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Overview of Project Management Methodologies: Traditional Versus Agile Approach

Wisal Morjane
Engineering Sciences Laboratory
National School of Applied Science
Kenitra- University Ibn Tofail, Morocco
Wisal.morjane@uit.ac.ma

Rachid Bannari
Professor
Engineering Sciences Laboratory
National School of Applied Science
Kenitra- University Ibn Tofail, Morocco
Rachid.bannari@uit.ac.ma

Jihane Gharib
Professor
Engineering Sciences Laboratory
National School of Applied Science
Kenitra- University Ibn Tofail, Morocco
Jihane.gharib@uit.ac.ma

Abstract

Project management has become a paramount tool in project development, regardless the sector or size of a project, Project Management Methodologies (PMM) is employed to enhance the probability of meeting the project targets. According to the recent trend of using the agile approach on different types of projects, it becomes obvious to say that there are two opposite flows - traditional and agile project management approach. The paper starts with a presentation of the traditional approach and the agile movement. It provides an overview of different methodologies of the two sides. The literature review shows a comparison between the two approaches and what the main characteristics of each methodology are. This study aims in the first instance to provide some criteria to choose the appropriate approach for a project. In the second instance, through a bibliometric analysis to show the synergy between the two movements.

Keywords
Project management, Traditional, Agile, Engineering, Scrum.

1.Introduction
Long before there was an institute for project management, or any guides on how to manage projects, or even before the existence of Gantt charts, history offers several examples of colossal projects successfully completed. The monuments of the ancient world, such as Egypt's pyramids, Rome's splendors, and the temple complexes of the Khmer empire, have the hallmarks of modern-day projects. Project Management, at its core, is concerned with creating an environment where people can work together to achieve a mutual objective, in order to deliver successful projects on time and on budget (Seymou et al. Hussein 2014).By the early twentieth century civil engineers were beginning to think more systematically, some of the techniques used by contemporary project managers came into practice. The Hoover Dam made extensive use of a graphic planning tool developed by Henry Laurence Gantt (1861–1919): the now familiar Gantt chart. It's not until the 1950s that organizations have started to apply systematic tools and techniques to complex projects. The U.S. Navy greatly contributed to the formulation and documentation of principles of modern project management methodologies and techniques.

In the late 1950s, Booz Allen Hamilton worked with the US Navy to create the project evaluation and review technique "PERT". During the 1960s ambitious projects such as landing a man in the moon further helped in the formation and utilization of tools to manage large scope projects. In the 1970s technological advancement made the creation of project management software possible, via software companies such as Oracle. A project-driven businesses emerged in the 1990s as the discipline of project management extended from the construction and defense industries into corporations, nonprofits, and government agencies; and many companies have adopted a management-by-projects approach. Some organizations have established project management offices (PMOs) to assist them in developing standards to manage projects. In the third millennium, academia started offering degrees for project management (Lester 2007). Moreover, project management theories, tools, and techniques are now mainstream in many organizations and industries.

This paper, is structured as follows: section1 presents the traditional project management methodology and the two widely used best practices: PMBOK and Prince2. Section 2 describes the Agile movement and provides a comparison between the two of the top Agile methodologies SCRUM and KANBAN, section 3 provides a comparison between the two approaches Traditional and Agile using some comparison criteria and section 4 gives a conclusion and a synergy between the two methodologies.

2. Literature Review

2.1 Traditional methodologies

2.1.1 Overview
Several methodologies had been developed to be employed when managing projects, the most popular and known are PMBOK- Project Management Body of Knowledge- approach, which is used in North America, and PRINCE2 -Projects IN Controlled Environments -, which is utilized in the United Kingdom. In this section, we begin by a short historical review of the two traditional methodologies then we define each one of them and we compare the principles of both of them.

The PMBOK was created by the PMI (Project Management Institute), to ensure a set of knowledge principles in project management. The purpose is to guide a project manager to fulfil successfully a project (PMI 2008). The PMBOK is a detailed framework of nine knowledge areas, broken down into activities across five stages or process groups of the project life cycle, that are claimed to encompass the sum of knowledge generally recognized as good practice in the project management profession. In addition to these detailed knowledge areas, tools and techniques, PMBOK also notes that effective project management requires an understanding of the application area, the project environment, general management knowledge and skills, and interpersonal skills. The main idea behind the PMBOK approach is to describe the sum of knowledge for the profession of project managers.

The PMI's creation was in 1969 with the objective of serving the interests of the industry of project management. The principle of PMI is based on the idea that the tools and techniques of project management are common even among the different area of the projects. In 1981 the direction of PMI authorized the development of what has come to become A Guide to the Project Management Body of Knowledge (PMBOK Guide), containing the standards and guidelines of practice management, which are widely used in this role (PMI 2008).

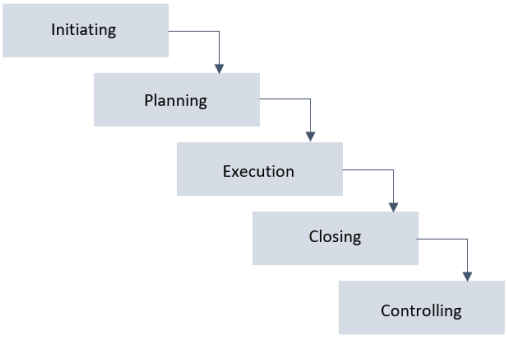

Figure 1. Traditional process

PRINCE2, Projects in Controlled Environments, was created in 1989 by CCTA -the Central Computer and Telecommunications Agency-. It is a method of project management structured based on experience gained in thousands of projects and contributions of numerous sponsors, managers, project teams, academics, trainers and consultants (APM 2003). PRINCE was originally based on PROMPT, this is also a project management method created by Simpact Systems Ltd in 1975 and adopted by CCTA in 1979.

The latest version of this methodology tries to approach a generic approach to become flexible to the point of shaping all types of design, i.e., it becomes a practical reference, possible to apply to any type of project, scale, organization, geography or culture. So it has become widely recognized as one of the methods of project management more accepted Luqman (2006). The main features of this methodology are based on the business case which is a component of all projects undertaken using Prince2 method.

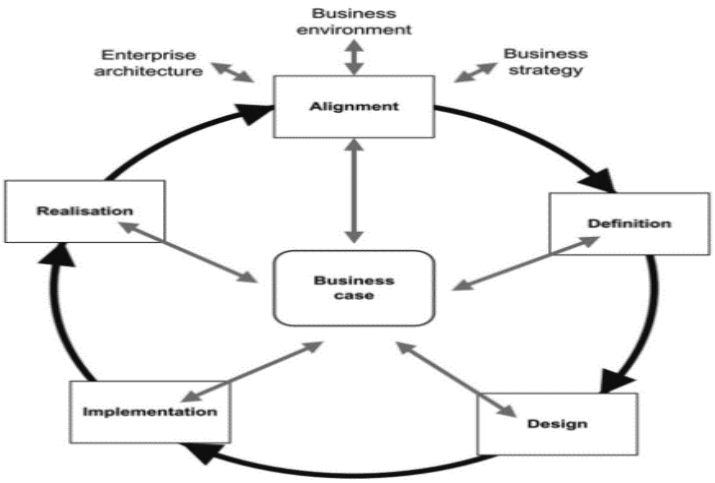

Figure 2. Business case change lifecycle (Martins, F. Ribeiro, P et al Duarte, F 2018)

As mentioned in the figure, the business case is regularly reviewed during the project to ensure the business objectives, which often change during the lifecycle of the project, are still being met; the planning is done with orientation toward the final product and its emphasis is on the division of the project into phases an organizational structure directed to the project management team. Prince2 is the standard used by the English government and widely recognized and used in the private sector, mainly in the UK. PRINCE 2 is designed to provide a common language across all the interested parties involved in a project. The method provides the necessary controls and breakpoints to work successfully within a contractual framework. (Martins et al. 2018)

After what is evoked before, we can now proceed to a comparison between the two methodologies; PMBOK and PRINCE2 were compared in several studies from different perspectives. Chin and Spowage (2012) compares various methodologies across different countries and different sectors according to defined features. Ghosh, Forrest, Dinetta, Wolfe and Lambert (2012) compares PMBOK with five different standards including PRINCE2; they identify high level differences and synergies between two methodologies, gaps in PRINCE2 covered by PMBOK and lastly how PRINCE2 can enhance PMBOK in terms of principles, themes, processes and activities. Singh and Lano (2014) compares methodologies at high level, as well as knowledge areas vs. themes and processes. Waheed (2014) compares PMBOK, PRINCE2 and CMMI at high level. In this study we begin with comparing methodologies at high level, by reviewing above studies and also PRINCE2 and PMBOK. Then, we continue comparison with themes vs. knowledge areas and processes from both perspectives, by reviewing PRINCE2 and PMBOK in detail. (Karaman et al. 2015)

2.1.2 PMBOK VS Prince2

Both methodologies set documentation which must be tailored to suit the occasion project, to understand better these methodologies is necessary to understand their commonalities and their differences; e.g. the project definition is distinct for both approaches. For the PMBOK project is a provisional attempt undertaken to create a product, service or result. To Prince2, the project is a management environment created for the purpose of delivering one or more business products according to a specified business case.

We can say that the PMBOK lays out the processes, how link together and the techniques that can be used. It is not meant to tell people how to do any of the tools describes. Likewise, the application of PRINCE2 must be scaled for the size and needs of the particular project. (Matos et al. 2013)

The PMBOK is recognized as an international standard IEEE Std 1490-2003, which is a descriptive methodology that provides the fundamentals of project management. The PRINCE2 is a structured method, considered a standard and recognized in both the public and private sectors. It bet in perspective, details how the techniques of project management should be structured and implemented. The American approach follows the orientation toward the processes used in developing the project, the British one has a guideline to the final product, focusing on the successful delivery and quality.

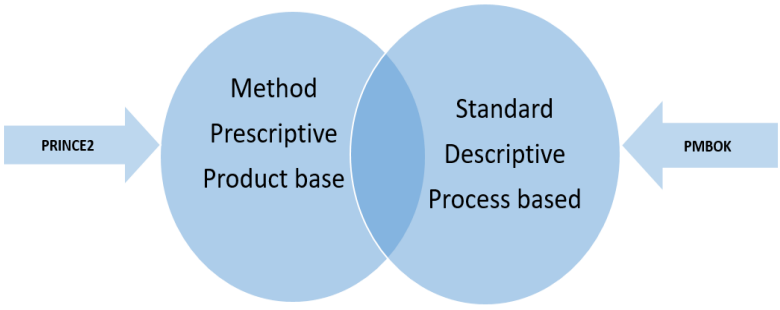

Figure 3. Characterization of both methodologies

The relevance between the approaches are not the same, for the Prince2 the authority to run the project manager always responding to the project board, while in the PMBOK project manager is the person responsible for meeting the goals. It is considered for the PMBOK 5 groups of processes, however the Prince2 8 are considered. It is possible to look for a correspondence between processes; the first two processes of Prince2 start and direction is equivalent to the process of home PMBOK. The Planning Process PMBOK embodies the same principles of processes and Home Planning Prince2. The processes Execution / control will be proportionate to three process

groups: the control phase, managing product delivery and direction. In the end, the locking process is common to both approaches. (Matos et al. 2013)

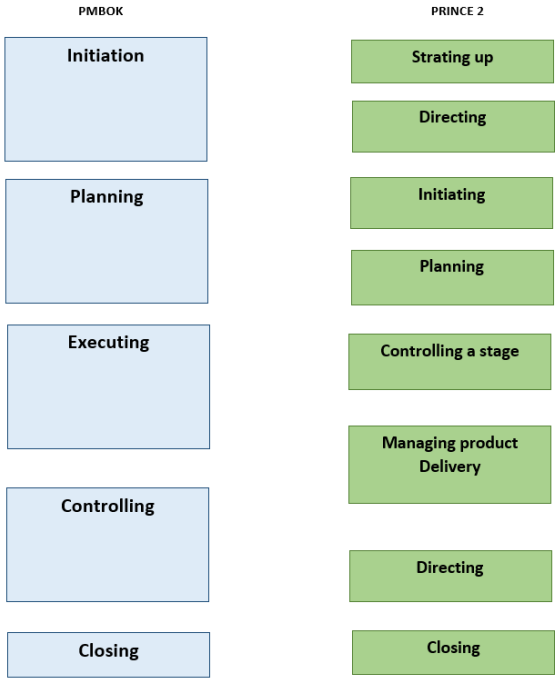

Figure 4. Processes in both methodologies

2.2 Agile methodology

2.2.1 Overview

All of the objections to traditional project management approach, together with the growing requests for continuous innovations that have impacted all industries and with the cost reduction trends, have resulted in advent of new project management approaches. These new approaches have appeared under several different names, all emphasizing difference to traditional approach even with the name. The most often used name is agile approach (Spundak M 2014).

Agile is described as iterative and incremental, seeking to avoid the standard approaches that emphasize early design and specification freeze, a fixed project scope, and low customer interaction, which means instead of in-depth planning at the beginning of the project, Agile methodologies are open to changing requirements over time and encourages constant feedback from the end users. The goal of each iteration is to produce a working product. Only in 2001 with the Agile Manifesto (Aguanno 2004) that these ideas have gained more significant visibility. Manifesto for Agile Software Development, written by the group of authors, set up four core values of the agile approach: "individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, responding to change over following a plan" (Manifesto 2001).

The word that was selected to differentiate new approach from the existing one was agility. James A. Highsmith in his book agile project management defines agility as ability to create and to respond to change in order to create value in turbulent business environment; Agility as almost every research endeavor, is based on several business principles like continuous innovation, product adaptation, shortening delivery times, adjustment of people and processes, and reliable results. Agility is also the ability to balance between flexibility and stability. We can emphasize that the adaptability is the key characteristics for the agile approach.
To be more comparable to traditional approach, researchers usually establish agile approach in several phases, similar to traditional project lifecycle phases.

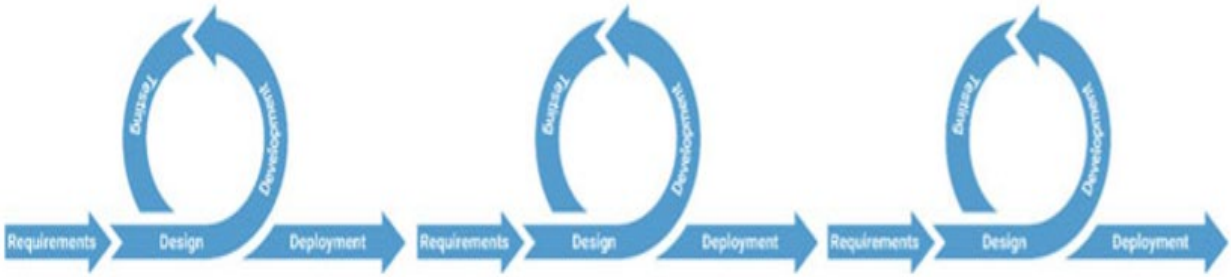

Figure 5. Agile approach life cycle

The phases of the agile are flexible and always evolving, and many of them can even happen in parallel:

1. **Requirements analysis:** Key stakeholders and users meet to identify business requirements that are quantifiable, relevant, and detailed, i.e., who will use the product, and how;
2. **Design:** it is prepared from the requirements identified and the team considers what the product or solution will look like, deciding on a test strategy or plan to proceed
3. **Development:** Coding or developing features to be implemented.
4. **Testing:** Test the code against the requirements to make sure the product is actually solving customer needs to make sure the software is solving the customer needs; This phase includes unit testing, integration testing, system testing, and acceptance testing.
5. **Deployment**: Deliver the product to customers. Once customers start using the product, they may run into new problems that the project team will need to address in future iterations (Salza, P. Musmarra, P et al Ferrucci F 2018).

Nowadays, the agility of the organization can be defined as the ability to react quickly to changes in the dynamic business environment. Although it emerged as a concept for software development and IT projects, agility today represents one of the basic competitive advantages of contemporary organizations (Ciric, D. Gracanina, D et al Tasica, N 2019). Thus, it is important to note that Agile does not abandon front-end planning as part of the project development methodology (M. Coram et al S. Bohner 2005); the iterative nature of Agile allows for frequent stakeholder interaction, adjustments made on the fly, and re-scoping project requirements in light of new information or customer requests. Therefore, volatility in the project scope is accepted (Rehman, I. U., S. Ullah, A. Rauf, et al A. A. Shahid 2010)

Agile evolved from different development approaches in the 1990s and is a response to some project managers' dislike of the rigid, linear Traditional methodology. It focuses on flexibility, continuous improvement, and speed. Furthermore, Agile is beneficial for projects where the end-goal is not clearly defined. As the project progresses, the goals will become evident and the team can adapt; breaking down the project into iterations allows the team to focus on high-quality development, testing, and collaboration so customers have many opportunities to see the work being delivered, share their input, and have an impact on the end product. (Bohdan, G. Janis, G et al Serhiy, P 2021)

While flexibility in Agile is usually a positive, it also comes with some trade-offs. It can be hard to establish a solid delivery date because project managers are often reprioritizing tasks it's possible some additional sprints may be added at any time in the project, adding to the overall timeline, documentation can be neglected, or the final product can be very different than originally intended.

Agile dislike working over comprehensive documentation, even that documentation does not lead to success but should not be neglected that's why teams should find the right balance between documentation and discussion.

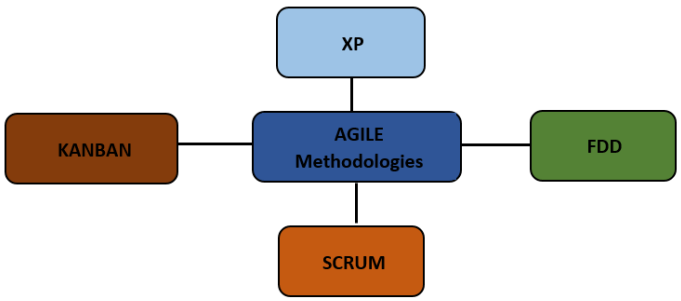

Figure 6. Different methods of the Agile movement

There are a number of specific methods within the Agile movement. We'll take an in-depth look at two of the top Agile Methodologies: **Scrum** and **Kanban**.

2.2.2 Scrum VS Kanban

Scrum is defined as a framework in which people can deal with complex problems, while maintaining high productivity in delivering high quality products (K. Schwaber et al J. Sutherland 2017). It is based on empirical process control theory, it is an iterative and incremental project management methodology to control risk and optimize the predictability of a project. Transparency, inspection, and adaptation, which are defined below, are three important factors in the Scrum process (K. Schwaber et al J. Sutherland 2017)

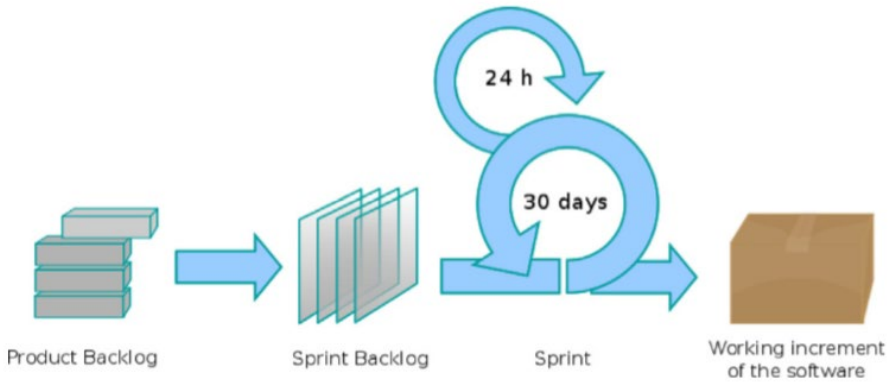

Figure 7. Scrum Process (Lein, H. Farnaz, G et al Ozcan, P 2017)

As mentioned in the figure below, the scrum approach has several stages, the first one start with product backlog creation. Then, the second one is processed through sprint -Fixed-length iterations - backlog creation and sprint planning and the definition of what a "Done" product is after each increment. Each sprint begins with a planning where the scrum team assemble in a long meeting to plan the details of the sprint. The third and the last stage based on meeting. Afterwards, the products will be developed as increments in the sprints.
The use of Scrum has already been attempted in projects with a higher dimension than the one which agile methods are usually applied to. (B. Boehm et al R. Turner 2003)
Scrum is a highly prescriptive framework with specific roles and rules. These rules have multiple advantages such as increased team responsibility because there is no project manager, a team is made to decide collectively and collaboratively work they can end in each sprint; also, there is more transparency and project visibility due to daily meeting each one knows the progress of the project it improves communication and to deal with issues right away. While Scrum provides physical benefits it has also some downsides because these approach requires experience and the team needs to be familiar with scrum principles and process. We can say that scrum was designed basically to support the management of the projects. (Mirosław et al. 2022)

Kanban, which means visual signal or card, was first used by workers in Toyota production system and lean manufacturing in the 1940 to track processes on their manufacturing system. Using Kanban, teams were able to communicate more effectively as this simple tool provided instance information on what needed to be worked on and when it is needed (Lein et al. 2015) it emphasizes just in time theory. The principal target of these approach is to show what to produce, when to produce it, and how much to produce. The basic principles of Kanban are: Limiting Work in Process, adding value through the development process, visibility of the development process, establishing quality, using a fixed backlog. (Lein et al. 2015). We can mention that Kanban encourages small changes in the current system it does not request set up or a specific procedure.

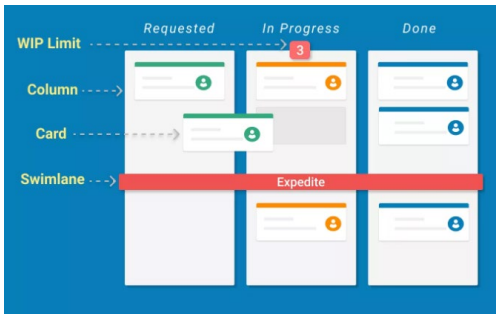

Figure 8. Kanban methodology process (Kanbanize 2018)

In order to start working with Kanban, a board is divided into three main columns to do, in progress, and done. The Kanban cards represent work and required tasks to be done it is used to visualize process and what is really happening in the actual system. When a task is completed in a given step, it goes downstream to the next step, and another task from the backlog is pulled from upstream notes and added to the Kanban. Kanban methodology allows for high project visibility by visually presenting the tasks that developers are working on. The methodology also shows the bottlenecks resulting from overloading, and the gaps between workflows (Lein 2017)]. Colorful cards can represent different details of work and a better visualization.

The Kanban board is easy to learn and understand, it increases flexibility and fluidity it helps to reduce waste because the team don't spend time on work that isn't needed or the wrong one. Furthermore, Kanban minimizes the amount of time it takes for work to achieve the whole team ensure that the work is going smoothly and on time. The main disadvantages of the Kanban are related to the misunderstanding of the Kanban board. The team is supposed to keep the board updated if not they will be working with the wrong information also it should remain clear and easy to read.

2.2.3 Traditional VS Agile

As mentioned before, the conceptual difference between the two ideologies is that the traditional approach is a sequential process of project development. Just like in a waterfall, the water progressively falls from one altitude to the lower, in a similar way, the production cycle progresses sequentially, from one stage to the other. Companies who are adopting this model, spend a considerable amount of time in each stage of development, till all doubts are cleared and all requirements are met. Now let's look at the agile method; the agile breed of models, focus on 'agility' and 'adaptability' in development. Each iteration of this methodology goes through all the steps of design, coding. Customers may be provided demonstrations at the end of each iteration, and their feedback may determine the next course of changes in the next iteration and testing. The team structure is cross functional, closely knit and self-organizing. Customers may be provided demonstrations at the end of each iteration, and their feedback may determine the next course of changes in the next iteration. (McCormick, M 2012) Agile and Traditional are completely different methodologies and their only common goal is to deliver a high-quality product. Agile methods are constant in time, cost, and quality – scope may not only change but also is expected to change. In the case of traditional methods, scope is the constant factor of the project with the variables being time, cost, and, partially, the quality of the delivered product. (Kisielnicki, J and Misiak 2017)

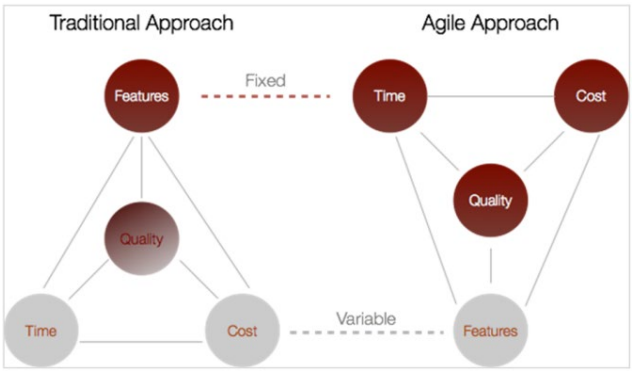

Figure 9. Comparison of the project triangle for traditional and agile approach

In the ongoing comparison if we speak about suitability, the traditional model is the appropriate choice for development of programs that are already stable., i.e. their design doesn't need a major makeover. Despite all its defects, it is a natural choice when the customer has provided a clear list of requirements, which are not likely to be modified. On the flip side, adopting agile makes sense when then customer is not clear about his requirements or expectations from the end product. Some important criteria for choosing the appropriate approach is the experience of the team members in handling the specific type of project. If the developers are experienced enough at handling that project, then Agile approach is a better option. (Abhiup et al. 2021)

Another point of consideration is the efficiency; it is decided by the number of bugs and the development time consumed. We found that agile due to their adaptability and volatility is the more efficient than the traditional model. The rigid development cycle is hard to make changes in requirement or design in the last minute. In contrary, the agile methods can incorporate changes and release a product due to their iterative nature in lesser time. Certainly, skill set, attitude and the ability of team members working in the project affects directly the efficiency; we can say that the agile models are not perfect but they are certainly applicable than the traditional model.
There is another point which is the time frame when the project is supposed to be closed. For a rapid delivery project the best way is the agile but when the proposed frame is long enough, opting the traditional model is the best.
Be it agile or traditional model, adopted communication within the team members and with the customer, goal setting and better planning contributes to achieve targets required by the customer respecting time, cost and quality.

Table 1. Dissimilarities between Agile and Traditional approach

Approach	**Agile**	**Traditional**
Suitability	Unsteady project	Stable project
Experience	Experienced team	Unexperienced team
Efficiency	Volatility more efficiency	Rigid cycle development
Time frame	Rapid delivery	Long time
Documentation	Minimal only as required	Comprehensive
Customer involvement	High	Low

2.3 Synergy between the Traditional and Agile Movement

This part aims to investigate the synergy between Traditional, agile approaches by applying a quantitative analysis method. The bibliometric study was developed with 56 documents, one data base was chosen to develop this study –Scopus, the evolution of this topic were limited to articles published between 2015 and 2021. The aggregated data were analyzed based on country, year of publication, subject and keyword. The country in the lead of producing papers on this subject was United States followed by Austria and brazil. The countries dominate because they have a developed IT history and infrastructure than others. Americans were the first in the world to get involves in the Agile approach. The agile manifesto was published on February 2001 in the Wasatch mountains of Utah -United States.

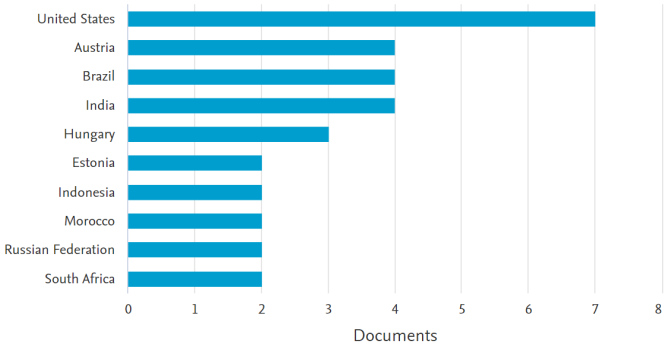

Figure 10. Geographical distribution of publications on Scopus from 2015 to 2021

This bibliometric analysis proposes the distribution of fields in which Traditional, agile approaches are discussed. In general, the distribution shows that articles on Traditional and agile methodologies is appearing in different fields ranging from computer science, business management and accounting, engineering etc. We can notice that the articles in IT surpass the publications in other domains, because Agile is a recent approach and it is gaining popularity in this domain.

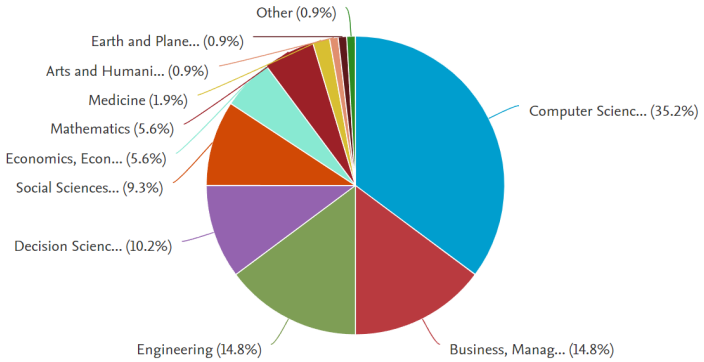

Figure 11. Most subject areas in publishing

The software used in this analysis is the VOSviewer. It offers a view that help to examine bibliometric maps in full details. It allows also to visualize the similarities by using a map and then having an easy way to use the interface. The program uses the distance approach and an association strength normalization to visualize networks (Lalmia et al. 2021)

For the keyword analysis, the authors mapped the keyword provided for each article and occurred for more than 5 times using the VOSviewer program. Of the 272 keywords 9 meets the threshold. In the first ranking, the most cited keywords were separated into groups: Project management (total link strength 42), information systems (total link strength 23), information technology and agile methodology (total link strength 21). The second ranking indicates the keywords that related to scrum, agile and Pmbok. Another ranking shows that agile software management, software engineering, information management are related. All keywords present in research exhibit domains and practices of the approaches.

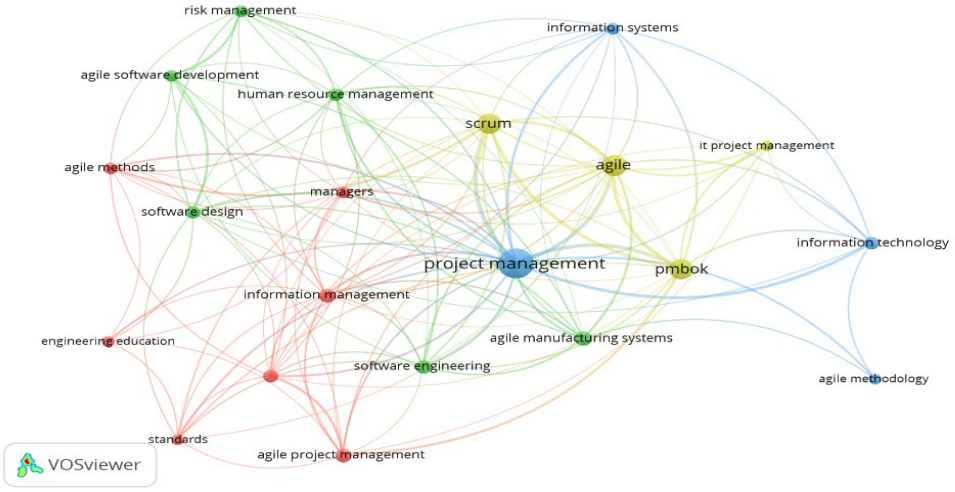

Figure 12. Keywords analysis

3. Conclusion

The project management became one of the most important field. It went through such huge changes in the recent years, different new trends and strategies have been adopted and old trends have been outdated with the passage of time. PMI one of the oldest organizations in project management announced that PMBOK till nowadays was focusing on traditional project management techniques. However, due to Technology, product life cycles become shorter and the conventional project management approach, it becomes impossible to line up easily with unstable requirements of the project for this reason agile project management methods and approaches emerged and started to be adopted PMI especially in the 7th version of the PMBOK (Master of project academy 2019) With this research work, we learned divers important aspects of project management approaches the two most famous flows Traditional and Agile, we assimilate the advantages, disadvantages and the dissimilarities between both of them; this comparison offers to managers a view to choose the appropriate methodology that can support the development of the project.
For the upcoming work, it will be established on the project management methodologies used in the industrial field, also we will discuss the evolution and the limits of the main methodologies used since the first industrial revolution till the industry 4.0.

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Biographies

Wisal Morjane is a Moroccan engineer who graduated from National School of Applied Sciences (ENSA) in 2021, is passionate about project management in the industry field, and is now a PhD student in the same school; working as a project management consultant in an automotive company.

Rachid Bannari is an associate professor of Industrial engineering at the national school of applied sciences (ENSA) at Ibn Tofail University Kenitra Morocco. He studied at the university of Bordeaux (France) and got his Phd at the university of Sherbrooke (Canada). His research work is based on mathematical modelling and process engineering. From 2017 till now he became head of department of industrial and logistics at ENSA kenitra.

Jihane Gharib is an assistant professor at ENSA Kenitra at Ibn Tofail University. Her main research interests are related to project, risk management and financial analysis. Several of her research papers related to these fields have been published in international scientific journals and conferences' proceedings. Dr Gharib is an industrial engineer from Ecole Mohammadia d'Ingénieurs (EMI) at Mohammed V University, she earned her PhD in analysis & quantification of investment projects profitability using the developed real options framework from EMI.