereby orchestrating a visual blueprint of the venture. The chart's inherent structure augments the capacity to monitor processes in alignment with prioritized planning, enabling stakeholders to deftly navigate project trajectories while proactively attending to critical milestones.

In an era characterized by multifaceted projects, intricate dependencies, and dynamic alterations, the Gantt chart functions as a compass, instilling a sense of direction and orientation within the project management landscape. It crystallizes project timelines, illuminates potential bottlenecks, and inherently encapsulates the amalgamation of historical evolution and contemporary prowess. By adroitly mapping tasks against temporal dimensions, the Gantt chart cements its relevance as an indispensable instrument, underpinning the orchestration of multifarious projects across diverse industries.

	Activities	Start	Duration	End
1	Write company`s charter, development plan	1	3	4
2	Establish a company	2	4	6
3	Hiring of employes	2	5	7
4	Find a suitable funding call or investors	1	9	10
5	Finding office and workshops for project work	3	4	7
6	Find and engage with partners	5	12	17
7	Develop a detailed design	17	6	23
8	Prototype construction	22	12	34
9	Testing	33	2	35
10	Changing and improving process	33	4	37
11	Work with municipalities on city plan,identification of problem areas of the city	15	4	19
12	Conducting researches to determine the installation location and quantity for production	16	4	20
13	Production of the required number of units	36	12	48
14	Installation in the city	44	4	48
15	Service	46	2	48

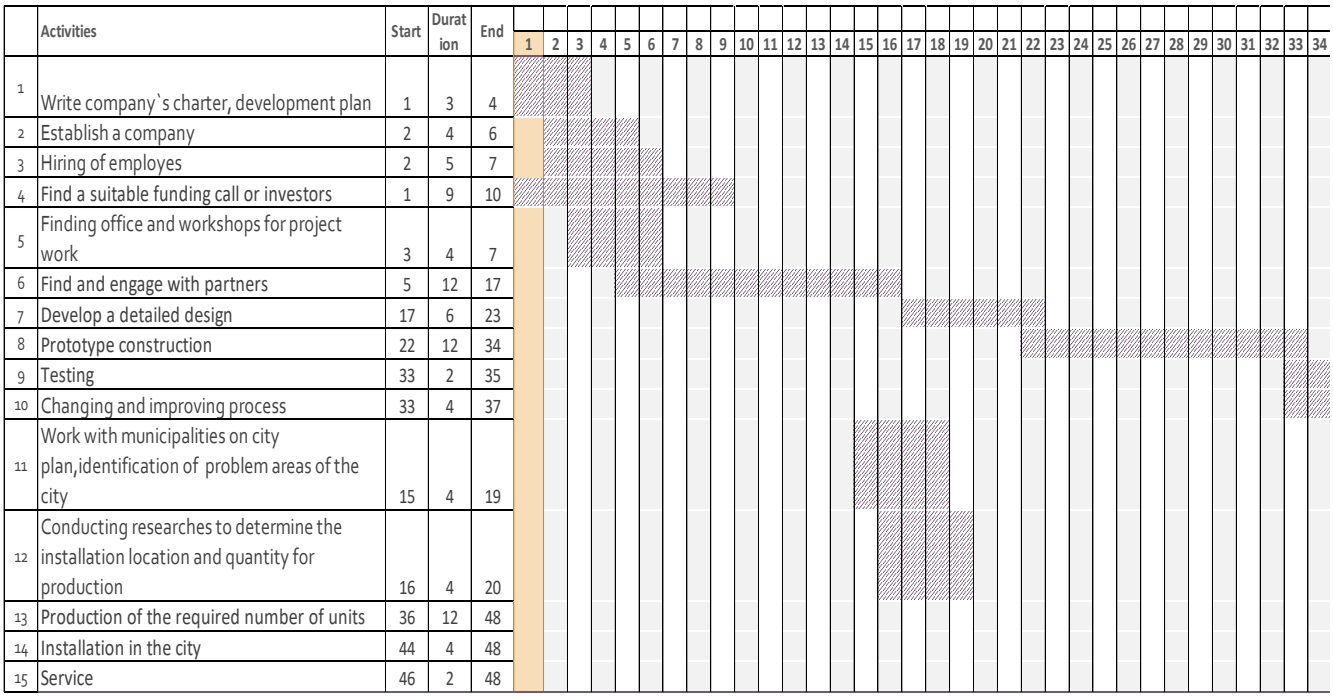

Figure 7- Gantt chart

This paper would argue that unlike some aspects in the project management methodology in the IT world, where Agile was completely adopted and the traditional method was abandoned, the traditional waterfall project methodology is essential for the building design and construction industry. In the IT or high tech world, some projects aim towards an unknown result creating the need for a quick iterative trial and error cycles

based on testing and experimenting. This results with the need for a pure Agile process, where the team can quickly adapt and eventually conduct multiple iterations to increase the chances the product will be useful. Nevertheless, constructing a building eventually consists with elements that are known factors, unlike some high tech product development. The building design and construction industry is establishing projects based on well defined end goals which are predetermined in the beginning of the project in the programming phase. Building requirements such as which program it serves, square footages, and main systems used, are listed in the beginning of the project in order to initiate the design process.

The inception of constructing a building emanates from the formulation of explicit prerequisites, ushering in a procedural trajectory aimed at resolving the fundamental queries of transmuting these prerequisites into tangible spatial configurations. This intricate orchestration accounts for the intricate interplay between spatial morphology and programmatic relationships, meticulously calibrated to cater to the client's exacting requisites. The conventional paradigm, a fixture of the design landscape, has been intricately interwoven with both the design process and legal parameters, thus ensconced within an established framework that resists radical modification. This exposition, however, is not poised to supplant the well-entrenched system, but rather endeavors to elucidate the symbiotic potential that Agile methodologies hold. The intention is not a complete overhaul of the pre-existing structure but a concerted effort to highlight how Agile principles can seamlessly augment the incumbent framework. This endeavor is characterized by a dynamic equilibrium, delicately poised between the preservation of an established and effective foundation and the integration of novel methodologies to invigorate its operational essence.

Agile's essence is inherently adaptable, its potency lies in the dynamic responses it can elicit from a shifting landscape. Recognizing this adaptive prowess, this discourse seeks to elucidate instances where Agile's tenets can synergistically harmonize with the pre-existing paradigm. By astutely identifying the junctures where Agile's iterative spirit can infuse an enhanced agility, the paper inherently aspires to contribute to an enriched design and project management ecosystem. The coalescence of these methodologies serves as a testament to the amalgamation of tradition and innovation, channeling the potency of both to navigate the intricate labyrinth of architectural and project complexities.

5.1.2 Agile Project Methodology

The technological advances creating new manufacturing processes and the need for new types of projects such as software development, created the need of a new project management system. This was initiated in Japan, where quality assurance methodologies failed to keep up with fast pace product improvements throughout the development process that were needed in the auto industry. There was a requirement to create a methodology that would align with nonlinear dynamic processes. These processes relied

on several variables creating a need for multiple development cycles in parallel to reach certain a target, through uncertainty, and fast paced scheduling as Cobb (2015) explains.

Figure 8- Agile management approach

The conventional approach introduced a challenge wherein errors within the process remained concealed until subsequent phases were finalized. This led to the propagation of issues and complexities across the entire project development lifecycle, exerting an adverse influence on workflow efficiency and the project's overarching advancement. Recognizing the imperatives of this context, the impetus for adopting iterative methodologies emerged, marked by the delineation of project tasks into succinct intervals. This iterative modality, founded upon the principles of trial and error, systematically ensured the expeditious resolution of emerging challenges. This iterative approach synergistically harnessed team feedback and intensified collaborative endeavors, fostering enriched participation and seamless coordination. In consequence, a more effective and proactive culture of problem-solving was nurtured.

Many techniques were developed to create fast paced development cycles but in 2001 the Agile Manifesto was created attempting to consolidate all techniques invented during these years, into a single project methodology: Agile. The importance of its content focused on several elements which impacted how projects were executed in industries that adopted such system. To allow for a flexible project management environment, this manifesto allows a project team to embrace its content as guidelines and not written rules enforcing a strict project layout structure, as can be found in the traditional method. The guidelines left room for interpretation, and allowed to adapt to a particular business condition and environment. The manifesto addressed several items that are relevant to

this paper. As an example, there was an emphasis on valuing "individuals and interactions over process and tools" as written by Highsmith, J. and Fowler, M. (2001). Meaning, this section meant to address the need to discontinue the hierarchy created by the traditional method, by changing team structure which will be elaborated in the next section. It also addressed the need to embrace adaptability and flexibility, allowing team members to fully participate in the project processes, enhancing decision making through a collaborative effort.

Another pivotal facet addressed by the manifesto pertained to the principle of "responding to change over following a plan." This perspective transformation, as elucidated by Cobb (2015), fundamentally involves a paradigm shift from the convention of rigidly controlling project parameters—such as schedules and costs, as conventionally prescribed by traditional project planning. This conventional trajectory often engendered hurdles in accommodating and integrating alterations and evolving client requirements, leading to constraints in adapting to dynamic shifts during the project's course.

In stark contrast, the Agile manifesto advocates for an environment predicated on agility and adaptability—where uncertainties and modifications are embraced as integral components of the process, rather than being perceived as impediments. This paradigm shift redefines the contours of project management, fostering an atmosphere conducive to facilely assimilating and accommodating alterations as they emerge.

The bedrock of this ethos resides in the dexterity to navigate changes throughout the project's lifecycle. The crux of this transformation lies in the nuanced collaboration fostered among team members, underpinned by a heightened depth of knowledge regarding the project's multifarious elements. This immersive cognizance, dynamically co-created throughout the project's trajectory, serves as a bulwark against the emergence of change orders—an intrinsic aspect of traditional methodologies.

The contrast with conventional approaches is profound. Traditional paradigms typically channel project knowledge predominantly towards the end-product, with the overarching focus set from the project's inception. In contrast, the Agile perspective embraces the concept of a dynamic continuum, where the journey and the evolution thereof assume an elevated prominence. This recalibration in focus facilitates the assimilation of changes with far-reaching ramifications for adaptability, responsiveness, and ultimate project success.

In essence, the manifesto's emphasis on "responding to change over following a plan" underscores a seismic shift in the philosophical underpinnings of project management. This transformation embraces the ebb and flow of change, harnessing its potential as an impetus for continuous improvement and heightened client satisfaction.

The manifesto addressed other elements such as creating an acceptable project environment where change was welcomed. Also, all project stakeholders work together daily in order to push ahead the project, through face to face interactions. In addition, creating the need for self organizing teams which allowed for better production during the

project's process, with effective an work pace. Through this method, the team would require to re-evaluate its own performance and would become more effective through adjustments, and performance adaptations as illustrated by Highsmith, J. and Fowler, M. (2001). Other elements were elaborated as well, though appear to fit better with Information Technology mechanisms.

5.2 Scrum methodology

In his comprehensive work "Essential Scrum," Rubin (2013) expounds upon the genesis of the Scrum methodology. This transformative framework was conceived with the primary objective of augmenting process efficiency through the adroit orchestration of swift iteration cycles characterized by a deliberate process of trial and error. The crux of this concept stems from situations wherein the pace of stakeholder communications lags, engendering inefficiencies that potentially culminate in the wastage of project resources and dilution of deliverable outcomes.

This foundational premise resonates poignantly within the context of the building design and construction domain. Within these realms, projects are inherently delineated by compressed phases, necessitating streamlined processes and accelerated decision-making. The architectural landscape is replete with intricate phases that demand iterative refinement and proactive communication. It is within this milieu that Agile Scrum emerges as a tailored solution, seamlessly converging with the condensed timelines characteristic of the industry.

The linchpin of this synergy is the recalibration of communication efforts—an augmentation exemplified by the Scrum methodology framework. The paradigm pivots around the dissection of the project development structure into a sequence of orchestrated cycles, each punctuated by a defined timeframe. These cycles, often colloquially termed tasks in this discourse, encapsulate the project's progression, tangibly manifesting the iteration principle that Agile Scrum champions.

By permeating the construction and design process with this iterative spirit, Agile Scrum not only harmonizes with the industry's condensed phases but also catalyzes an elevated level of communication. Stakeholders are immersed in a dynamic discourse, where rapid iterations and informed experimentation replace the conventional protracted deliberations. This recalibration expedites decision-making, truncates resource wastage, and accords paramount importance to delivering refined outcomes.

In summation, Rubin's insights underscore Agile Scrum's alignment with the exigencies of the building design and construction sector. Beyond a mere methodology, it manifests as a transformative ethos that reverberates across the industry's multifaceted landscape, harnessing iterative progression and proactive communication to amplify efficiency and engender optimal deliverable outcomes. There are several main type of elements composing the Scrum cycle:

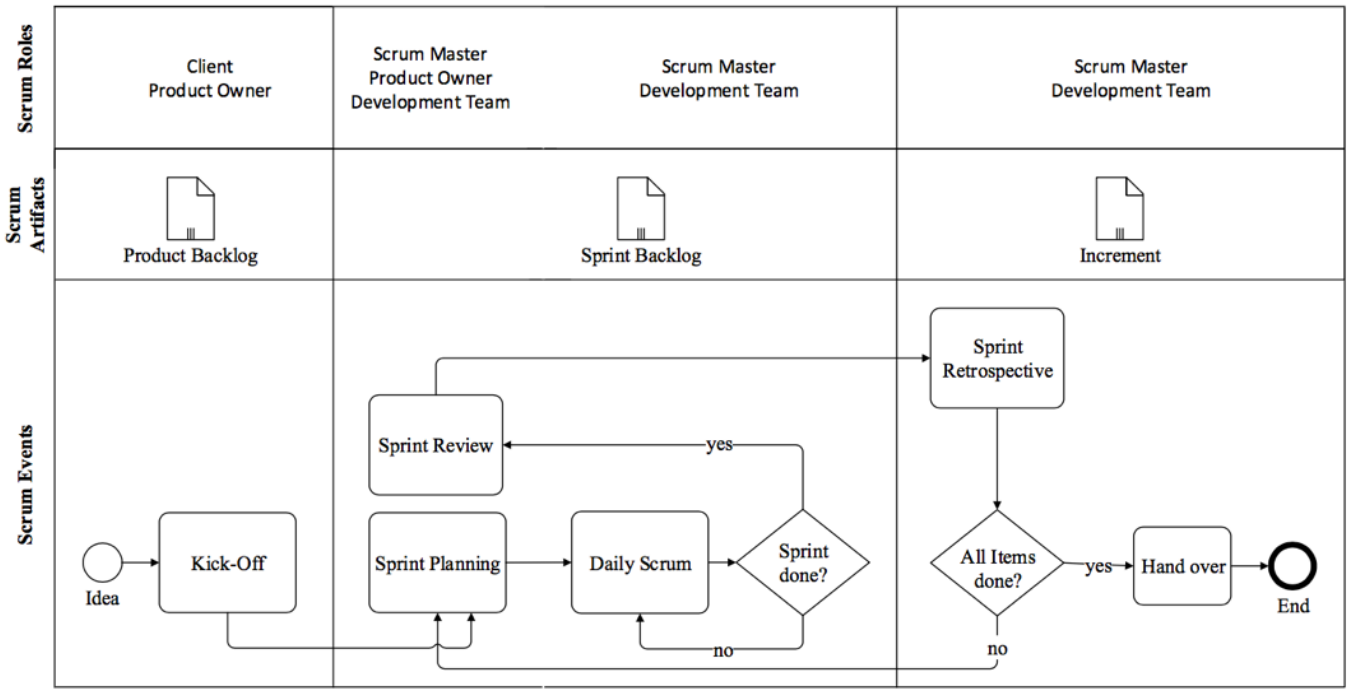

Figure 9 - Typical Scrum Framework

Product Backlog

The product backlog will consist of a list composed by the product owner, the team, and various related stakeholders in order to prioritize and formulate a prioritized list of desired features that the product should modify to, it's for repair, and other elements which could potentially enhance the product. The overall content decided in the sprint backlog will be decided based on the features set in the product backlog.

Sprint Planning

Antecedent to the commencement of each sprint, a comprehensive assembly will convene, encompassing the team, the product owner, and pertinent stakeholders. Within this pivotal discourse, the product owner undertakes the task of delineating critical imperatives that necessitate attention. This catalyzes a multifaceted conversation wherein the team actively engages in a deliberative dialogue, extrapolating the projected aspirations for the forthcoming sprint. The exchange probes the strategic nuances of the sprint, crystallizing the objectives that warrant realization within this iterative cycle.

One of the salient outcomes of this discussion lies in the contextual transformation of the product backlog into the sprint backlog. The items earmarked for inclusion within the sprint are systematically transposed from the overarching product backlog, marking their transition into the exclusive realm of the sprint's focus. This process not only orchestrates meticulous alignment between the goals of the sprint and the envisaged

deliverables but also serves as an emblematic representation of the dynamic adaptability inherent to Agile methodologies.

A noteworthy departure from traditional project management manifests in the collective agency employed in sprint planning. This is an engagement orchestrated not by a solitary project manager but by the entirety of the team, comprising diverse skill sets and perspectives. This egalitarian approach is underpinned by a pronounced ambition: to foster a comprehensive discussion, embrace multifaceted team involvement, and inculcate a shared responsibility for the sprint's realization.

In essence, this pre-sprint conclave engenders a palpable synergy. It harnesses the product owner's strategic insights and melds them with the team's technical prowess, crafting a synchronized tapestry that underpins the sprint's trajectory. Beyond its tactical implications, this approach embodies the philosophical core of Agile methodologies, nurturing a collaborative ecosystem where dialogues thrive, responsibilities are embraced collectively, and iterative progress becomes a shared pursuit.

Sprints

Series of events or tasks selected by the team to be executed in the next project cycle, are contained within Sprints. The Sprint's length is predetermined with no changes possible, and could take last for two weeks, a month, or a timeframe that would fit the project and its parameters (different industry will create different needs). The reason for short increments are to better adapt to changing dynamic environments, and would allow the team to adapt with the frequency required (unlike traditional phases which could last for months). Each Sprint will have a certain goal with several deliverables that would needed to be completed by the end of the current cycle.

The content of the Sprint (task list) will be also determined by the team as they see fit with guidance by the scrum master and product owner (see below for scrum team), and the cycles will begin. Tasks completed within the Sprints are marked as such, and others will be addressed until the iteration is complete. This will allow for up to date visible information that would help process clarity. During the Sprint, the team is assembled in a single space for better interaction and decision making, as during the task execution there are no exterior intervention (this element will require adaption in the building design and construction project). Creating a team in an isolated workspace will encourage open dialog, promote creativity, and will help with resolution of issues in a quicker collaborative manner. This structure breaks a traditional team where a single source project manager assigns individuals within the team tasks. In Scrum there is a product owner who will assist and determine the overall task content of what needs to be completed, but the team self manages these assignments until they are done.

The idea is to promote communication and self governing, ultimately creating a more efficient quicker development process. In Scrum, versus a traditional team structure, when executed properly all team members will be aware what others are doing at all times, enhancing knowledge about the project, and will promote resolutions by all team members

which are considered a single unit to attempt to complete tasks faster. As the communication effort will improve dramatically, so will the communal effort, as every person more involved will tend to carry more responsibility as he or she will feel more involved personally towards reaching the final goal in a successful manner.

Daily Scrum

To maintain a synchronized and informed team dynamic, a daily morning meeting will be instituted, serving as a pivotal forum for addressing challenges, issues, and pertinent concerns. This platform is dedicated to engendering constructive dialogues aimed at devising assured resolutions for pending matters. Furthermore, the meeting will serve as a conduit for team members to furnish updates regarding their respective progress statuses. This real-time sharing of developments not only cultivates transparency but also instills a tangible sense of progression.

This daily rendezvous yields multifaceted benefits. Firstly, it serves as an adept mechanism to promptly surface and address roadblocks or discrepancies that might impede progress. By promptly elevating such issues, the team can collectively mobilize resources and intellect to navigate obstacles, expediting the trajectory toward the intended objectives.

Secondly, the meeting nurtures a participatory environment where each team member's input is instrumental. This inclusive ethos ignites a communal spirit of ownership, rallying the collective prowess toward shared goals. The update-sharing component is not merely a status report; rather, it serves as a compass guiding the subsequent course of actions. It is an opportunity to synergize efforts, redirect resources if needed, and calibrate strategies to ensure alignment with the overarching Sprint's objectives.

In sum, this daily gathering manifests as a linchpin in the Agile framework. It embodies the ethos of adaptability, responsiveness, and collective accountability that underpins Agile methodologies. Beyond the tactical discussions, this meeting nurtures a cultural undercurrent—a shared commitment to surmounting challenges, harnessing opportunities, and steering the team toward a unified vision of success.

Sprint Review Meeting

During this meeting the team will summarize what has been completed, and will elaborate on the new features that were developed during the Sprint. This task should be quick and should not burden the schedule.

Sprint retrospective

In addition to the review meeting there will be a quality assurance process that includes examination of the Sprint performance, and examining certain items that were worked on during the Sprint. The team will provide feedback necessary, aiming to improve the process during the following Sprint. The main idea is to improve performance from Sprint to Sprint, creating an adaptive environment, which allows the team to cope with uncertainties in a better way.

The Scrum Stakeholders

In addition to the Scrum process, another condition is crucial to secure the success of adopting this Agile methodology. The Scrum team helps creating a highly efficient process by minimizing the number of stakeholder roles within a project. The Scrum team as elaborated by Rubin. M. (2013) consists of three main stakeholders:

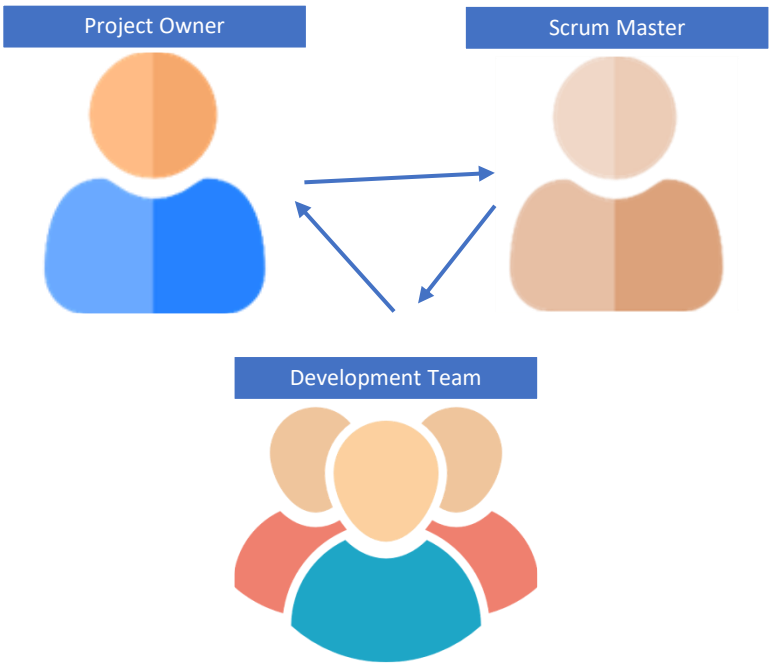

Figure 10- Scrum Team

The product owner, have certain responsibilities of a project manager found in the traditional method such as responsibility to coordinate with the client, and assure that the goals and aspirations of the project will become indoctrinated within the project team. Also, the product owner along with the scrum master (elaborated next section), will be in charge of assigning tasks on the sprint backlog, and prioritizing what tasks should be of a priority. The product owner this way can assure the tasks meet the business requirements and the project schedule assigned in a traditional method of the building design and construction project. He or she though, will not interfere with how these tasks are being

completed and by whom in the team, but they can assist with coaching and advising to improve efficiency and performance, and assure these tasks will be completed successfully by the end of the Sprint. Tasks that are completed, the product owner will announces their release, and will assign new tasks to the Sprint backlog.

The role of the Scum Master is to assure that the Scrum process is being executed properly with maximum efficiency, with the highest standards and quality to assure the project will be successful. He or she should also provide a quality assurance verification to assure that services or products provided meet the company's standards. The capability of the team executing the tasks will be enhanced by the scrum master which is often present to assist the team. Meaning, the Scrum master acts as a coach, not as a manager and does not have the authority to order the team to do things. In the case of a case-company, the Operations Director acted as a Scrum Master, supporting the team as a coach, giving them the opportunity to perform tasks on their own, which ultimately led to positive results and growth of the team as professionals.

The scrum master will facilitate and help resolve issues which can impact the team's effort, and will assure the sprints will be as efficient as possible, but will not have authority over them as explained by Rubin. M. (2013). The Scrum master can guide the product owner also through complex technical Sprint tasks located in a current backlog, and will help prioritize what needs to be assigned to a certain Sprint. He or she will also help to assure a good collaboration between the Scrum team and a product owner. In fact, the Scrum master's main duty is to assure high performance and quality assurance in all Sprint (or iteration) cycles to assure project's success.

The Scrum Team which is usually comprising with nine people which fit the number of an architectural team of a large project, will be self organizing, and they will conduct the tasks marked in the Sprint backlog as they see fit according to their priorities. The team characteristics as elaborated in the chapter of the analysis of the literature review, will include motivated individuals with capabilities to adapt quickly, and improvise as needed in order to fit the quick iterative dynamic pace found in Scrum.

5.3 Hybrid prototype of construction management

Enabling the assimilation of Agile Scrum methodology within the intricate stages of architectural endeavors in building design and construction necessitates a process of adaptation. Evidently demonstrated and encapsulated by Moriel (as depicted in Figure Two on page 29), a notable deficiency exists in the cohesiveness of communication channels between architects, engineers, and consultants. This fragmentation manifests in unwieldy communication cycles, precipitating the demand for numerous interactions to accomplish

a singular task. This convolution inevitably extends the temporal horizon required for task completion.

Consequently, an imperative need arises for a recalibration of the project's organizational structure, particularly within the project team. This impending modification becomes imperative as it seeks to reconfigure the existing framework, aligning it more congruently with the tenets of Agile Scrum. By redefining roles, optimizing collaboration, and streamlining communication pathways, the anticipated transformation strives to counteract the prevailing inefficiencies and protracting timeframes that currently mar the architectural process during the dense phases of building design and construction.

The differences between the Agile Scrum teams found in the IT industry which includes people from the same discipline such as a software development team, in the Scrum of the building design and construction project a multi discipline team would require to gather, and work together much more often than common in the building design and construction projects found today. Having at least representatives of each of the main engineering trades: structural, mechanical, electrical, and plumbing engineers within the Scrum team can have a substantial impact on the efficiency of the project's progression. These main stakeholders coordinate with architects much more often than just on a daily basis.

The whole progression of the work relies on working alongside with these engineers. Therefore, the Scrum team will consist of the architecture team, the main engineers of the project (possible 1 representative for each trade). As consultants may be relevant on occasion and are not needed on daily basis but on specific tasks, they can be added temporarily to the team structure as determined by the Scrum team. Having these disciplines together as a single unit, has the capability of pushing projects ahead in much more efficient quicker manner, unlike the traditional team structure today found on large complex projects. True that there are coordination meetings taking place usually once a week in building design projects found in the traditional setting, but instead of waiting for critical issues to be solved after a week, issues rising up during the sprint will be dealt with possibly on the spot. This will allow project progress in a faster pace than perceived prior to this new team structure suggestion. In terms of client interaction, the product owner will still steer the client coordination in order to promote crucial coherent client communication and effectiveness. In terms of contractor interaction, this will be more efficient but still flexible. The contractor will have the ability to speak to the project team with maximum efficiency as they are all assembled together as a single unit, or have the choice to discuss only with the product owner, allowing him or her to facilitate the information to the Scrum team. This minimizes the communication routes and will allow to adapt the Sprint backlog according to urgency in a quicker adaptable manner.

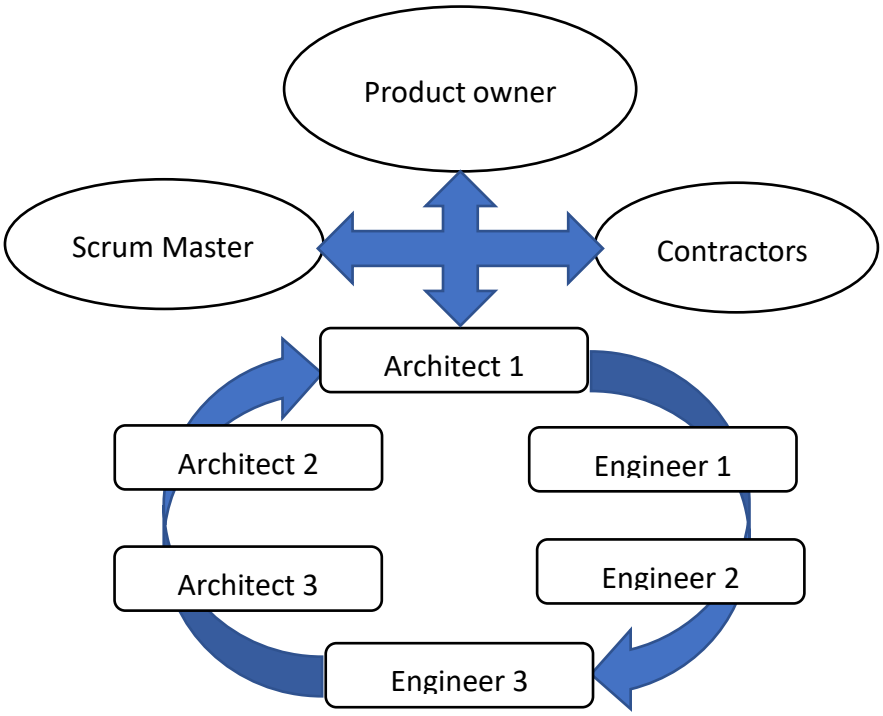

Figure 11 - Scrum Team Structure for the Building Design and Construction Industry

The Scrum master's role as a guide and advisor will be highly efficient because of direct contact with the core team that are in charge of producing the contract documents. As consultants are not needed on any given time of the project, the Scrum team will adapt to incorporate them when needed in peak coordination efforts.

Scrum and the Architectural Design Process - Hybrid Scrum for Architects + Engineering Team (A+E)

Scrum Framework Ceremony	**Traditional Scrum**	**Hybrid Scrum For Architects + Engineering Teams**
Product Backlog	Features or Requirements list desired for product	determining overall goals for quality, deliverables definition of A+E work performance , Projected obstacles, Redefining Programming phase type feedback.
Sprint Planning Meeting	Meeting to prioritize features list & changes for upcoming sprint.	Discussing overall objectives in hierarchy and prioritizing tasks required for spring backlog.

Sprint Backlog	List of tasks to be completed in the sprint.	List of tasks to be completed in the sprint.
Sprints	Fixed duration cycles Usually 1-2 weeks.	Fixed duration cycles Recommended 2-4 weeks.
Daily Stand-up	Daily meeting to follow up on status, and adapt as necessary.	Daily meeting to follow up on status, and adaptas necessary.
Sprint Review	Accomplishment review, demonstration of new features (briefly).	Quality control of production of sprint content (of added documents and design development).
Sprint Retrospective	Feedback on sprint performance, evaluation and lessons learned for improvement.	Feedback on sprint performance, evaluation and lessons learned for improvement.

Figure 12- Moriel, R. (2017) Scrum Process Comparison Chart

The overall layout of the Scrum framework is suitable for the building design and construction projects, however, some modifications are required (see figure six above for comparison). As the architectural team will now work alongside with at least one engineering representative from each trade within the Scrum team, these new team dynamics will need to undergo constant questioning, and discussion regarding how to improve this close collaboration.

In the product backlog stage, if in the traditional Scrum team developing an IT software or other tech product, the features will be determined and goals related will be decided, the Hybrid Scrum for A+E (architects + engineers) will be to determine the overall quality of the work that needs to be performed. This will help the team understand the overall effort and time that is required to be made for each task. To decide product features is not as focused and relevant in the architectural process, but what can be done is a programming phase level discussion, to see how the current building design can be pushed ahead and improved. This discussion will involve how to remove elements that are wasteful to project resources, and raise questions regarding project resources efficiency. In fact, the product backlog phase is a means to re-question the holistic elements of the projects, something that usually does not occur after the programming phase in the traditional

setting. After understanding better the overall approach and goals of the project, the Sprint should be outlined with more efficiency.

The standards and overall deliverables discussion made in the product backlog phase should help the team to decide during the Spring planning meeting on current burning tasks that are a priority. This will be done by identifying overall issues that currently requires attention and to be resolved to allow for the project's progression. Essentially the team will decide together on the hierarchy and priorities of current project's issues and understand its status. This informative meeting will help understand how these tasks should be executed and the different parameters involved.

After the team's understanding regarding the current situation of the project, the extents of steps ahead in terms of quality, time per task, and other useful information that will shed light on the operation required to execute the next Sprint effectively, the team will create a list of tasks in the Sprint backlog. During the Sprints, although there will be a better project development pace with the Scrum Hybrid comparing the traditional method, some tasks are complex in large building projects, and would still require time to execute. Therefore, the Sprints should be longer than of the traditional Scrum such as for IT software projects, where a specific feature will be tested and developed.

In the building design project, several tasks will be executed in parallel, and therefore it would be better to allot the Sprint time from 2-4 weeks instead of half the time typically used in the traditional Scrum. The Daily Stand-up stage will be similar to the traditional Scrum where the team will assess and assure it is updated with project's status. It is important that this information will be discussed by the whole Hybrid Scrum team. In the traditional Scrum, the Sprint review is meant to discuss and understand new software or product features. In the Hybrid Scrum, there should be a quick assessment of what was produced, and assess the quality of the new work. This will help to question current production and issues related, and will allow the team to resolve these problems on the spot instead of waiting for the Sprint to complete before these are noticed and addressed.

This stage will provide for a crucial quality control that lack in the traditional project execution at many times. The Sprint Retrospective in the Hybrid Scrum should match the characteristics of the traditional Scrum as it is a viable stage to assure improvement on future Sprint performance. It will help the team adapt to new conditions and will assist with Sprint completion successfully.

Kanban Addition to the Scrum Hybrid

Within the context of enhancing team workflow efficiency in the realm of Scrum Hybrid, an augmentation will be introduced in the form of Kanban, a supplementary facet of Agile methodology. Kanban functions as a project execution instrument that conveys project information management within the team framework. By leveraging Kanban boards, this tool elucidates the present project processes, enabling a visual representation of the workflow.

By integrating a straightforward board adorned with adhesive notes, the team convenes to deliberate over distinct tasks, delving into their respective statuses and circumstances. This practice empowers the team to swiftly reference the ongoing project status. Notably expounded by Carmichael and Anderson (2016), this unpretentious yet pivotal mechanism fosters heightened communication among team members and facilitates an enhanced grasp of the project's current standing. In terms of adapting it to the Scrum Hybrid, it would be efficient to add columns of the different Scrum Stages: Product Backlog, Sprint planning meeting main points, Sprint backlog content, daily stand-up summary, Sprint review summary, and sprint retrospective conclusions. Having this viable information will assure the team is fully aware of project status, and will maintain high participation levels.

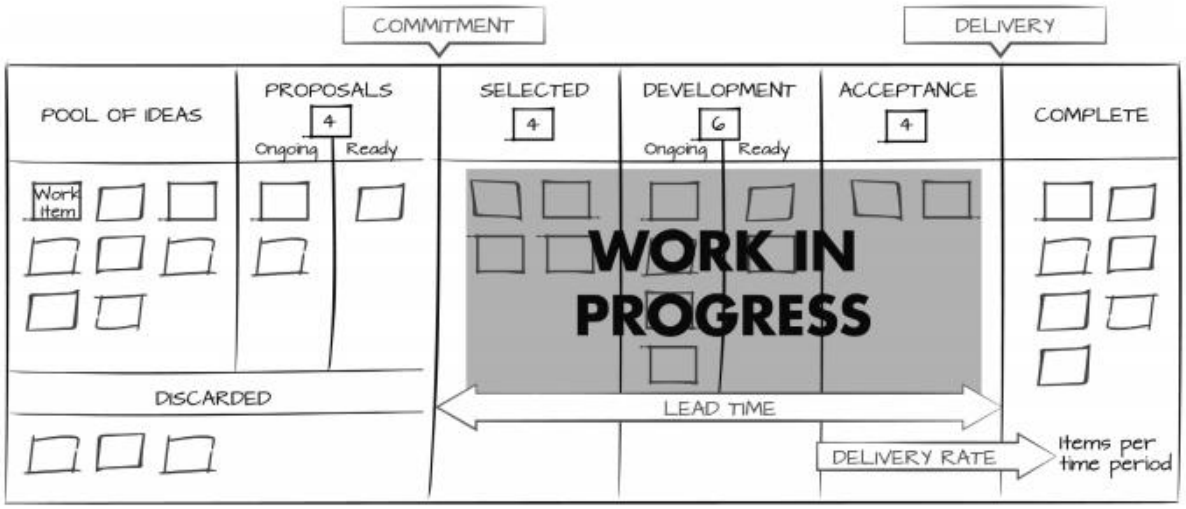

Figure 13 - Carmichael, A. Anderson, D. (2016). Kanban Board Example - Visualizing the Workflow

5.4 Conditions for implementation

5.4.1 The Nature of the Construction Industry

One of the Agile management features requires the team to be collocated to increase the early involvement for all parties. The Agile method requires lots of interdisciplinary office coordination and communication, therefore it needs a higher level of clarification in terms of work flow and responsibility assignment. Since construction is a complicated process, it needs the engagement from a number of disciplines, and the whole industry will need time to adopt this model. However, the nature of the design process requires different parties' involvement at different level during the same phase. Multi-disciplinary makes it extremely difficult to align from the very beginning of a project. At the same time, numbers of companies involved all with different cultures, working habits & competing objectives, this causes more difficulties for applying the Agile methodologies into the industry. In addition, the design industry typically involves more creativity and innovation. The "uniqueness" of every building design makes construction projects fraught with potential unforeseen changes; it is difficult to just copy and paste precedent projects management structure into new projects. This feature makes the kind of new Agile methodologies hard to be adopted into the traditional construction industry.

5.4.2 The Culture of Construction Industry

The culture of the industry is another key point that limits the application of the new methodologies. Since construction has been an industry for such a long time it is even harder to change processes and practices, while IT has existed for mere decades. Knowledge of how Agile project management works is lacking and insufficient across for the whole industry. Building Information Management and Modeling (BIM) as a new technique has been a slow change to the industry from decades ago. Agile project management methodology is too new of an approach, which will be a slow change as well for the industry to catch up.

There are also some difficulties with organizations (government, government sponsored, etc.) and their abilities to use new and different contracts which affects the industry. Overall lack of tech savvy personnel at the field/execution level and the resistance to change delay the development of Agile in construction. The same problem exists in technology such as public transportation having abysmal technology and something that would have been fixed easily in the private sector.

In addition, clients in real estate tend to keep traditional ways of doing business, and they prefer to conduct the project conservatively to avoid risks. Clients are either not familiar/comfortable with these 'new' methodologies or feel that their projects may not be

large enough to derive benefits from Agile. By using Agile methodologies, more power is given to the contractor to influence the early design phase. Therefore, architect need to add a lot of value in coordination and design models are going to be a part of actual construction digital information. It takes more time and energy for architects under Agile management environment, but typically architects are not being compensated more.

5.4.3 The Cost of Industry Change

Other than above mentioned two major reasons, the financial problem plays an important role in slowing the application of Agile in construction as well. Since project in construction industry vary in type, size and scale, the upfront cost can be prohibitive to smaller projects. Assessments have to be made if a project is big enough to offset the upfront investment.

Compared with the traditional construction project management methods, Agile needs a lot of preliminary input. It needs more researches to set the standard and template, and it requires continuous financial support. Owners and clients not only have to be fully invested in Agile technique but they must also champion the processes. Since the standard for Agile application in the construction industry still need further development, it takes a lot of buy-in on the owner's part to agree to this delivery method.

In sum, the data from this question finds the major causes that trigger the slow development of Agile application in construction industry. It helps the construction field identify the correct and applicable route for the further development of Agile project management.

However, the potential problems that might be occurred by adopting Agile into the construction industry, for example, quick turnaround times sometimes reduce the thought put into the work on a project, and it causes redo of work. In addition, Agile helps tracking and quick turnaround, but also adds lots of meeting and management effort that traditional design process does not typically have. Therefore, instead of directly copying and pasting frameworks from the IT field to the construction industry, it is more significant to wisely adopt and modify the existing framework in order to make it fit the particular requirements of the construction industry.

Conclusion

IT and software development fields gained significant benefits from applying the Agile approach. The objective of this thesis is to deeply explore and analyze the advantages of implementing Agile in construction projects in the design phase. It is important to drive project management in the construction industry forward. Potentially, the study and research of this new framework could create a revolution in terms of project management throughout the entire construction industry. Agile project management methodologies effectively increase the involvement of the clients. Through the way designing and processing the Agile approach, the participation of the client will be improved to create more custom satisfaction. And the early engagement of the client makes the design phase smoother.

The traditional waterfall method that is used in the building design and construction projects fails to adapt to communication and coordination intensities found in contemporary large and complex projects. As many industries today have adapted their project management methodologies to fit dynamic, quick paced conditions with adopting Agile, the building design and construction industry should do the same, as current processes used tend to lack effective performance. This thesis paper illustrated how Agile Scrum could be a good fit in some aspects of the building design and construction projects, and help enhance the progression efforts by changing current team structures, and adopting new processes that help improve communication routes that are necessary in order to accomplish the completion of tasks and deliverables in a more efficient manner. By creating a Hybrid Scrum process, using a Kanban visualization technique, the team's processes will become quicker and more effective in order to carry out the various tasks that are required in the building design and construction projects. This paper does suggest to replace the overall structure of the building design and construction projects, but merely suggests to adapt it and enhance some of its processes, specifically in the intense phases where it is needed.

Within the realm of Agile methodologies, Scrum emerges as a formidable framework imbued with a collaborative and dynamic project management ethos. When transposed onto the construction domain, particularly during the design phase, the application of Agile heralds substantial advantages. Foremost among these is the enhancement of team efficiency. By endowing project team members with appropriate levels of authority, Agile engenders a palpable sense of empowerment. This empowerment cascades into heightened motivation among personnel—a critical catalyst that invariably propels project performance to greater heights.

The mechanics of Agile, especially within the Scrum framework, are intrinsically conducive to fostering a holistic engagement. Team members not only hold a stake in the project but are actively invested in its successful execution. This intrinsic engagement culminates in a pronounced willingness to contribute one's best—a phenomenon that is not merely driven by external directives but is woven into the fabric of the Agile philosophy.

This heightened motivation generates a positive feedback loop: the team's enthusiasm begets improved performance, which in turn fuels further motivation. This virtuous cycle precipitates a tangible elevation in overall project outcomes.

In essence, Agile's adept integration within the construction project's design phase engenders a paradigm wherein team efficiency is not just a result of streamlined processes but an organic consequence of individual empowerment. The orchestration of Agile's collaborative essence and its capacity to imbue teams with a proactive drive, thereby transcending traditional boundaries, indeed serves as a potent catalyst for the overall enhancement of project performance.

In addition, Agile provides the bottom-to-top process which creates a work environment with transparency and increases the share of the real-time information and feedbacks. Since the people become more aware of their responsibilities, tasks and goals, the project deliverables are better produced.

However, Scrum as an advanced tool still need further adjustments, modifications and development in order to be applied better to the construction industry. Although the Agile Scrum as an iterative system is easy to be implemented, the particular features of the construction projects still require new Agile approach to make changes accordingly. In sum, the application of Agile Scrum framework in construction projects during the design phase can improve the project performance in many ways. Case-company is an example of the effective implementation of the principles of Agile methodology in team management. In-depth analysis and skillful drafting of a combined management system can help a company grow in the long run.

Upon synthesis of the undertaken efforts, it is discernible that the adoption of contemporary Agile management methodologies is not only plausible but also yields a plethora of favorable outcomes. This efficacy is corroborated through an empirical examination of a project-oriented company, substantiating the proficient accomplishment of projects and the current state of the project team. In the course of the transformative journey, personnel highlight an upswing in professionalism and lucidity across the entire spectrum of project stakeholders.

Comparatively benchmarked against the IT sector, a hybrid management approach surfaced as the optimal choice, amalgamating fundamental Agile tools such as Scrum and Kanban. This configuration embodies a pragmatic and versatile framework, particularly tailored for nascent transitional project teams. It emerges as a foundational bedrock, upon which bespoke variations can be superimposed in consonance with the company's distinctive contours and ongoing projects.

Moreover, the study delineates three pivotal prerequisites underpinning the successful deployment of this methodology. A comprehensive scrutiny of these requisites culminates in the crystallization of a granular corporate profile, enabling the blueprinting of a bespoke transformational trajectory. Through the lens of meticulous analysis, a tailored transformation map comes into focus, thereby engendering a systematic and informed evolution towards Agile methodologies within the organizational structure.

Recommendations of Future Work

As very little literature currently exists regarding the implementation of Agile in the building design and construction industry, more theoretical research is required in addition to conducting experiments in practice in order to develop a highly efficient interaction processes required between the new proposed design team (architects, engineers, consultants) in the Scrum Hybrid. Also, further studies are required to elaborate on specific roles and responsibilities to assure that the scrum master and product owner do help implement the Scrum Hybrid with success. More research and analysis of this could help understand how Scrum should be better be adapted to serve this new project structure and perhaps more guidelines can be developed and written in order to help architects with the adoption process which is completely alien to the industry. Another important area that should be explored, and was not covered by this paper is the adoption of Agile on the contractor's side. The construction team has a large portion of work involved in the building design and construction industry and not much is known regarding Agile's influence on the contractor and their work.

In the contemporary landscape, the realm of building design is augmented by an array of software tools and innovative technologies, with Building Information Modeling (BIM) technology emerging as a pivotal force. These advancements afford designers the ability to meticulously craft project sections within a three-dimensional realm, subsequently amalgamating them into a singular file, thus seamlessly encapsulating the entirety of the project in a 3D rendition. This confluence of technology expedites the identification of incongruities at an incipient stage, facilitating prompt rectification.

This paradigm shift within the construction sphere is underpinned by an unprecedented opportunity to cultivate flexibility, initiate early-stage product testing, and iteratively refine designs. The virtual landscape enabled by these tools becomes an arena for rigorous validation, where discrepancies are unearthed and mitigated before the physical manifestation ensues. This inherently proactive approach eliminates pitfalls that could have otherwise been overlooked until a later phase, effectuating resource savings and infusing precision into the design process.

By catalyzing the integration of novel software programs and innovative management methodologies, the construction industry stands poised at the precipice of transformative growth. The potentialities within this transformation traverse multiple dimensions—ranging from enhanced flexibility in responding to dynamic changes, to the ability to refine and optimize designs iteratively, thereby cultivating a milieu conducive to resource maximization and project efficacy. This marriage of technological prowess and strategic innovation undoubtedly promises to propel the construction industry into a newfound echelon, characterizing its trajectory with heightened efficiency and enriched outcomes.

Literature resources

Carmichael, A. Anderson, D. (2016). Visualizing the Workflow. Essential Kanban Condensed. LeanKanban University Press. Retrieve from: http://leankanban.com/wpcontent/uploads/2016/06/Essential-Kanban-Condensed.pdf

Cobb, M. (2015) The Project Manager's Guide to Mastering Agile. John Wiley and Sons Inc, Hoboken, NJ. ISBN 978-1-118-99104-6

Highsmith, J. and Fowler, M. (2001). The Agile Manifesto. Retrieved from http://andrey.hristov.com/fht-stuttgart/The_Agile_Manifesto_SDMagazine.pdf

Hussain Emam; Muhammad Ali Babar; Paik Hye-young; Using Scrum in Global Software Development: A Systematic Literature Review; 4th IEEE International Conference on Global Software Engineering;2009.

Hussain, M. Nouri, Sabah. (2012). A Literature Review Exploring Challenges and Solutions When Implementing Agile. Department of Computer Science and Engineering, University of Gothenburg. URO: http://hdl.handle.net/2077/30050. Retrieved from: https://gupea.ub.gu.se/bitstream/2077/30050/1/gupea_2077_30050_1.pdf

Rubin. M. (2013) Essential Scrum. A Practical Guide to the Most Popular Agile Process. Pearson Education Inc. Amm Arbor, Michigan. ISBN-13:978-0-13-704329-3

Chan, F. Thong, J. (2011). Acceptance of agile methodologies: A critical review and conceptual framework. Department of information systems. Hong Kong University of Science and Technology. SSRN: http://ssrn.com/abstract=1976955
Retrieved from:http://papers.ssrn.com/sol3/papers.cfm=abstract_id=1976955

Sheuly, S. (2013). A Systematic Literature Review on Agile Project Management. Department of Software Engineering and Information Management, Lappeenranta University of Technology. Retrieved from:https://lutpub.lut.fi/handle/10024/90511

Demir, S., & Theis, P. (2016). Agile Design Management – The application of Scrum in the design phase of construction projects. 24th Annual Conference of the International Group for Lean Construction, (pp. 13-22). Boston.

Schwaber, K., & Sutherland, J. (2016). The definitive guide to scrum: the rules of the game. Retrieved from Scrum.org: http://www.scrumguides.org/docs/scrumguide/v2016/2016-Scrum-Guide-US.pdf

Streule, T., Miserini, N., Bartlomé, O., Klippel, M., & de Soto, B. (2016). Implementation of Scrum in the Construction Industry. Procedia Engineering(164), 269-276.

Koskela, L., Howell, G., Ballard, G., & Tommelein, I. (2002). The foundations of lean construction. In R. Best, & G. De Valenece, Design and construction: Building in value (pp. 211-226). Butterworth-Heinemann.

Moe, N., Dingsøyr, T., & Dybå, T. (2010). A teamwork model for understanding an agile. Information and Software Technology, 52(5), 480 - 491.

Memon, A. H., Roslan, N., & Zainun, N. Y. (2014). Improving Time Performance in Construction Projects: Perspective of Contractor. *Journal of American Science, 10*(8), 46-50.

Owen, R., & Koskela, L. (2006). Agile construction project management. *6th International Postgraduate Research Conference in the Built and Human Environment*, *6.*

Pitagorsky, G. (2013, Jan 30). *Measuring In-Progress Project Performance.* Retrieved from PMtimes - Resources for Project Managers: https://www.projecttimes.com/georgepitagorsky/measuring-in-progress-project-performance.html

Schwaber, K., & Sutherland, J. (2016). *The definitive guide to scrum: the rules of the game.* Retrieved from Scrum.org: http://www.scrumguides.org/docs/scrumguide/v2016/2016-Scrum-Guide-US.pdf

Scrum Alliance. (2016). *What is Scrum? An Agile Framework for Completing Complex Projects.* Retrieved from Scrum Alliance: https://www.scrumalliance.org/why-scrum

Streule, T., Miserini, N., Bartlomé, O., Klippel, M., & de Soto, B. (2016). Implementation of Scrum in the Construction Industry. *Procedia Engineering*(164), 269-276.

Abdelhamid, T., Salem, O., & El-Gafy, M. (2008). Lean construction: Fundamentals and principles. *American professional constructor journal, 4*, 8-19.

Beck, K., & Andres, C. (2004). *Extreme programming explained: embrace change.* Addison-Wesley Professional.

Burger, R. (2016, Feb 16). *The Ultimate Review of Construction Project Management Methodologies.* Retrieved from Capterra Construction Management Blog: https://blog.capterra.com/review-of-construction-project-management-methodologies/

Cho, K., Hong, T., & Hyun, C. (2009). Effect of project characteristics on project performance in construction projects based on structural equation model. (B. Lin, Ed.) *Expert Systems with Applications, 36*(7), 10461-10470.

Daneshgari, P., & Daneshgari, P. (2010). *Agile construction for the electrical contractor.* Jones & Bartlett Learning.

Daneshgari, P., & Wilson, M. T. (2006, January). The Profitability of Agile Construction . *CFMA BP*, pp. 9-16.

Demir, S., & Theis, P. (2016). Agile Design Management – The application of Scrum in the design phase of construction projects. *24th Annual Conference of the International Group for Lean Construction*, (pp. 13-22). Boston.

Li, J., Hou, L., Wang, J., Guo, J., Zhang, S., Jiao, Y. (2014). A Project-based Quantification of BIM Benefits. International Journal of Advanced Robotic Systems, 11(8). Retrieved from http://journals.sagepub.com/doi/abs/10.5772/58448

Kenley, R. Harfield, T. (2015). Construction project control methodologies and productivity improvement: EVM, BM, LBM. Proceedings of the 6th International Conference on Engineering, Project, and Production Management. 57-66. Retrieved from http://130.217.226.8/handle/10652/3400

List of used pictures

List of used tables

Record of the thesis loan

I declare:
I give my permission for lending this thesis. The user confirms with his/her signature, that she/he will duly cite this thesis in the list of used literature.

Name and Surname:
In Prague: Signature:

Name	Department/workplace	Date	Signature