CHOOSING THE BEST PROJECT MANAGEMENT METHODOLOGY FOR RESEARCH AND DEVELOPMENT PROJECTS: AGILE, WATERFALL, OR HYBRID?

ESCOLHENDO A MELHOR METODOLOGIA DE GERENCIAMENTO DE PROJETOS PARA PROJETOS DE PESQUISA E DESENVOLVIMENTO: ÁGIL, CACHOEIRA OU HÍBRIDO?

ELEGIR LA MEJOR METODOLOGÍA DE GESTIÓN DE PROYECTOS PARA PROYECTOS DE INVESTIGACIÓN Y DESARROLLO: ¿ÁGIL, CASCADA O HÍBRIDO?

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RESUMO
A seleção da metodologia de gestão de projetos mais adequada para uma empresa é uma decisão complexa que requer uma cuidadosa consideração de vários fatores. Este artigo explora os principais fatores que devem ser levados em conta ao escolher uma metodologia de gestão de projetos, incluindo o tipo de projeto, a cultura da empresa, os objetivos e metas, a experiência da equipe e o envolvimento das partes interessadas. Ele discute as vantagens e desvantagens das metodologias tradicionais (cascata), ágeis e híbridas. O artigo também apresenta os benefícios do uso de metodologias para evitar erros, reduzir custos, mitigar riscos e identificar erros precocemente. Além disso, ele discute as características dos projetos de tecnologia, inovação, pesquisa e desenvolvimento e a importância de escolher a metodologia adequada para tais projetos. O método Analytic Hierarchy Process (AHP) é sugerido para avaliar e selecionar a melhor metodologia de gestão de projetos para projetos de pesquisa e desenvolvimento. Adicionalmente, o artigo introduz o Cynefin Framework como uma ferramenta para determinar a abordagem mais adequada com base no contexto do projeto. Ele conclui que uma metodologia híbrida é bem adequada para projetos complexos, combinando boas práticas e técnicas emergentes de gestão de projetos.

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Palabras clave: Metodología; gestión de proyectos; metodología híbrida; ágil; cascada.

1. Introduction

Modern project management combines traditional management processes (waterfall management) with agile practices. Companies that use hybrid methodologies, in addition to managing risks, schedules, lessons learned, also use management processes and performance indicators to quickly and efficiently address changes that may occur during project execution. Project management supports the activities of executing, organizing, communicating and obtaining collaboration from stakeholders. But what is the best project management methodology for your company? The classic methodology, the agile methodology, the lean methodology or a mixture of all methodologies?

Choosing the best project methodology for a company can be a complex decision, as different methodologies offer different advantages and disadvantages. However, there are some key factors that companies should consider when making this decision.

It’s important to consider the type of project and its requirements. For example, projects with a high degree of uncertainty and rapidly changing requirements may be better suited to Agile methodologies, whereas projects with well-defined requirements may be more appropriate for Waterfall methodologies.

Secondly, we must consider the company's culture and the team's level of experience with different methodologies. For example, if the company is already using a specific methodology, it may be easier to stick with that methodology rather than adopting a new one. Additionally, the team's level of experience and expertise with different methodologies can impact their ability to successfully execute a project using a particular methodology.

It’s also necessary to consider the company's goals and objectives. For example, if the company values speed and flexibility, then Agile methodologies may be more appropriate. On the other hand, if the company values predictability and control, then Waterfall methodologies may be a better fit.

Finally, it’s important to consider the level of stakeholder involvement in the project. Agile methodologies emphasize collaboration and frequent feedback
from stakeholders, whereas Waterfall methodologies have a more formalized approach to stakeholder involvement.

According to the Project Management Institute (PMI), many large companies around the world are increasingly adopting hybrid methodologies that combine elements of both Agile and Waterfall methodologies. This approach allows companies to leverage the benefits of both methodologies and tailor the approach to the specific needs of each project.

In conclusion, choosing the best project methodology for a company involves considering a variety of factors, including the type of project, the company's culture and goals, the team's level of experience, and the level of stakeholder involvement. Ultimately, the decision will depend on the specific needs of each project and company.

For any company to be world class, the strategy is:

- Avoid mistakes;
- Reduce cost;
- Reduce risk;
- Meet project schedules;
- Identify and correct errors early;
- Avoid excessive documentation.

And why not use the best practices of methodologies to avoid mistakes, reduce cost, mitigate risks and identify and correct errors early? (Azenha et al., 2021) published an article that addresses a systematic review of hybrid project management methodologies applied to technology project areas. According to the methods, there is a clear trend in the combination of traditional methodologies with agile methods, both in product development and technological services. The results of this publication revealed that hybrid approaches are fundamental for organizations to be able to deal with different organizational cultures, specific processes, customers contractual requirements and projects specificities.

2. What is a Methodology?

According to the Cambridge Dictionary, a methodology is a set of guidelines that can be specifically created and applied to a specific situation. In a
project environment, these guidelines might be a set of strategies and practices that facilitate the planning and execution of a project. A methodology could also be a specific approach, templates, forms, and even checklists used over the project life cycle. A formal project methodology should lead the work of all team members throughout the life cycle of a project. All members of a team should be familiar with and use the chosen methodology throughout their projects.

3. Traditional Methodologies

Traditional (or predictive) methodologies are applied so that all project planning is done before its execution. In this way, all relevant project characteristics such as schedule, scope, risks, budget and materials are defined in advance, reducing tolerance for changes in the project. Traditional projects are clearly defined with well-documented and understood features, functions, and requirements (Fernandez, Daniel & Fernandez, John, 2009), apud (Cruz et al. 2020)

This type of methodology is mostly used by companies that already have experience with projects and know the practices that best fit their work model. With this project expertise, these organizations face fewer needs to change the original project planning.

According to the Seventy Edition of PMBOK® Guide, a project life cycle is the series of phases that a project passes through from its start to its completion:

- Project Initiation Phase;
- Project Planning Phase;
- Project Execution Phase;
- Project Control Phase;
- Project Close Out Phase.

The process or product to be built goes through all the phases, and at the end of each one, another step begins, until the whole project is implemented and working.

These are some examples of traditional methodologies custom made: PMBOK (Project Management Body of Knowledge), V-model (German government), RBPM (Risk Based Project Management - HSBC), SDLC (System Development Life Cycle) and PRINCE2 (Projects IN Controlled Environments)
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(Cruz et al. 2020)

4. Agile Methodologies

An agile methodology, unlike the traditional ones, is adaptable according to the direction assumed by the project during its execution time. Planning is done iteratively, that is, characteristics are defined according to deliverables.

If a stage of the project ends up taking longer to complete, for example, the schedule may be adapted to this unforeseen event. Therefore, the tolerance for changes is much greater, compared to traditional methodologies.

Being more flexible, the agile methodology is mostly used by startups and organizations, that need more flexibility to deal with changes in the original plan.

In addition, agile is also useful for companies that constantly innovate, which requires more adaptable methodologies.

These are some examples of Agile methodologies: SCRUM, XP (Extreme Programming), Kanban, DSDM (Dynamic System Development Model) and MSF (Microsoft Solutions Framework). (Cesarotti et al. 2019)

5. Hybrid Methodology

A hybrid methodology, as the name suggests, is composed by a mix of traditional and agile concepts. Thus, the company can choose which practices are most appropriate to achieve its current objectives and goals, creating a “personalized” project management.

An organization might want to organize team effort into sprints, for example, but choose to use a detailed schedule to gain customer approval.

Thus, this methodology may be applied for companies that already have extensive knowledge about projects, but that are constantly looking for innovation and updating their practices. Hybrid methodology may offer the advantages of both traditional and agile methodologies.

6. Technology, Innovation, Research and Development Projects Characteristics

One of the characteristics of technology, innovation and research and
development projects is a high-risk project. Doubts and uncertainties are constantly perceived by those involved soon after the conception of an idea. In these types of projects, it is very common not to have all the phases, tasks and even the requirements very well defined.

Another important characteristic of these types of projects is the unpredictability. According to the project progresses, the next steps will be planned. The project plans must be carried out in time periods, successively. This technique is known as Rolling Wave.

Constant project evaluations are important for projects with these characteristics. These assessments allow for the prediction of adversities and facilitate corrective actions if project is not contributing to the organization’s needs, as originally planned.

Projects with these characteristics are considered as complex projects. (Dao et al., 2016) define project complexity as follows: “Project complexity is the degree of interrelatedness between project attributes and interfaces, and their consequential impact on predictability and functionality”.

7. The Choice of the Best Methodology to Apply in Research, Development and Innovation Projects Using a Multicriteria Method

- When evaluating methodologies there are many factors that we should consider: Organizational strategic objectives and core values;
- Key business drivers;
- Restrictions;
- Stakeholders;
- Risks;
- Complexity;
- Project size and cost.

Once the evaluation criteria have been defined based on the above factors, you will need to use a process or method for identifying the best Project Management Methodology options for your specific project. A widely used method to analyze and compare various criteria is the AHP method (Analytic Hierarchy Process) (Saaty, 1987). Based on the classification and conversion of the criteria used to select a project methodology, in the multi-criteria comparison
between them, it allows the crossing of existing methodologies with these, allowing the selection of the most recommended methodology for research and development projects.

8. Waterfall, Agile or Hybrid Methodologies: Using the Cynefin Framework

One of the ways to choose which approach is more appropriate for the company is the Cynefin Framework. This framework was developed in the early 2000s by David J. Snowden. Graduated in Philosophy, David Snowden researched the use of stories (storytelling) in organizations to favor the management of tacit knowledge, that is, of difficult expression. He felt that some contexts favored the understanding of certain situations and created the Cynefin Framework. (Mind Tools Content Team, 2022)

The Cynefin Framework has 5 regions or domains: Clear, Complicated, Complex, Chaotic and Disorder, as shown in Figure 1.

Figure 1 - The Cynefin Framework

Source: Englands, 2020

9. Domain I: Clear or Simple

The Clear or Simple context is the domain of best practices, where the relationship between cause and effect is evident to everyone and is characterized
by stability. It presents easy-to-understand contexts, there are no complications and we know exactly what to do. There are not many surprises and significant risks. Consequently, there is no much room for creativity.

This is a simply ordered environment in which cause and effect are clear. Decisions follow a simple scheme: Situational awareness → Situational categorization → Respond by applying a known solution.

As an example, workflows at a company like McDonald’s ensure that the food and products have the same level of quality regardless of where in the world you may be. Another example is in tech companies, the IT industry uses checklists to maintain standards and procedures to ensure an application works correctly.

10. Domain II: Complicated

The Complicated context is the domain of specialists, where the relationship between cause and effect requires a deeper analysis, which sometimes requires specific knowledge. As opposed to the simple domain, complicated context can contain multiple correct answers. Therefore, the logic is that best practices are not applied, but good practices, since there is not always the best way to define the best solution and there are uncontrollable variables. Some changes may occur along the way, that may have an impact on the overall scope. This is an ordered environment where the connection between cause and effect may not be so obvious. Decisions follow this scheme: Situational awareness → Expert analysis of the situation → Respond by applying one of several solutions.

It’s important to note that, unlike the previous domain, there is no longer a single correct solution. Attempts to apply the Simple Domain may be detrimental to motivation since groups may not agree on a single-solution option. In this domain, practices would be called good practices since there can be alternatives. Common uses of this domain are found in the traditional frameworks of project management PMBOK and PRINCE2.

As an example, when building a pool, a dug pit and supplied communications are useless until the pool bowl is designed and filled. But the pool design does not guarantee success without the involvement of an expert
who can keep the project moving according to plan, replace materials if necessary or adapt to potential unforeseen challenges.

11. Domain III: Complex

The Complex context is the domain where the situation is unpredictable and hence, it may be impossible to identify one "correct" solution. In this way, changes will occur throughout the entire process and, the better we deal with them, the better the result of the project will be. Most cause and effect relationships can only be realized in retrospect, not in advance. In this context, it is not possible to discover the right answer right at the beginning.

This environment is no longer ordered but is not necessarily disordered. With the absence of information showing the connection between cause and effect, data need to be collected. Decisions are made with the following scheme: Take actions to collect data on the Situation → Awareness based on received data → Form an answer to the situation to be used in the complicated domain (second domain).

Common uses of this domain are found in the agile frameworks of project management SCRUM, XP and Kanban.

For example, a certain hypothesis is formed, an MVP is created, and with the results from testing, the business has the necessary information to choose among the possible solutions.

12. Domain IV: Chaotic

The Chaotic context is the domain of rapid response, in which there is no cause-and-effect relationship at the system level. Searching for the right answer is not feasible, as the scenario undergoes constant changes and there are no controllable standards.

The chaotic domain deals with an unordered environment. If the links between cause and effect were unclear in the previous domains, in this domain, the links are simply absent. The scheme of actions is: A leader takes immediate action based on instincts to “staunch the bleeding” → Based on the results of the action, “bleeding is stopped,” the leader thinks of and performs actions to stabilize
the situation → All feedback from the situation will de-escalate it to Domain III.

For example, the system is being attacked by malefactors who’ve found a vulnerability. Company employees try to use uncoordinated measures to resolve the situation. This example is similar to a house fire in the middle of the night. There isn’t time for planning and thorough thinking. A leader who can give clear orders to save lives and/or property is needed. Having avoided the immediate threat, one can then plan further actions.

13. Domain V: Disorder

As a last domain, Disorder corresponds to when the environment in which it is inserted is unknown. This is where we find ourselves most of the time when we don’t have a holistic view of reality and end up interpreting situations according to our influences or personal beliefs. This is an invisible struggle that, when it becomes known, gains space in one of the other domains.

In this model, decision-makers are not aware of which domain they’re currently in nor what practices should be applied. The model assumes that it’s necessary to move clockwise — from a chaotic domain to simplification. The bulk of unfavorable situations will remain between the complex and complicated domains, and only some parts will move to the first domain, where the environment is ordered.

14. Conclusion

Considering the characteristics of research and development projects, such as the need for risk management, unpredictability, constant communication, the need for cyclical planning and anticipation of errors, we can say that these types of projects, while being complex, are also complicated. For certain project situations it is necessary to use good practices, already known, as well as in other situations it is necessary to use emerging project management practices (agile techniques). The hybrid methodology is the most suitable for these types of projects, following the Cynefin framework, as illustrated in Figure 2.
In conclusion, the use of a hybrid methodology for project management is becoming increasingly popular due to its ability to provide a flexible and adaptable approach to project delivery. While both Agile and Waterfall methodologies have their respective strengths, a hybrid approach can leverage the best of both worlds to deliver successful outcomes for complex projects.

One of the key benefits of a hybrid approach is its ability to adapt to changing requirements throughout the project lifecycle. This is particularly important in today’s rapidly evolving business environment where requirements and priorities can shift at a moment’s notice. By combining Agile’s iterative approach with Waterfall's structured framework, a hybrid methodology can provide the necessary flexibility to adjust to these changes while still maintaining a clear plan for project delivery.

Another advantage of a hybrid approach is its ability to provide greater visibility and control over project progress. By breaking down the project into smaller, more manageable phases, project teams can more easily track and monitor progress, identify potential roadblocks, and make necessary adjustments. This can lead to more efficient use of resources, improved risk management, and ultimately, greater success in delivering projects on time and within budget.

Finally, a hybrid approach can also help to foster greater collaboration and communication between project teams and stakeholders. By incorporating Agile’s emphasis on collaboration and feedback into a Waterfall framework, project
teams can work more closely with stakeholders to ensure that project requirements are fully understood and that the final deliverables meet their needs. This can lead to stronger relationships between the project team and stakeholders, improved alignment of project goals, and ultimately, greater success in delivering projects that meet business objectives.

In summary, while the decision to use a hybrid methodology for project management will depend on the specific needs of the project, there are clear benefits to this approach. By combining the strengths of Agile and Waterfall methodologies, a hybrid approach can provide the necessary flexibility, control, and collaboration to deliver successful outcomes for complex projects.

REFERENCES


