SE7128 Assignment

2220666 OZGUR OZBEK

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Introduction

Frameworks called project management techniques offer an organised strategy for creating, carrying out, and finishing projects (Atkinson et al., 2006; Guide, 2001). According to PMBOK (Guide, 2001), these methodology's application methods, priorities, and fit for various tasks vary (Besner & Hobbs, 2012). The goal of literature studies on project management techniques is to examine the body of knowledge regarding these frameworks and to pinpoint each different methodology's advantages and disadvantages, as there is no one-size-fits-all approach (Ika, 2012). Various project management methodologies, such as Waterfall, Agile, Scrum, Kanban, Critical Path Method (CPM), Feature-Driven Development (FDD), as well as multiple frameworks, and Total Quality Management will be reviewed in this article through a literature review.

This work will give a thorough analysis of the key traits, benefits, and drawbacks of various approaches. The applicability of each shown methodology, whether they are from books or academic publications, for various projects, organisations and work environments will also be examined. Furthermore, a project will be mentioned and observed including three to four methodologies under each section.

Linear and Sequential

Each project phase must be finished before going on to the next, which is the hallmark of the linear and sequential project management approaches (Thomas & Mengel, 2008; Wysocki, 2011). For projects with clearly defined requirements and an ultimate purpose, these techniques work best (Wysocki, 2011). Waterfall (Wahid, 2020) is one of the most popular linear and sequential methods (Guide, 2001).

Primarily, one of the oldest project management techniques is the waterfall. It is composed of a linear progression of stages, including gathering requirements, designing, implementing, testing, and maintaining (Augustine et al., 2005; Guide, 2001; Wysocki, 2011). The waterfall is best suited for projects with clear and constant requirements (Thesing et al., 2021) because it is straightforward and simple to understand (Kramer, 2018). However, one of the main limitations of Waterfall is that it does not allow for changes once a phase has been completed (Amlani, 2012; Osorio et al., 2011), making it unsuitable for projects with changing requirements (Atkinson et al., 2006; Osorio et al., 2011; Thesing et al., 2021).

In the UK and throughout Europe, the structured project management methodology known as Projects in Controlled Environments (PRINCE2) is frequently employed (Calder, 2006; Yeong, 2007). Moreover, according to Bentley, it is a method-based approach that establishes the duties of the project team and offers a defined method for organising, carrying out, overseeing, and regulating projects (Bentley, 2012). The fact that PRINCE2 is well-established and well-known (Skogmar, 2015) while offering a common language for project management (Wideman, 2002; Yeong, 2007) is one of its key benefits. Additionally, it offers a logical and transparent structure for project management (Sargeant et al., 2010), making it appropriate for small, big or complicated projects (Bentley, 2005). However, one of PRINCE2's key drawbacks is that it may be cumbersome and time-consuming (McGrath & Whitty, 2020), which makes it less appropriate for smaller projects. Contradictory, the book Bentley argues that PRINCE2 is a decent approach for even smaller-sized projects (Bentley, 2005).

A project's resources are managed through the use of the Critical Chain Project Management (CCPM) approach (Stratton, 2009), which

identifies and controls the critical chain of activities that influence the project's completion date (Leach, 1999; Raz et al., 2003). CCPM is an excellent solution for managing projects with many interdependent activities and a constrained amount of resources (Leach, 1999; Raz et al., 2003). One of CCPM's key benefits is its emphasis on managing the project's critical path (Leach, 1999), which enables on-time project delivery (Stratton, 2009). But one of CCPM's key drawbacks is that it can be difficult to execute, which makes it less appropriate for smaller projects (Ghaffari & Emsley, 2015).

A network diagram is used by the PERT (Program Evaluation and Review Technique) technique to describe a project's tasks, identify the essential path, and pinpoint the crucial tasks (Cottrell, 1999). Large, complicated projects with plenty of interdependencies are best suited for PERT (Cook, 1966; Lyngdoh & Dhaliwal, 2018). One of PERT's key benefits is that it makes it possible to identify significant tasks and the critical path (Ba'Its et al., 2020), allowing the project team to concentrate on the most crucial work. However, one of PERT's key drawbacks is that it can be difficult and time-consuming to set up, which makes it less suitable for less significant and shorter projects (Tysiak, 2011). Besides, collaborating with other techniques can help overcome similar issues (Tysiak, 2011), so incorporating multiple methodologies in various environments of project management can be beneficial.

The Manhattan Project was a research and development undertaking during World War II that produced the first nuclear weapons. The project was managed using a linear and sequential methodology (Weaver, 2007), with a clear end goal of developing a nuclear weapon (Reed, 2014). The project was completed on time and within budget (Weaver, 2007), and the methodology used was considered a success (Reed, 2014; Seymour & Hussein, 2014).

Iterative and Adaptive

Small, useful pieces of the project are supplied at regular intervals under the iterative and adaptive project management approaches (Larman & Basili, 2003), which are distinguished by their flexible and gradual approach (Trivedi & Sharma, 2013). These techniques work best for projects with flexible needs that change over time (Trivedi & Sharma, 2013; Wautelet et al., 2013). Agile and Scrum are two of the most popular iterative and flexible approaches (Trivedi & Sharma, 2013).

A flexible and adaptive method called agile project management emphasises delivering manageable chunks of the project at regular intervals (Fernandez & Fernandez, 2008). Projects that demand flexibility and have changing requirements are best suited for agile approaches like Scrum (Hu et al., 2009). Agile is ideal for projects with ambiguous requirements since it enables for changes and adjustments to be made at any time during the project (Fernandez & Fernandez, 2008). Agile can be challenging to manage and control (McCormick, 2012) within projects that have complicated cycles running simultaneously, which is one of its drawbacks.

Subsequently, scrum is an agile project management methodology that is built on these ideas (Hu et al., 2009; Schwaber, 1997). It emphasises providing brief, useable segments of the project on a frequent basis (Schwaber, 1997). Scrum's high degree of adaptation and flexibility make it ideal for projects with shifting requirements (Permana, 2015; Schwaber, 1997), which is one of its key benefits. Scrum is also tremendous for implementing incremental result delivery (López-Martínez et al., 2016). The fact that Scrum can be challenging to manage and keep under control (Ereiz & Mušić, 2019), as other agile strategies however, makes it less ideal for complex projects where the key focus is

delivery (Permana, 2015) and not quality (Hron & Obwegeser, 2018; López-Martínez et al., 2016).

Small, collaborative teams that operate in an incremental and evolutionary manner are the main focus of the Crystal Clear methodology (Cockburn, 2004). Projects with uncertain needs and modest scopes (Aaker & Mascarenhas, 1984) are best suited for this methodology (Cockburn, 2004). One of Crystal Clear's key benefits is the great degree of flexibility and adaptability it offers (Mangudo et al., 2012), which makes it ideal for projects with shifting requirements (Cockburn, 2004). Crystal Clear is also excellent for establishing product delivery in stages (Fernandez & Fernandez, 2008). However, one of Crystal Clear's key drawbacks is that it might not be appropriate for huge and intricate projects, as Crystal Clear is also not a one-size solution (Chang, 2010).

The Agile technique known as "Feature-Driven Development" (FDD) emphasises the delivery of features in condensed iterations (Chowdhury & Huda, 2011) and the management of the project using a set of clearly defined procedures (Fernandez & Fernandez, 2008). It works well for tasks that have a lot of ambiguity (Aaker & Mascarenhas, 1984). The fact that FDD allows for a great degree of flexibility and adaptation, making it suited for projects with changing requirements, is one of its key advantages (Aaker & Mascarenhas, 1984). FDD is also excellent for enabling incremental product delivery (Goyal, 2008). However, one of FDD's key drawbacks is that communication over features that are being built upon previous features or completed ones and requests over them can be cumbersome (Goyal, 2008; Hummel et al., 2013).

The development of modern medicine through the EU was achieved using an iterative and adaptive methodology, especially via the EU medicine agency’s approach (Nicotera et al., 2019), with a focus on flexible and adaptable pathways (Schulthess et al., 2016). The initial international development process was divided into small, incremental stages, allowing for changes to be made throughout the project (Nicotera et al., 2019; Schulthess et al., 2016). The project was completed and the methodology used was considered a success (Grössmann et al., 2019).

Visualizing and Improving

Focusing on visualising the flow of work and minimising the amount of work in progress defines the visualising and enhancing project management approaches (Beaumont & Jackson, 1998; Zhang & Zhu, 1997). These techniques work best for tasks requiring constant improvement (Zhang & Zhu, 1997) and a high volume of incoming requests (Manole & Grabara, 2016). Kanban and Lean project management are two of the most popular approaches for visualising and enhancing processes (Corona & Pani, 2013).

The foundation of the Kanban technique is visualising the flow of work (Corona & Pani, 2013) and restricting the amount of work that is actively being done (Ahmad et al., 2013). It works well for projects that require constant improvement and a huge amount of incoming requests (Alaidaros et al., 2021; Wakode et al., 2015). One of Kanban's key benefits is the great degree of flexibility and adaptability it offers, which makes it ideal for projects with shifting requirements (Alaidaros et al., 2021; Wakode et al., 2015; Zhang & Zhu, 1997). Kanban is also excellent for enabling incremental product delivery, as there are planned openings for future interventions (Ahmad et al., 2013; Alaidaros et al., 2021; Wakode et al., 2015). However, one of Kanban's primary drawbacks is that it might not be appropriate for a changing team and workflows (Alaidaros et al., 2021; Corona & Pani, 2013), as well as unimportant

complex projects with low resource allocation (Mojarro-Magaña et al., 2018).

The goal of lean project management is to optimise workflow and remove waste (Ballard & Howell, 2003; Krause, 2009; Nicoletti, 2010). It is based on the ideas of lean manufacturing (Koskela et al., 2002). It places a strong emphasis on teamwork (Krause, 2009), client value, and ongoing progress (Krause, 2009). The manufacturing, software development, and service industries all frequently employ this strategy (Koskela et al., 2002; Krause, 2009; Sunder M, 2016). Lean project management has a number of benefits, including the capacity to be very flexible and adaptable (Melton, 2004), which makes it appropriate for projects with shifting requirements (Ballard & Howell, 2003). Lean project management is also excellent for implementing iterative process improvement and incremental product delivery (Ballard & Howell, 2003). The fact that it might not be appropriate for multiple heavily integrated projects, however, is one of the key drawbacks of lean project management (Mesa et al., 2019).

The Theory of Constraints (TOC) technique focuses on identifying and managing the constraints (Newbold, 1998) that have an impact on how well an organisation or project performs (Jacob & McClelland Jr, 2001; Rand, 2000). Projects or organisations that need to increase their performance or capacity are best suited for it (Newbold, 1998). One of TOC's key benefits is the great degree of flexibility and adaptability it offers (Blackstone Jr et al., 2009), which makes it ideal for projects with shifting requirements (Newbold, 1998). Although, one of TOC's biggest drawbacks is that too much shifting could render the methodology redundant (Blackstone Jr et al., 2009).

The Toyota Production System is an approach to manufacturing that focuses on visualizing the flow of work and limiting the amount of work in progress (Ohno, 1982; Ohno & Bodek, 2019). The TPS is based on the principles of Lean manufacturing, which aims to optimize the flow of work and eliminate waste with constant improvement (Monden, 2011; Ohno, 1982). The methodology used in TPS is considered a success and it is widely adopted in the manufacturing and service sectors (Ohno & Bodek, 2019; Sugimori et al., 1977).

Mathematical and Optimization

The emphasis on enhancing quality by lowering errors and variability distinguishes the mathematical and optimising project management approaches (Escalante, 1999; Piraveenan, 2019). Projects requiring process improvement (Piraveenan, 2019) and an emphasis on data-driven decision-making (Adamski et al., 2005) are best suited for these techniques. Six Sigma and the Critical Path Method (CPM) are two of the most popular mathematical and optimising techniques.

The goal of the Six Sigma technique is to increase quality by lowering errors and variance (Klefsjö et al., 2001). The initiatives with a need for process optimization and an emphasis on data-driven decision-making are most suited for it (Patel & Patel, 2021; Sunder M, 2016). One of Six Sigma's key benefits is that it enables a high level of precision and accuracy in project management with optimised teamwork (Krause, 2009), making it appropriate for tasks that are both complicated and risky (Patel & Patel, 2021). Six Sigma is also excellent for streamlining procedures (Patel & Patel, 2021) and lowering expenses (Sunder M, 2016).

Network diagrams are used in the Critical Path Method, a mathematical method of project management, to determine the critical path and the crucial tasks in a project (Kelley Jr & Walker, 1959; Willis, 1985). According to Willis (1985), the project's minimum completion time should

be determined, and the work should be scheduled well (Rand, 2000; Willis, 1985). One of CPM's key benefits is that it enables a high level of accuracy and precision in project deadlines and schedules (Kelley Jr & Walker, 1959), making it appropriate for projects with a high level of risk (Jewell, 1965). CPM is also excellent for streamlining operations (Austin et al., 1995) as they are constantly monitored during the development and planning phase. However, one of CPM's key drawbacks is that it can be difficult and time-consuming to set up depending on how it is calculated (Lepadatu, 2009).

Earned Value Management measures project performance and progress using a combination of quantitative data and management's subjective opinion (Kim et al., 2003). Data on scope, schedule, and cost are combined, and project performance is forecasted (Khesal et al., 2018). EVM is a fantastic tool for project managers to comprehend the status of their projects and make informed decisions (Christensen, 1998; Kim et al., 2003). Its high degree of precision and accuracy in project management makes it suited for projects with a high level of complexity and risk, which is one of its key advantages (Kwak & Anbari, 2012). EVM's main drawback is that it can be difficult to realize certain values (Kim et al., 2003) during the planning phase, and it could be time-consuming to implement afterwards (Christensen, 1998; Kim et al., 2003).

Motorola was one of the first companies to adopt the Six Sigma methodology in the 1980s (Dedhia, 2005). The company implemented Six Sigma as a way to improve quality (Henderson & Evans, 2000) by reducing defects and variability (Coronado & Antony, 2002). The methodology was used to improve the processes (Coronado & Antony, 2002) and to reduce costs (Dedhia, 2005). The Six Sigma implementation at Motorola is considered a success (Henderson & Evans, 2000) and it is widely adopted in various industries (Coronado & Antony, 2002).

Conversation

The project management approaches which are linear and sequential, are best suited for projects with well-defined requirements and a distinct end goal. Linear and sequential techniques offer an organised strategy for organising, carrying out, and concluding undertakings, making them straightforward and simple to comprehend (Calder, 2006; Cottrell, 1999; Ghaffari & Emsley, 2015; Kramer, 2018; Sargeant et al., 2010; Stratton, 2009; Yeong, 2007). However, they are less suited for projects with changing requirements because they do not permit adjustments once a phase has been finished (Amlani, 2012; Lyngdoh & Dhaliwal, 2018; McGrath & Whitty, 2020; Osorio et al., 2011; Sargeant et al., 2010; Stratton, 2009; Tysiak, 2011).

The baggage handling system at Denver International Airport ran from 1989 to 1995 (Montealegre, 1996; Montealegre & Keil, 2000). The goal of the DIA project, a significant airport expansion, was to automate the baggage handling process (Montealegre, 1996). The project was handled using a linear and sequential technique (Montealegre & Keil, 2000), however, the system created could not efficiently handle the baggage (Szyliowicz & Goetz, 1995), leading to delays and increasing the project's overall cost. The project was over budget and more than two years late (Montealegre & Keil, 2000).

The project management approaches that are iterative and adaptive, like Agile and Scrum, are best suited for projects with changing requirements and a clear need for adaptability (Aaker & Mascarenhas, 1984; Chowdhury & Huda, 2011; Cockburn, 2004; Fernandez &

Fernandez, 2008; Goyal, 2008; Hron & Obwegeser, 2018; Mangudo et al., 2012; McCormick, 2012; Permana, 2015). These approaches offer a flexible and gradual, step-by-step methodology, delivering manageable chunks of the project on a regular basis. Therefore, they are less suited for urgent and complex projects since they can be challenging to manage and control while tackling previously completed feature changes or alterations regarding the overall project (Chang, 2010; Ereiz & Mušić, 2019; Hu et al., 2009; Hummel et al., 2013; López-Martínez et al., 2016).

Projects with a large volume of incoming requests and a need for continuous improvement are most suited for the visualising and developing project management approaches (Beaumont & Jackson, 1998; Grössmann et al., 2019; Manole & Grabara, 2016; Zhang & Zhu, 1997). These approaches, which offer a high degree of flexibility and adaptability, concentrate on visualising the flow of work and minimising the amount of work in progress. However, previously mentioned methodologies might not be appropriate for significant and intricate undertakings (Chowdhury & Huda, 2011; Corona & Pani, 2013; Goyal, 2008; Manole & Grabara, 2016).

Projects requiring process improvement and an emphasis on data-driven decision-making are best suited for the mathematical and optimising project management approaches (Jacob & McClelland Jr, 2001; Nicoletti, 2010; Patel & Patel, 2021; Rand, 2000; Sunder M, 2016; Willis, 1985), such as Six Sigma and Critical Path Method (CPM). These approaches enable process improvement and cost reduction while offering a high degree of precision and accuracy in project management (Jacob & McClelland Jr, 2001; Nicoletti, 2010; Patel & Patel, 2021; Rand, 2000; Sunder M, 2016; Willis, 1985). They are less suited for projects in a hurry because of the complexity and time required to deploy them effectively (Christensen, 1998; Kim et al., 2003; Lepadatu, 2009).

The construction of the Burj Khalifa is an example of a project that uses a combination of mathematical and optimizing methodologies (Abraham, 2019), such as CPM and EVM. The project used CPM to schedule the tasks in an efficient way and EVM to measure project performance and progress (Walker, 2015). The construction of the Burj Khalifa is considered a success (Abraham, 2019; Walker, 2015).

Finally, project management approaches offer an organised method for creating, carrying out, and finishing projects (Guide, 2001). Different techniques are appropriate for various types of projects and organisations, each with its own strengths and weaknesses (Atkinson et al., 2006; Wysocki, 2011).

Conclusion

It is crucial to remember that the ideal approach to employ depends on a number of variables, including the project's specifics, the culture of the organisation, and the team's expertise (Atkinson et al., 2006; Besner & Hobbs, 2012; Guide, 2001; Thomas & Mengel, 2008; Wysocki, 2011). Project managers must be aware of the many techniques in order to select the one that best meets the needs of the project (Guide, 2001; Thomas & Mengel, 2008; Wysocki, 2011).

Located in Sydney, Australia, the Sydney Opera House is a venue for performing arts. The project was supposed to be finished in time for the city's 200th anniversary, but it took more than 14 years to complete and ended up costing more than 14 times what it had been projected to (Shenhar & Dvir, 2007). Moreover, a clear project strategy, a suitable budget and timetable, and a clear scope description were all cited as missing in the project management (Shenhar, 2008; Shenhar & Dvir, 2007).

The project was managed using a linear and sequential technique, but it was unable to deal with the modifications, which led to delays and increased the project's overall cost (Sanchez et al., 2015). Therefore, the failure of the project was caused by improper project management practices and frequent changes to the project's scope, design, and budget (Sanchez et al., 2015; Shenhar & Dvir, 2007; Walker, 2015).

The mixing of many methods to generate hybrid approaches that can benefit from the advantages of various methodologies is one of the future paths for study in project management techniques (Hassani et al., 2018; Jaziri et al., 2018; Pollack, 2007). A different path might involve integrating AI and machine learning techniques into project management methodologies to enhance decision-making and maximise project performance (Levitt & Kunz, 1987; Martínez & Fernández-Rodríguez, 2015). It would also be helpful to conduct further research on the application and acceptance of project management approaches in other sectors and industries in order to comprehend the unique difficulties and opportunities in those fields. Similarly, bias and other ethical concerns of artificial intelligence in project management (Challen et al., 2019) need further research for up-to-date technologies (Odendaal, 2017).

In conclusion, it is important to note that the success or failure of a project is not solely determined by the project management methodology used (Atkinson et al., 2006; Guide, 2001; Osorio et al., 2011). The Sydney Opera House project, which was managed using a linear and sequential methodology, failed due to a lack of proper project management methodologies and the constant changes in scope, design, and budget (Sanchez et al., 2015). On the other hand, The Apollo project, which was managed using a combination of linear and sequential methodologies, was a success and completed on time and within budget (Kwak, 2005; Seamans, 2005). It is essential for project managers to understand the different methodologies and to choose the one that best fits the project's requirements (Guide, 2001). Additionally, it's important to have proper project planning, budgeting, and scope definition (Guide, 2001) as well as good communication among the team and stakeholders (Hummel et al., 2013), to ensure a successful project outcome.

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