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How project management approach impact project success? From traditional to agile

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Abstract

Purpose – This research aimed to explore whether different project management approaches (traditional, agile or hybrid) differentiate concerning their impact on project success, taking project success as multidimensional phenomena. In addition to this, the authors wanted to explore if specific project characteristics moderate these effects.

Design/methodology/approach – The authors empirically addressed these on a sample of 227 project professionals worldwide. The exploratory factor analysis (EFA) of project success dimensions was done to validate these factors' constitution concerning their manifest variables. The K-means cluster method was used to distinguish respondents' profiles among agile, hybrid and traditional project management approaches. To test the significance among research groups, the research hypotheses were tested with ANOVA tests.

Findings – The authors evidenced that the agile approach has a more significant positive impact concerning the two out of five dimensions of project success, under analysis in this research (impact on the team and preparing for the future), over the traditional approach.

Practical implications – The research is relevant for project management practitioners to tailor the success-oriented project management approach and for academics to develop project management contingency theory.

Originality/value – The authors constructed a research framework to test the impact and effectiveness of different project management approaches (traditional, agile, hybrid) on the dimensions of project success in different contextual conditions (organization industry, project type, novelty, technology, complexity and pace). The paper's main contribution is to expand data on the impact of these approaches on project success and compare them with relevant results and findings of previous research.

Keywords Agile, Traditional, Hybrid, Project success, Project management approach, Cluster analysis, EFA

Paper type Research paper

1. Introduction

Today, there are many different, and in some cases, overlapping approaches to manage the complexities of any given project, making it rather complicated to choose the best one (Sheffield and Lemétayer, 2013) to achieve project success. Things get further complicated as the project's success definition is still elusive (Mohanarajah, 2015), and it's controversially discussed in the literature. Some consider it as a one-dimensional construct that should be perceived through the prism of budget, time, quality and meeting technical requirements (Atkinson, 1999; Brown and Adams, 2000; Bryde, 2005; Müller and Turner, 2007; Carvalho *et al.*, 2015). Others see it as a complex, multidimensional concept with many more attributes (Judgev *et al.*, 2001; Shenhar *et al.*, 2001; Shenhar and Dvir, 2007; Mir and Pinnington, 2014).

We acknowledge that project success is a complex concept that should be considered multidimensional, dynamic and relative, making it challenging to compare sensibly. This has to be taken into account (inspired by Svejvig and Andersen (2015)). However, a universal

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recipe for achieving the desired project success does not yet exist. It is unlikely that a universal project management approach that guarantees success will ever be developed. Such a thing is neither realistic nor desirable in today's changing environment. Intense industrial competition and ever-changing customer requirements have led organizations to deviate from a traditional project management approach (Young *et al.*, 2012), as evidence accumulated that it can result in significant downstream pathologies. This could include excessive rework, lack of flexibility, customer dissatisfaction and the project's potential to be fully developed (Serrador and Pinto, 2015). In recent years, agile has taken the world of project management by storm, especially in software development (Sweetman and Conboy, 2018).

Previous studies provided some valuable knowledge on the effectiveness of the agile approach in managing software development projects (e.g. Butler *et al.*, 2020; Gemino *et al.*, 2020; Mohagheghi and Jørgensen, 2017; Chin, 2004; Augustine, 2005; Highsmith, 2004; Adkins, 2015; Goodpasture, 2010; Wysocki, 2009; Crowder and Friess, 2015; Cobb, 2011; Dybå and Dingsøyr, 2004; VersionOne, 2014). Still, little research has been done on whether the agile approach delivers more successful projects comparing software and non-software domain, even though, more recently, in several studies, the interest in transferring agile outside of software development is evident (Abrahamsson *et al.*, 2009; Lappi *et al.*, 2018; Niederman *et al.*, 2018).

To date, the majority of research exploring the impact of the agile approach on project success, beyond the software domain where the more traditional approach was common, has been circumstantial, based on small-sample, or limited by industry or geography (Owen *et al.*, 2006; Chen *et al.*, 2007; Nowotarski and Paslawski, 2015; Olsson *et al.*, 2015; Tomek and Kalinichuk, 2015; Demir and Theis, 2016).

The early adopters of agile believe that agile may positively affect project success (Berinato, 2001; Larman, 2004; Lindstrom and Jeffries, 2004). Followers of a more traditional approach believe that agile is more chaotic and lacks the formal procedural rigor that the former possess (Vinekar *et al.*, 2006), affecting project success. The question about the value and effectiveness of different project management approaches in different contextual conditions could be raised.

Empirical studies comparing traditional and agile project management approaches were recommended by several authors so far (Ahimbisibwe *et al.*, 2015; Lappi *et al.*, 2018; Niederman *et al.*, 2018).

Some of the recent researches have delved deeper into this topic and made a significant contribution to understanding the impact that agile versus traditional approaches can have on project success. Serrador and Pinto (2015) explored the efficacy of the agile approach through a comprehensive and large-scale empirical analysis of projects being developed with varying levels of agile approaches and their subsequent likelihood of success. They provided valuable research findings supporting the agile project management approach. They found that the level of agile used in projects has a statistically significant impact on project success but is limited a way in that it covers just the following two dimensions of success as judged by efficiency and stakeholder satisfaction and two items taken as a measure of the agile in the project (how much agile process is used in the project; how much planning is completed during execution). This research did not directly compared the impact of agile with other approaches such as traditional and hybrid. The most recent study done by Gemino *et al.* (2020) goes one step further. It considers the relative impact of three project management approaches – traditional, agile and hybrid on project success. They also confirmed the value of agile in delivering stakeholder satisfaction. Namely, both agile and hybrid approaches outperformed traditional approaches with regard to this project success dimension. On the other hand, the three approaches exhibited similar performance levels on budget and time success and scope and quality success dimension. This research is also limited to the aforementioned project success dimensions and the fact that it focused on the project, not the

surrounding organization or industry. The global reach was also limited, as most projects were completed in North America.

More research in this field is needed, comparing these approaches taking into account different contextual conditions and multidimensional aspects of project success, signaling a clear gap in the literature.

Following the aforementioned, this research is underpinned by the following research questions: *How agile, hybrid, and traditional project management approaches differentiate concerning their impact on individual project success dimensions? Do specific project characteristics differentiate agile, hybrid, and traditional project management approaches concerning their impact on individual project success dimensions?*

We empirically addressed these questions on a sample of 227 project professionals worldwide. Research results provided more extensive evidence and findings for scholars and practitioners that could support project management approach selection in various contextual settings, to achieve project success and more visible results.

The rest of this paper is structured as follows. The following section reviews the literature on agile, traditional and hybrid approaches in project management and project success. In Section 3, the project management approach and its relationship to project success are discussed. The research framework and hypothesis are presented, followed by explaining the research instrument, research data collection process, and sample demographics in Section 4. In Section 5, statistical data and results are presented, and Section 6 gives a discussion of results followed by a conclusion with limitations and directions for future research.

2. Theoretical background

2.1 Discussion of traditional, agile and hybrid project management approach

The managing principles established in the 1950s stipulated that project management should be uniquely applied to each project. Such a uniform application should ensure robustness and applicability to a wide range of projects, from simple and small projects to the most complex and large ones (Špundak, 2014).

The traditional project management approach includes highly disciplined and thoughtful planning and control methods, based on logical sequencing activities, emphasizing the importance of planning (Conforto *et al.*, 2014; Serrador and Pinto, 2015), but is limited by the fact that projects rarely follow the sequential flow. The basic idea behind the traditional, rational and normative approach is that projects are relatively predictable and linear, with clearly defined constraints and project goals (DeCarlo, 2004; Fernandez and Fernandez, 2008). Such projects are expected to have a very low rate of change in requirements, and no major end-customer involvement in the project is needed. The emphasis is placed on planning and linear monitoring to optimize project activities and efficiency in their execution (Boehm, 2002; DeCarlo, 2004; Shenhar and Dvir, 2007; Boehm and Turner, 2005; Williams, 2005; Wysocki, 2009). After all, the traditional approach is often the best fit in a stable environment where a defined result needs to be delivered for a fixed budget. Such projects are usually known to the organization, or similar projects have already been realized in the past.

Although the good practice and efficiency of the traditional project management approach has been proven and distributed around the world for decades (Crawford, 2006; Kloppenborg and Opfer, 2002; Kolltveit *et al.*, 2007; Shenhar and Dvir, 2007), specific problems may arise when this approach is applied in a dynamic environment, on projects that contain a certain degree of innovation and uncertainty. Today, most innovative products are developed under uncertainties where a plan-oriented traditional project management approach has reached its limits. This approach is characterized by inflexibility for adapting to project uncertainty, implying changing customer requirements and unpredictable activities, and to project complexity implying complex relationships both within the project team as well as with

internal and external stakeholders where the traditional approaches have reached their limits (Chin, 2004; Bergmann and Karwowski, 2019). Therefore, in uncertain situations where project complexity and ambiguity in requirements are significant, and the level of experience with tools and techniques used within the development environment is minimal, a less rigid management approach is needed.

Limitations imposed on the traditional project management approach caused by the growing demands for continuous innovation, followed by the pressure to reduce costs, have affected all industries, resulting in the emergence of new project management approaches. These emergence approaches were closely linked to the information technology (IT) sector and software development due to the significant specifics that characterize this sector. A high level of uncertainty characterizes such projects, vague objectives or incomplete and unpredictable requirements, which one might assume will change significantly during the project (Boehm, 2002; DeCarlo, 2004; Hass, 2007; Highsmith, 2004; Shenhar and Dvir, 2007; Wysocki, 2009). Project management in the IT sector has become increasingly challenging. Short deadlines, daily technological advances and changing demands have forced the profession to deliver competitive software to the market faster and faster.

Project management practitioners are aware that various projects need different project management approaches (Ciric *et al.*, 2016). Consequently, new project management approaches have emerged under different names, emphasizing differentiation from the traditional one, even in its own name. The word chosen to distinguish these new approaches from the existing one was agility (Špundak, 2014).

In 2001, prominent software development practitioners convened to arrive at a consensus on how the software development industry could produce better results and overcome limitations (Hass, 2007) of traditional software development. It is generally accepted that the agile project management approach has emerged from the Agile Manifesto (Beck *et al.*, 2001), which constitutes 12 principles and four values for agile software development and compacts the basic idea of the agile movement. The agile approach implies a set of management practices based on iterative cycles and incremental development, where requirements and solutions evolve and prioritize through collaboration between self-organizing, cross-functional teams and customers (Denning, 2013; Boehm and Turner, 2005). It aims to promote a better understanding of the project complexity through decomposition and emphasizes the project system's flexibility to a permanently changing environment (Chen *et al.*, 2007). The agile approach aims to achieve customer satisfaction, taking as naturally that the client will have frequent changes to the request. These changes will be adopted during development through the iterative process. In an agile project, change is the norm, not the exception. According to different project parameters identified in the literature, differences between agile and traditional project management approaches are presented in Table 1.

The traditional approach is comprehensive, and for decades has been proven to work in the management of various project types. Simultaneously, the agile approach adds new ideas and offers solutions to the challenges posed by technological development to project management, initially in the software industry. But any of these two is not an all-or-nothing approach. The "command and control" traditional management style, used in many industries and projects, provides a sense of trust and security. In contrast, an agile approach facilitates leadership, encourages creativity and motivates the team (Owen *et al.*, 2006). However, this is not an absolute proposition and choice, whether full control or no control (Cobb, 2015). There are many ways to achieve the right balance of control over agility.

After the agile approach came to life and experienced its expansion in the software industry, some software companies began to incorporate specific agile practices into their existing management processes, thus creating hybrid models. Their experience suggests that agile and traditional approaches could be combined to use their advantages' synergy (Cooper,

Project parameter	Traditional	Agile	Representative source
Scope	Known early, largely stable; designed for current requirements	Largely emergent, rapid change; designed for current and foreseeable requirements	Špundak (2014), Lappi *et al.* (2018), Serrador and Pinto (2015), Boehm *et al.* (2002)
Project plan	Linear	Iterative	Špundak (2014), Ahimbisibwe *et al.* (2015)
Team collaboration	Plan oriented; less collaboration	Collaborative; agile	Ahimbisibwe *et al.* (2015), Boehm *et al.* (2002)
Team location	Distributed due to different physical locations	Co-located; all located at the same place	Ahimbisibwe *et al.* (2015), Špundak (2014), Boehm *et al.* (2002)
Team organization	Strict separation of roles; access to external knowledge; pre-structured teams; spread across different projects	Self-organized and cross-functional teams; 100% dedicated to the project	Ahimbisibwe *et al.* (2015)
Management style	Command and control	Leadership and collaboration	Nerur *et al.* (2005), Ahimbisibwe *et al.* (2015), Dybå and Dingsøyr (2004)
Customer	Minimal commitments; not co-located and not empowered	Dedicated, knowledgeable; co-located; representative, frequent collaboration	Ahimbisibwe *et al.* (2015), Špundak (2014), Boehm *et al.* (2002)
Development model	Linear or incremental (anticipatory)	Evolutionary-delivery model (iterative or adaptive models)	Nerur *et al.* (2005), Ahimbisibwe *et al.* (2015), Dybå and Dingsøyr (2004)
Fundamental assumption	Systems are fully specifiable, predictable, and are built through meticulous and extensive planning	Continuous design improvement and testing based on rapid feedback and change	Nerur *et al.* (2005), Ahimbisibwe *et al.* (2015), Dybå and Dingsøyr (2004)
Quality control	Substantial planning and strict control; late heavy testing	Continuous control of requirements; design and solutions, continuous testing	Nerur *et al.* (2005), Ahimbisibwe *et al.* (2015), Dybå and Dingsøyr (2004)
Prioritization	Manager negotiated; scope-based delivery	Client prioritized; time-boxed delivery	By the authors of this article
Requirements	Clear initial requirements; low change rate expected	Creative, innovative; requirements unclear; changes expected	Ahimbisibwe *et al.* (2015), Špundak (2014), Boehm *et al.* (2002)
Refactoring	Expensive, difficult to implement	Inexpensive, easy to implement	Ahimbisibwe *et al.* (2015), Boehm *et al.* (2002)
Organizational form/structure	Mechanistic (bureaucratic with high formalization and rigid procedures)	Organic (flexible and participative encouraging cooperative social action, adaptable procedures)	Nerur *et al.* (2005), Ahimbisibwe *et al.* (2015), Dybå and Dingsøyr (2004)
Team size	Larger teams	Smaller teams	Ahimbisibwe *et al.* (2015), Špundak (2014), Boehm *et al.* (2002)
Project size	Bigger projects	Smaller projects	Špundak (2014)
Knowledge management	Explicit	Tacit	Nerur *et al.* (2005), Špundak (2014), Boehm *et al.* (2002), Ahimbisibwe *et al.* (2015), Dybå and Dingsøyr (2004)
Communication	Formal	Informal	Nerur *et al.* (2005), Ahimbisibwe *et al.* (2015), Dybå and Dingsøyr (2004)

Table 1.
Agile vs. traditional approach in project management

Source(s): Adapted by the authors from Serrador and Pinto (2015), Špundak (2014), Lappi *et al.* (2018), Ahimbisibwe *et al.* (2015), Dybå and Dingsøyr (2004), Imreh and Raisinghani (2011), Nerur *et al.* (2005) and Boehm *et al.* (2002)

2016). By introducing a hybrid approach, organizations can benefit from agile practices without abandoning the traditional approach's stability (Barlow *et al.*, 2011). Many organizations successfully use hybrid models to introduce new features quickly, respond

to change, improve team performance while ensuring proper system documentation, and utilize traditional business analysis techniques to help keep a project on track (Conforto and Amaral, 2015; Sommer *et al.*, 2015; Cooper, 2016; Cooper, 2016; Lehnen, 2016). However, the mechanisms driving the positive effects of hybrid models remain mostly unknown.

2.2 Project success

Projects differ in terms of complexity, size, value, length and type; thus, there is a divergence of opinions on what constitutes project success and criteria by which a project is judged (Pinto and Slevin, 1988; Freeman and Beale, 1992; Gemuenden and Lechler, 1997; Shenhar *et al.*, 1997; Müller and Turner, 2007; Shenhar and Dvir, 2007; Khan *et al.*, 2013; Lisher and Shtub, 2019). There is no single adopted concept for measuring project success, and consequently, different models and frameworks have been developed (Mir and Pinnington, 2014).

Project success measure criteria have evolved from simple quantifiable time, scope and cost, which primarily are related to project efficiency (Atkinson, 1999; Bryde, 2005; Carvalho *et al.*, 2015), to a multidimensional construct that, besides the short term, have a long term perspective directly relating to effectiveness and organizational impact (Judgev *et al.*, 2001; Khan *et al.*, 2013; Pacagnella *et al.*, 2019; Shenhar and Dvir, 2007). The focus is on achieving organization goals, the project purpose and the customer's satisfaction with the product (Albert *et al.*, 2017).

Indeed, the short-term view triple constraints are essential, but they are often less important than customer satisfaction in stakeholders' long-term view (Shenhar and Dvir, 2007). Müller and Jugdev (2012) describe project success as "predominately in the eyes of the beholder," meaning one stakeholder may consider a project successful, where another stakeholder would consider it a failure. The same is argued by Nara *et al.* (2015), including that the project success depends on the type of project, the temporal perspective and the organization. Shenhar *et al.* (1997) advocated that projects are strategic, and project success should be assessed according to short-term and long-term project objectives. They proposed a comprehensive multidimensional framework for determining project success, including five dimensions, with assessment criteria presented in Table 2. This framework was cited and used in many project management studies (Pacagnella *et al.*, 2019; Serrador and Pinto, 2015; Mir and Pinnington, 2014; Müller and Jugdev, 2012; Bryde, 2008). The model presented by Shenhar *et al.* (1997) was selected to assess project success in this research.

3. Research framework: project management approach and its relationship to project success

Linking project management approach with project success was a topic of interest for many authors (Pacagnella *et al.*, 2019; Rolstadas *et al.*, 2019; Joslin, 2017; Badewi, 2016; Carvalho *et al.*, 2015; Inayat *et al.*, 2014; Joslin and Müller, 2014; Mir and Pinnington, 2014; Dvir *et al.*, 2003a, b). However, these studies looked at this linkage through different lenses, i.e. the governance of the project, project management performance, project management enablers and efforts, individual project management practices, and their impact on project success, usually referring to project success as one-dimensional phenomena.

As argued by some authors, the traditional project management approach that exclusively pursues the success criteria of costs, time, quality and meeting technical requirements and the project plan has become considered ineffective (Bourne *et al.*, 2000; Walton and Dawson, 2001). Serrador and Pinto (2015) and Gemino *et al.* (2020) provided some valuable research findings supporting agile project management approach. Both studies found that the level of agile used in projects significantly increase stakeholder success. In

Project Success Dimension	Measures
Project efficiency	Meeting schedule goal
	Meeting budget goal
Impact on the team	Team morale
	Skill development
	Team member growth
	Team member retention
Impact on the customer	Meeting functional performance
	Meeting technical specifications
	Fulfilling customer's needs
	Solving customer's problem
	The customer is using the products
	Customer satisfaction
Business success	Commercial success
	Creating a large market share
Preparing for the future	Creating a new market
	Creating a new product line
	Developing a new technology

Table 2.
The five dimensions of project success after Shenhar and Dvir (2007)

addition, Serrador and Pinto (2015) confirmed the positive impact on project success, as judged by efficiency (project budget, time and scope goals). Even though frequent changes in requirements could negatively affect project success, the agile approach is more likely to be successful than the traditional one when the requirements change rate is high since it has been specifically developed to address the circumstances when requirements and specifications change frequently. Iterative delivery helps reduce uncertainty and leads the project through uncertainty while basing on customer feedback for continuous quality improvements (Ahimbisibwe *et al.*, 2015). Close customer collaboration and user participation are some of the main pillars of the agile approach. Although it could be assumed that close collaboration with the customer, and his continuous involvement in the development process, can further encourage suggestions for changes in the specification, which may increase variations in the budget, Yetton *et al.* (2000) found that customer involvement can also reduce budget variations by managing expectations and resolving potential problems quickly. The positive impact of continued customer collaboration on the software development project's success has been proven in several studies (Chow and Cao, 2008; Misra *et al.*, 2009).

Both agile and traditional project management approaches bring specific challenges when analyzing their suitability for projects of different characteristics. To overcome these challenges, the concept of a hybrid project management approach was introduced, which unites and combines the features, principles, values and practices of both agile and traditional approaches (Mohanarajah, 2015). Various studies confirmed the effectiveness of the hybrid project management approach (Gemino *et al.*, 2020; Serrador and Pinto, 2015; Conforto and Amaral, 2015; Cooper, 2016; Sommer *et al.*, 2015). Gemino *et al.* (2020) suggested, based on their research results, that hybrid is a leading project management approach. Sommer *et al.*, 2015 conducted in-depth case studies within seven manufacturing companies to explore how agile/traditional hybrids can improve product development performance. They indicated several advantages of hybrid processes: increased team productivity, improved communication and coordination, improved morale and motivation, a better fit between the work process and methods, more flexibility in the design process. Conforto and Amaral (2015) examined applying a hybrid approach in technology-based projects as part of a case study. The research results showed a positive impact on the performance of the project and the product development process. The authors pointed out the importance of combining these two approaches to balance the stability and flexibility necessary for managing innovation

projects in high-tech companies. Research findings by Carvalho *et al.* (2012) also indicated a positive impact of applying the hybrid approach. The combination of rigorous requirements management, guided by the traditional approach, and taking advantage of the agile process dynamics resulted in a 16% increase in productivity.

Based on the literature review and previous research findings, our *a priori* contention is that the agile or hybrid project management approach could be more successful than the traditional approach concerning its impact on individual project success dimensions.

For research purposes, we considered.

P1. The agile or hybrid project management approach is more successful than the traditional approach concerning the perceived impact on individual project success dimensions.

The following hypotheses, from H1 to H5, will be tested to test the relevance of this proposition:

H1. The agile or hybrid project management approach is more successful than the traditional approach concerning the perceived impact on project efficiency.

H2. The agile or hybrid project management approach is more successful than the traditional approach concerning the perceived impact on team satisfaction.

H3. The agile or hybrid project management approach is more successful than the traditional approach concerning the perceived impacts on customer/client satisfaction.

H4. The agile or hybrid project management approach is more successful than the traditional approach concerning the perceived impact on business and direct organizational success.

H5. The agile or hybrid project management approach is more successful than the traditional approach concerning the perceived impact on preparation for the future.

3.1 Variables moderating the relationship between project management approach and projects success

Different industries may have various project management needs depending on the project type and its frame conditions (Rolstadas *et al.*, 2019; Collyer *et al.*, 2010). This may have an impact on the need for planning and the effect of planning on success. So, the first two moderating variables are defined as follows:

- *Organization industry* (clustered in non-information and information technologies)
- *Project type* (clustered in non-software and software development projects)

According to Wysocki (2009), as project technical complexity increases, a more flexible and adaptive project management process is needed. As opposed to that, Shenhar and Dvir (2007) and Highsmith (2010) indicate the need to resort to a more formal, traditional approach when project complexity increases. Serrador and Pinto (2015) found that project complexity does not moderate the relationship between agile and project success, taking into account two dimensions: efficiency and overall stakeholder satisfaction. Furthermore, the use of new technologies in projects increases uncertainty and requires a team to adapt as they learn. According to Shenhar and Dvir (2007), projects with a higher level of technological uncertainty may increase budgets and longer projects and require a more formal approach indicating better planning and control. The agile project management approach was developed to respond to change and uncertainty in requirements and reduce the cost of

change throughout the project (Cockburn and Highsmith, 2001). Regardless of the industry or technology involved, Shenhar and his associates identified four dimensions to distinguish among projects: novelty, technology, complexity and pace (Shenhar, 2001; Shenhar and Dvir, 2007). Together, these four dimensions create the NTCP model and form a context-free framework for selecting the proper management style. These variables were included as remain four moderators in our research:

- *Novelty* – how new the product is to the customers and the market (derivative, platform and breakthrough).
- *Technology* – the extent of use of new or even non-existing technology at the time of project initiation (low-tech, medium-tech, high-tech and super-high-tech).
- *Complexity* – is a measure of the project scope, reflected in characteristics such as the number of tasks and the degree of interdependency (where the project's product is located on the scale from a simple component to an array).
- *Pace* – how urgent the project is at the time of initiation, the criticality of the project's completion time (regular, fast/competitive, time-critical and blitz).

For research purposes, we considered.

P2. Project characteristics moderate the difference in the level of impact that an agile, hybrid or traditional project management approach has on the perceived impact on individual project success dimensions.

The following hypotheses, from H1a to H5a, will be tested to test the relevance of this proposition.

H1a. Project characteristics moderate the impact that an agile, hybrid or traditional project management approach has on the perceived impact on the project efficiency.

H2a. Project characteristics moderate the impact that an agile, hybrid or traditional project management approach has on the perceived impacts on team satisfaction.

H3a. Project characteristics moderate the impact that an agile, hybrid or traditional project management approach has on the perceived impact on customer/client satisfaction.

H4a. Project characteristics moderate the impact that an agile, hybrid or traditional project management approach has on the perceived impact on business and direct organizational success.

H5a. Project characteristics moderate the impact that an agile, hybrid or traditional project management approach has on the perceived impact on preparation for the future.

This research includes a project management approach as an independent variable and project success as a dependent variable, with six moderating variables representing project characteristics. The research framework is graphically presented in Figure 1.

4. Research instrument, research data collection process and sample demographics

4.1 Research instrument

This research can be considered descriptive and explanatory. It follows a quantitative approach, being implemented through the survey method. The questionnaire used for the survey had four sections with 66 questions. In the first section, respondents gave their background information. In the second section, respondents were asked to select one project,

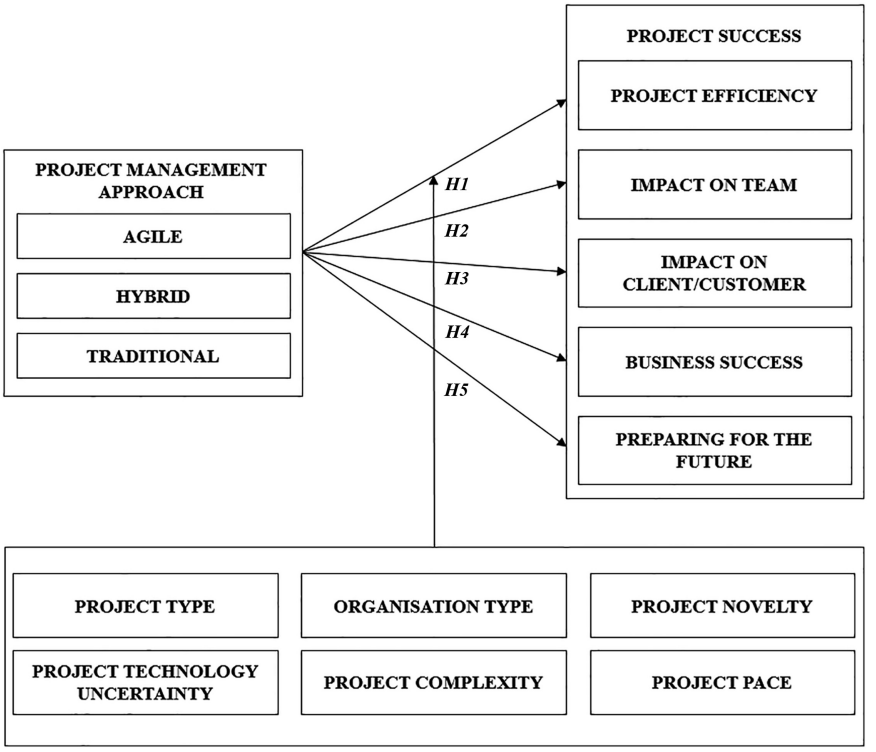

Figure 1.
Research framework

concluded in the last year, in their organization, and answer all further questions concerning that project. In the third section, the project management approach applied to that particular project was assessed, and the fourth section was dedicated to project success assessment.

This research used a self-reporting (subjective) assessment of the project management approach and project success, as perceived by respondents. The project management approach and project success assessment factors were operationalized with 44 manifest variables in the questionnaire. According to the results of previous studies, literature review, and relevant literature sources (see Table 1), the project management approach, as the independent variable, was operationalized with 21 questions and analyzed through differentiation between agile and traditional project management approach.

The variables were classified into five groups: (1) *project initiation and planning*, (2) *personnel management*, (3) *customer involvement*, (4) *modularity of work* and (5) *troubleshooting*. Each group describes a specific managerial aspect of the project management process and is entitled to that by the authors to simplify the questionnaire's clarity. Project initiation and planning include four questions describing the project's initiation process (definition, clarity and stability of project scope and the upfront planning level). Personnel management consists of five questions describing the team and the manager role (how the team collaborates, the team members' location, the organization of the work, and manager role). Customer involvement includes two questions describing the importance and the level of customer involvement throughout the project life cycle. The modularity of work consists of five questions describing the development process (the value of modularized and

incremental work, sequence of iterations, prioritization). Trouble-shooting includes five questions explaining how changes in requirements are managed and implemented.

While the fife-dimension framework (see Table 2) for assessing project success, as a dependent variable, consisted of (1) *impact on the project efficiency*, (2) *impact on the team*, (3) *impact on the customer*, (4) *impact on the business and direct organizational success* and (5) *impact on the preparation for the future*, taking the project success assessment questionnaire proposed by Shenhar and Dvir (2007). Following relevant literature sources, only variables with the theoretical background and academic validation in previous studies constituted research dimensions.

For conducting face validity, the final version of the questionnaire was tested with a group of University professors dealing with project management and 30 project managers from various industry sectors. The final version of the questionnaire, in section project management approach, was consisted of 4 questions for *project initiation*, five questions for *personnel management*, two questions for *customer involvement*, five *questions for modularity of work,* and five questions for *trouble-shooting*. The operationalization of project success was measured with at least four manifest variables for *project efficiency*, *impact on the customer,* five questions for *impact on the team*, *business and directional success,* and *preparing for the future*.

To capture respondents' subjective estimates about the project management approach applied in a particular project, a continuum of seven-point, bipolar Likert type scale was used (Nunnaly and Bernstein, 1994), where a far-left point (i.e. 1) is a measure of a strong, agile approach, opposed to a far-right measure of strong, traditional approach (i.e. 7). The medium-scale section (i.e. 4) was designed to indicate the hybrid approach (nor strongly in agile or traditional, but a mixture of these two). Given that they are different by nature, in contrast to the afore-mentioned, a unipolar, five-point Likert type scale was used (Nunnaly and Bernstein, 1994) to measure respondents' perception of project success dimensions (1 – strongly disagree, 5 – strongly agree).

4.2 Sample and data collection

The sample used in this research is non-probabilistic and individuals were selected using expert sampling as a type of purposive sampling technique. The distribution process was done electronically through the PMI (Project Management Institute) worldwide network of project management professionals. Invitations were sent by email, via surveymonkey.com, to PMI members, and posted in PMI communities or PMI LinkedIn and other professional groups.

The distribution process was conducted following Dillman's approach (Dillman and Smyth, 2008). Thus, only one reply was accepted by the respondents. To ensure the receipt of one response per respondent, multiply answers were unable in SurveyMonkey questionnaire settings, only allowing the survey to be taken once from the same device. Moreover, given that Dillman's approach utilities social exchange theory, the dissemination process was followed by a series of follow-up email reminders. After the two months, responses were obtained from 314 respondents. The exact number of targeted project professionals and response rate could not be defined as various PMI chapters distributed the questionnaire through their communities and different channels with no specific information concerning the number of persons contacted. However, only 227 received responses were considered and treated as a "completed survey." In other words, 87 responses were omitted from the final respondents' database due to the potential risk of non-engaged bias, measured by the very low standard deviations in responses (below 0.2) or with the low percentage of non-completed questions (below 70%). To ensure sample representativeness, 227 respondents were

compared with the omitted ones. The results show there are no differences between these groups.

4.3 Sample demographics

The sample consisted of respondents across different categories of age, education and years of work experience. 227 respondents were from 49 different countries worldwide, encompassed staff with vast project management working experience. 148 respondents had 10 or more years of project management working experience (with 48 of them with 20–30 years and 8 with more than 30 years), and more than 80% of respondents have a professional PM certification.

The organizations where respondents were employed and to which all furthered questions are related varied in size with 43 (18.9%) organizations with 1–50 employees, 30 (13.2%) with 51–200 employees, 21 (9.3%) with 201–500 employees, 27 (11.9%) 501–1,000 employees and 106 (46.7%) with over 1,000 employees. Respondents came from organizations from diverse industries: 25% from IT, 11.5% finance and financial services, 8.8% construction, machinery, and homes, 8.4% telecommunications, 7.5% utilities, energy, and extraction, 7.5% government, 5.3% education, 4.8% manufacturing, 4% healthcare and pharmaceuticals, 3.1% business support and logistics, 3.1% insurance, 2.2% airlines and aerospace (including defense), 1.8% food and beverages, 1.8% transportation and delivery and other industries have less than 1% (advertising and marketing, automotive, nonprofit, real estate). The sample structure for the moderating variable is given in Table 3.

5. Results

5.1 Exploratory factor analysis

The exploratory factor analysis (EFA) of project success dimensions was done for two main reasons. First, aside from theoretical validations in prior studies (Mir and Pinnington, 2014; Shenhar and Dvir, 2007; Shenhar *et al.*, 2001), it was essential to validate these factors' constitution concerning their manifest variables. Second, previous studies did not mention any specifics about the construct robustness and structural consistency across different states and organizational types. Such differences might affect the composition of research constructs by their respective manifest variables.

Subsequently, the authors Shenhar *et al.* (2001), in their study, have empirically validated only four out of five factors constituting the project success (i.e. project efficiency, impact on the customer, business success and preparing for the future). The fifth factor, impact on the team, was, eventually, proposed and incorporated into the same authors (Shenhar and Dvir, 2007). This five-factor solution to project success was empirically tested in a study conducted by Mir and Pinnington (2014) afterward. However, to empirically validate the constitution of these factors by their respectful manifest variables, the authors have used PCA (principal component analysis), which is, opposed to the factor extraction method used in this research (i.e. maximum likelihood), a simple linear combination of manifest variables (Hair *et al.*, 2009).

Thus, bearing in mind the results and diversity of methodological approaches in previous studies, EFA was conducted to validate and confirm the constitution of these factors, by their respectful manifest variables (i.e. (1) *project efficiency*, (2) *impact on the team*, (3) *impact on the customer*, (4) *business and direct organizational success* and (5) *preparing for the future*). For EFA, the maximum likelihood method of extraction was used. A un-rotated factor solution was examined first. The KMO (Kaiser-Meyer-Olkin measure of sampling adequacy) has yielded a value of 0.877, while Bartlett's test of sphericity was statistically significant ($p < 0.01$, df = 210). These values were acceptable (Thompshon, 2004). Concerning the eigenvalues greater than one, the extraction results have yielded a five-factor solution

Type of variable	Frequency	Percent (%)
Organization industry clustered in non-information and information technologies		
Non-information technologies	165	72.7
Information technologies	57	25.1
Missing	5	2.2
Project type clustered in non-software and software development		
Non-software development	160	70.5
Software development	67	29.5
Type of project client/customers		
An internal client	75	33.0
External client	145	63.9
Other	7	3.1
Project length		
To 6 months	45	19.8
6 months to 1 year	79	34.8
1–2 years	64	28.2
More than 2 years	39	17.2
Project value		
To $100.000,00	57	25.1
$100.000,00–$500.000,00	55	24.2
$500.000,00–$2 million	51	22.5
Over $2 million	64	28.2
Team size		
Less than 8 members	82	36.1
8–15 members	76	33.5
More than 15 members	69	30.4
Project complexity level		
I level "assembly"	70	30.8
II level "system"	157	69.2
Project novelty level		
Products, services, features new to the market	68	30
Product, service (project output) totally new to the organization (but not for the market)	50	22.0
Some components features new to the organization (but not for the market)	63	27.8
Routine operation – not new for the organization neither for the market	46	20.3
Project technology utilization		
Low-tech	43	18.9
Medium-tech	112	49.3
High-tech	72	31.7
Project pace		
Regular-time	57	25.1
Fast-competitive	110	48.5
Time-critical	60	26.4

Table 3.
The sample structure

(Thompshon, 2004). The five-factor solution was also confirmed by the values of the scree plot (Thompshon, 2004). Eigenvalues were also acceptable. Moreover, the five-factor solution has yielded a good result in the percent of the cumulative sample variance (68%). The explained variance of the five-factor solution is given in Table 4.

Consequently, the rotated factor solution, with a fixed number of five factors, was applied. Since the relevant literature sources did not mention that factors should not be correlated, the promax method of rotation was used (Thompshon, 2004). Among 23 items, two items had a very low factor loading scores. Thus, these items were omitted from the matrix structure (Thompshon, 2004). The values of factor loadings for the remaining 21 items were following literature recommendations (Thompshon, 2004). Hence, the final, five-factor solution for EFA was accepted. This is shown in Table 5.

The remaining items formed a five-factor solution for project success. Thus, the first factor was identified as "Impact on the team" (I53.2-I53.1), followed by the "Impact on the Customer/Client" (I54.4-I54.1), "Business and Direct Organizational Success" (I55.2-I55.4), "Preparing for the Future" (I56.5-I56.3) and "Project efficiency" (I52.1 and I52.2), respectively. This final solution is further analyzed by the Cronbach's alpha test of reliability $\alpha \geq 0.7$ (Nunnaly and Bernstein, 1994), while the associations between these constructs were tested by Spearman's correlations (Hair *et al.*, 2009). These values were acceptable (Thompshon, 2004). This is shown in Table 6.

Thus, the results of EFA provided the empirical validation of project success factors. The constitution of five factors of project success, concerning their manifest variables, was empirically tested. It could be argued that project success factors are robust and structurally consistent across different origins of the respondents (i.e. states) and organizational types. For further analysis, EFA results were recorded as regression latent factor scores.

5.2 Cluster analysis of project management approach

The K-means cluster method was used to distinguish respondents' profiles among agile, hybrid and traditional project management approaches. This method's application was carried out following previous studies in project management, where cluster analysis was commonly applied (e.g. Yang *et al.*, 2011; Huang and Han, 2008; Reyck *et al.*, 2005). In a study by Reyck *et al.* (2005), the grouping of organizations with different levels of project portfolio management (PPM) adoption was done with the K-means method of clustering. Using this multivariate statistical method, the authors could classify elements into relatively homogenous groups by minimizing the variance in using PPM approaches within the groups and maximizing the variance across the research groups. Similarly, Hunag and Han (2008) have used cluster analysis to classify software projects according to project duration. The authors have observed the statistically significant distance between group means of clusters to distinguish among research groups. In the study of Yang *et al.* (2011), identifying homogenous project clusters with the same perceptions of teamwork was also carried out with K-means clustering as a primary classification method.

Thus, to continue the empirically validated good research practice in project management, K-means of clustering were also used in this research. Given that the cluster analysis requires continuous data (Hair *et al.*, 2009), the summation of respondents' scores was conducted across 21 manifest variables. This way, the composite value was obtained for each row (i.e. response). Presumably, the number of clusters was set to three (i.e. agile, hybrid and

Factor	Eigenvalue	% Variance	Cumulative %
1	7.971	37.955	37.955
2	2.003	9.540	47.495
3	1.818	8.657	56.152
4	1.375	6.548	62.700
5	*1.071*	*5.101*	*67.801*

Table 4.
Five-factor solution explained variance

Manifest variable	Fac. 1	Fac. 2	Fac. 3	Fac. 4	Fac. 5
I53.2	0.830				
I53.3	0.779				
I53.5	0.778				
I53.4	0.764				
I53.1	0.740				
I54.4		0.866			
I54.3		0.815			
I54.2		0.788			
I54.1		0.636			
I55.2			0.940		
I55.3			0.742		
I55.1			0.736		
I55.5			0.375		
I55.4			0.332		
I56.5				0.817	
I56.1				0.631	
I56.4				0.580	
I56.2				0.538	
I56.3				0.421	
I52.1					0.872
I52.2					0.793

Table 5.
Rotated, five-factor solution

No	Construct	Items	α	1	2	3	4	5
1	Impact on the team	I53.2-I53.1	0.896	1				
2	Impact on the customer/Client	I54.4-I54.1	0.873	0.60*	1			
3	Bus. and org. success	I55.2-I55.4	0.839	0.47*	0.52*	1		
4	Preparing for the future	I56.5-I56.3	0.754	0.50*	0.39*	0.43*		
5	Project efficiency	I52.1, I52.2	0.783	0.55*	0.65*	0.50*	0.37*	1

Note(s): *Significant at the level 0.01 level (2-tailed)

Table 6.
Rotated, five-factor solution

traditional). After six iterations, the values of cluster centers do not significantly change. Thus, we could presume that the composite variable's cluster analysis has yielded an acceptable solution (Hair *et al.*, 2009).

Moreover, the ANOVA (Analysis of Variance) test has shown statistically significant differences between the final cluster mean values concerning their mutual distances ($F = 468.567$, $p < 0.01$). Hence, it could be said that the three-cluster solution is stable (Hair *et al.*, 2009), where cluster 1 captures the middle values of the composite variable (i.e. hybrid approach), while cluster 2 and 3 are leaning towards the opposite sides of each other (far left – agile, far-right – traditional, respectively). Cluster analysis statistics are shown in Table 7.

An additional descriptive data about the main cluster characteristics are presented in the Table A1 in Appendix, which provides a cross tabulation of clusters (agile, hybrid, traditional) with a distribution of organizational size and industry sector across clusters.

5.3 Testing research hypotheses

Similar to the previous studies in project management (e.g. Reyck *et al.*, 2005; Yang *et al.*, 2011), to test the significance among research groups, the research hypotheses H1 to H5 were tested with ANOVA tests. Specifically, the differences in EFA regression latent factor scores

	Cluster 1 – Hybrid	Cluster 2 – Agile	Cluster 3 –Trad
Initial cluster centers			
	88.0	43.0	133.0
Changes in cluster centers			
Iteration 1	0.749	12.500	12.643
Iteration 2	0.394	5.341	6.714
Iteration 3	0.220	2.808	4.038
Iteration 4	0.119	1.242	1.217
Iteration 5	0.312	0.497	0.000
Iteration 6	0.000	0.000	0.000
Final cluster centers			
	87.86	65.39	108.39
Distance between final cluster centers			
Cluster 1	0	–	–
Cluster 2	22.468	0	–
Cluster 3	20.532	43.000	0
Number of cases per cluster			
	111	67	49

Table 7.
Cluster analysis statistics

of project success dimensions were compared across the project management approach (i.e. cluster 1 – hybrid, cluster 2 – agile, cluster 3 – traditional).

The results have shown a statistically significant difference in the case of two project success dimensions: "impact on the team" and "preparing for the future." The results of the homogeneity of variances tests between clustered groups speak in favor of these results. The ANOVA descriptives are given in Table 8, while the tests of homogeneity of variance and ANOVA test results of hypotheses are shown in Tables 9 and 10, respectively.

The posthoc tests for the hypothesis of H1 and H5 further reveal the nature of these differences. Specifically, regarding the "impact on the team," there is a clear distinction between agile and traditional approaches. A more agile-oriented approach produces a significantly more significant positive impact on the team. This assumption is strongly endorsed, given that the difference is evident in all posthoc tests (Tukey HSD, LSD, and Bonferroni; $p < 0.05$; Hair *et al.*, 2009). Similarly, in the case of "preparing for the future," the agile approach, opposed to hybrid and traditional ones, also have a distinctively significant greater impact (Tukey HSD, LSD, and Bonferroni; $p < 0.05$; Hair *et al.*, 2009). However, given the inconsistent results of p-values of the Bonferroni test ($p > 0.05$; Hair *et al.*, 2009), a similar assumption is not met regarding the differences between hybrid and traditional approaches.

5.4 Inclusion of the moderating variables

To test the research hypothesis, H2a to H5a moderating variables were included, and the ANOVA results were further analyzed. H2a and H5a were analyzed because only in these two dimensions (impact on the team, preparing for the future) there is a statistical difference among hybrid, agile, and traditional project management approaches.

The regression analysis was used to test the impact of moderating variables across three clusters of project management approach – agile, hybrid and traditional. Model fit statistics are given in Table 11, while regression analyses are to be found in Table 12. The model fit statistics show that the agile approach is statistically significant in both dependent variables. In contrast, the hybrid approach is only acceptable in the case of an impact on the team.

Impact on the customer/client		N	Mean	Std. dev	Std. error	Lower bond*	Upper bond*
	Hybrid	111	−0.099	0.946	0.09	−0.277	0.08
	Agile	67	0.203	0.947	0.116	−0.029	0.434
	Traditional	49	−0.054	0.984	0.141	−0.336	0.23
Impact on the team							
	Hybrid	111	−0.027	0.883	0.084	−0.193	0.14
	Agile	67	0.227	0.985	0.121	−0.014	0.467
	Traditional	49	−0.25	1.034	0.148	−0.546	0.048
Business and direct organizational success							
	Hybrid	111	0.013	0.875	0.084	−0.152	0.178
	Agile	67	0.065	1.083	0.133	−0.2	0.329
	Traditional	49	−0.117	0.888	0.127	−0.372	0.139
Preparing for the future							
	Hybrid	111	−0.073	0.865	0.083	−0.235	0.091
	Agile	67	0.431	0.864	0.106	0.22	0.641
	Traditional	49	−0.426	0.835	0.12	−0.666	−0.186
Project efficiency							
	Hybrid	111	−0.038	0.868	0.083	−0.201	0.127
	Agile	67	0.162	0.977	0.12	−0.077	0.4
	Traditional	49	−0.137	0.999	0.143	−0.424	0.151

Table 8.
ANOVA descriptives

Note(s): *95% Confidence Interval for Mean

	Levene statistic	df1	df2	Sig. (*p*)
Impact on the customer/client	0.123	2	224	0.885
Impact on the team	0.437	2	224	0.646
Business and direct organizational success	2.183	2	224	0.115
Preparing for the future	0.801	2	224	0.450
Project efficiency	1.717	2	224	0.182

Table 9.
Test of homogeneity of variances

Hypothesis	Dimension	*F*	Sig. (*p*)	H supported?
H1	Project efficiency	1.631	0.198	NO
H2	Impact on the team	3.652	0.027**	YES
H3	Impact on the customer/client	2.175	0.116	NO
H4	Business and direct organizational success	0.541	0.583	NO
H5	Preparing for the future	14.837	0.000*	YES

Table 10.
Organizational ANOVA test results of hypotheses

Note(s): *Significant at < 0.01, **Significant at < 0.05

It was not the case for the traditional approach. Thus, only regression analyses for hybrid and agile approaches, concerning their impact on dependent variables, were considered meaningful and further analyzed.

In the case of project success dimension impact on the team, four moderating variables (i.e. organizational industry, project type, project novelty, and project complexity) have a statistically significant moderating effect that differentiates impact on the team concerning

the project management approach applied. In the case of project success dimension preparing for the future, two moderating variables (i.e. project complexity and project technology uncertainty) have a statistically significant moderating effect. It could be concluded that H2a and H5a are partly accepted.

6. Discussion

The results have shown that projects that are managed in a more agile way had a greater positive impact concerning the two out of five individual project success dimensions over the traditional one: impact on the team, which represents teamwork effectiveness and satisfaction, and preparation for the future, which addresses the contribution of the project to building capacities in technological and organizational infrastructure and improving business success for the future.

We could say that it is not surprising that a more agile approach produces a significantly greater positive impact on the team because an agile approach gives preference to people and their interactions (Vinekar *et al.*, 2006). Agile values and principles stress the importance of energizing, empowering team members and their interactions to build the project around motivated individuals (Beck *et al.*, 2001; Augustine, 2005). As opposed to the traditional approach, much more emphasis is placed on collaboration and communication among team members and stakeholders (Gemino *et al.*, 2020). When the project team is strengthened and trusted to get the job done, it motivates them and increases their responsibility (Hendriksen and Pedersen, 2017). It could be argued that the empowered and motivated team could also reduce the time needed to complete different features and tasks.

	Hybrid				Agile				Traditional			
Dep. var	R	R^2	F	Sig	R	R^2	F	Sig	R	R^2	F	Sig
Impact on the team	0.46	0.21	2.32	0.014*	0.55	0.31	2.11	0.035*	0.58	0.34	1.67	0.122
Prep. for future	0.37	0.13	1.37	0.201	0.54	0.29	1.96	0.05**	0.41	0.17	0.65	0.772

Note(s): * Significant ≤ 0.05; **Significant at 0.05

Table 11. Organizational model summary statistics and ANOVA tests for regression models

	Hybrid			Agile			Traditional		
Variable	Stan. β	t	Sig	Stan. β	t	Sig	Stan. β	t	Sig
Dependent variable – Impact on the team									
Org. industry	0.243	2.373	0.020*	0.322	2.579	0.013*	0.067	0.365	0.717
Project type	0.250	2.494	0.014*	0.118	0.896	0.375	0.390	2.454	0.019*
Project complexity	0.245	2.472	0.015*	0.068	0.528	0.600	0.006	0.032	0.975
Project novelty	0.077	0.789	0.432	0.334	2.293	0.026*	0.092	0.539	0.593
Tech. uncertainty	0.204	1.879	0.063	0.219	1.615	0.112	0.327	1.795	0.081
Project pace	0.010	0.103	0.918	0.116	0.870	0.388	0.174	1.067	0.293
Dependent variable – Preparing for the future									
Org. industry	0.066	0.614	0.540	0.246	1.946	0.057	0.078	0.379	0.707
Project type	0.072	0.686	0.494	0.105	0.788	0.434	0.078	0.439	0.663
Project complexity	0.113	1.091	0.278	0.274	2.091	0.041*	0.095	0.477	0.636
Project novelty	0.061	0.600	0.550	0.128	0.873	0.387	0.050	0.261	0.796
Tech. uncertainty	0.249	2.196	0.030*	0.171	1.243	0.220	0.051	0.250	0.804
Project pace	0.100	0.954	0.342	0.140	1.033	0.306	0.133	0.727	0.472

Note(s): * Significant ≤ 0.05

Table 12. Organizational Regression results for all three clusters

The results of this research offer limited support for research done by Serrador and Pinto (2015). They examined the effect of applying an agile approach in organizations in relation to organizational goals, taking into account two dimensions of project success: efficiency and overall stakeholder satisfaction. The research results showed that the level of agility used in the project has a statistically significant impact on both dimensions of project success, judging by stakeholders' efficiency and satisfaction (including team satisfaction). The same was evidenced by Gemino *et al.* (2020), that agile and hybrid outperformed traditional approaches impact on stakeholder success measures. According to Pacagnella *et al.* (2019), projects in which the team is considered integrated have a 2.898 greater chance of achieving project success than otherwise. According to those authors, this result indicates that the team's ability to share tacit knowledge increases the project's agility, especially in troubleshooting, tending to bring it closer to its goals concerning deadlines and costs. Team satisfaction and effectiveness are considered an important component of project success in many other studies (e.g. Bryde, 2008; El-Saboni *et al.*, 2009; Müller and Turner, 2007; Müller and Jugdev, 2012; Westerveld, 2003).

Preparing for the future success dimension includes questions that assess how an organization prepares for future opportunities through a particular project. When analyzing the significantly greater impact of the agile approach on preparing for the future, we did not identify any research that we could use to approve or disapprove or compare this result in previous literature. Dvir *et al.* (2003a, b) identified, in their research, the managerial factors contributing to success dimension preparing for the future as follows: "prior identification of all critical stages in the project and assigning them as control milestones, the timing of the design freeze (the later this occurs, the greater the project's contribution to future potential), number of design cycles (the greater the number of design cycles, the greater the contribution to future potential), organizational structure (flexible), written reports (a negative effect)." Though, with big reserve, we could indicate from these variables that they are more agile in terms of our research. To some extent, this finding could support our result, and we could argue that a more agile approach in managing projects could give a higher possibility and chance to build organizational, personnel, and infrastructural capacity for the future.

Surprisingly, no statistically significant difference exists in the customer's impact. A more agile approach highlights the value and importance of collaboration with the customer to deliver the desired value while facing the project's unpredictability (Augustine, 2005). This could be explained by the fact that different project types require different customer involvement levels. When using the agile approach, customers' involvement is intensive during the whole project, with constant feedback. In our sample, we had different kind of projects, where this kind of interaction would not be necessary. Though at the end customer would be satisfied. Projects guided by a more traditional approach do not necessarily require customer support and ongoing customers' involvement, once the specifications are clearly defined. That could be the reason why neither one approach has a significantly higher impact on this dimension.

The interesting finding, which complements the research results presented by Gemino *et al.* (2020), is that the data did not show statistically important differences among traditional, agile and hybrid approaches concerning their impact on the efficiency project success dimension (meeting schedule, budget goal).

If we return back to the Proposition 1: Project management approaches differentiate concerning their impact on individual project success dimensions, we could say that this proposition is relevant for the two out of five dimensions.

We further found evidence that the organizational industry (grouped in IT and non-IT), project type, project novelty and project complexity level can act as significant moderators in favor of agile and hybrid approach. In detailed, these correlations are positive, meaning that, positive impact on the team has shown to be higher when the agile approach is used in projects from IT industries, which have a higher level of novelty.

Project novelty is determined by the project's product – how new the product is to the market, the customers, the potential users. It affects the accuracy of market data, time, and a number of iterations it takes to finalize and freeze the product's requirements. Clearly, agile approach is more suitable for project team and it is not surprising that it increases team efficiency and satisfaction. As the novelty of the product increase, the team extend their experience from quick product modifications, in derivate projects, to gaining extensive experience in new markets (inspired by Shenhar and Dvir, 2007).

The team's positive impact has shown to be higher when the hybrid approach is used in software development projects in IT industries, which are characterized by a higher complexity level. Build upon their research, Shenhar and Dvir (2007) indicated the need to resort to more formal procedures when project complexity increases. Increased project complexity implies a more complex organization, an increased interaction among its parts, and increased formality in managing the project. A hybrid approach to more complex projects includes a higher level of formality, which could be more suitable for these projects. It must be taken into account that different managerial variables were under analysis in these two studies. As opposed to this, Serrador and Pinto (2015) found that project complexity does not act as a moderating variable between the agile approach and project success, taking into account two dimensions: efficiency and overall stakeholder satisfaction (including team satisfaction).

Concerning the difference in the level of impact that an agile, hybrid, or traditional project management approach has on project success dimensions preparing for the future, project complexity and technology uncertainty act as significant moderators. Projects with a higher complexity level managed in a more agile way, and projects with a higher level of technology uncertainty managed in a more hybrid way, have higher success when considering the dimension preparing for the future. The more complex projects are and the higher level of technological uncertainty they have, if managed appropriate, they will bring from additional organizational capabilities, over new product lines and markets, to leadership positions and new core technologies. It is reasonable to get these two moderators as significant when we analyze the impact on preparing for the future, because through derivate and low-tech project we can get almost none advancement when talking about preparing organization capabilities and technologies for the future. It should be taken into account that projects with higher level of technological uncertainty, may cause increased budgets and longer projects (Shenhar and Dvir, 2007) and require more formal approach indicating the need for better planning and control. This could support our finding that hybrid approach distinguished in this case.

If we return back to the Proposition 2: Project characteristics could moderate the differences among project management approaches and their impact Project management approaches differentiate concerning their impact on individual project success dimensions, we could say that this proposition is relevant for the two out of five dimensions.

7. Conclusion

Built upon the literature, we developed and tested the research framework that explores new research ground. Up to our knowledge, this is one of the few studies examining the efficiency of agile as opposed to the traditional approach for project success in and beyond the software domain, taking into account different project success dimensions. Although various parameters identified in the literature differentiate agile from the traditional approach, when clustered, they exhibited statistically significant differences in just two out of five project success dimensions analyzed in this study.

Different project types require different management approaches. However, it can be acknowledged that agile and traditional should be combined in project management practice to benefit from both approaches. Approach selection and the combination should be handled

with care, considering both the project's characteristics, the desired impact in the short and long term, and other contextual factors. However, correctly choosing a project management approach does not necessarily lead to project success, depending on the implementations' efforts and efficiency. Perceiving this as exploratory research, we do not intend to offer final and conclusive solutions to existing problems but better understand this thematic, which was not subject to previous research in the same or a similar manner.

7.1 Limitation and future research

According to relevant scientific literature sources, only variables that were theoretically grounded and academically validated in previous studies were used to develop the research instrument. However, the differentiation between an agile and a traditional approach, based on the literature's findings, cannot be regarded as absolute and conclusive.

Biases from the previous research findings and literature were potentially embedded in the research instruments. The impact of such biases on the interpretations of the results we presented must be acknowledged.

Agile and traditional approaches may differ in other parameters, which were not included in this research. Improving the research instrument in the future would increase the validity of the research findings. Furthermore, a project's success is a complex concept seen in this research as multidimensional, dynamic, and relative, making it difficult to compare the effects that different management approaches can have on a project, which must be taken into account. The research was limited to five project success dimensions, following the model proposed by Shenar and Dvir (2007). Future research could include other success measures to deepen understanding.

The research also explored whether there were differences in the impact on the individual project success dimensions. In contrast, overall success was not observed. It would be valuable to capture this in future research. Some of the expected differences in this research have not been confirmed. Future research is needed to delve deeper into the analysis of the difference in the agile approach's impact compared to traditional ones in and beyond the software industry. It is essential to emphasize that observation and the conclusion given in this paper are "perceptions-based" and not "facts-based." Data collected through experimental research or observation of many case studies would increase the validity of the research results in the future.

The distribution process through the PMI network could have some influence on the responses obtained. If the respondents had belonged to another community as IPMA or SCRUM association, there is a possibility that the results would be different. For example, it would be expected for the SCRUM association that respondents are majorly from the IT industry and experienced in software development. We did not want to have the one-dimensional perception of respondents. Future research could be based on a random sample method of project managers globally to increase the universality of results.

Another challenge is to define more clearly and empirically establish a hybrid project management approach. Future research would also be necessary to identify essential project characteristics for deciding whether to implement a particular management approach, and the problems that agile, hybrid, and traditional approaches may cause, taking into account the different project characteristics. Finally, an objective comparison between variables identified in different studies indicating which were proven significant and which one are not could provide new insights for future research.

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Appendix

Table A1. Cluster descriptive data

	Cluster 1 – Hybrid		Cluster 2 – Agile		Cluster 3 – Trad	
	No	%	No	%	No	%
Organizational size						
1–50 Employees (Micro)	21	18.9	13	19.4	9	18.4
51–200 Employees (Small)	10	9.0	10	14.9	10	20.4
201–500 Employees (Medium)	16	14.4	2	3.0	3	6.1
501–1,000 Employees (Large)	12	10.8	7	10.4	8	16.3
Over 1,000 Employees (Very Large)	52	46.8	35	52.2	19	38.8
Total	111	100.0	67	100.0	49	100.0
Industrial sector						
Advertising and Marketing	1	0.9	1	1.5	4	8.2
Airlines and Aerospace (including Defense)	2	1.8	2	3.0	2	4.1
Automotive	3	2.7	9	13.4	4	8.2
Business Support and Logistics	7	6.3	2	3.0	2	4.1
Construction, Machinery and Homes	8	7.2	12	17.9	3	6.1
Education	11	9.9	1	1.5	6	12.2
Finance and Financial Services	3	2.7	1	1.5	11	22.4
Food and Beverages	10	9.0	5	7.5	1	2.0
Government	4	3.6	15	22.4	2	4.1
Healthcare and Pharmaceuticals	31	27.9	2	3.0	2	4.1
Information Technologies	4	3.6	6	9.0	8	16.3
Insurance	3	2.7	5	7.5	3	6.1
Manufacturing	2	1.8	1	1.5	4	8.2
Non-profit	6	5.4	3	4.5	2	4.1
Real Estate	3	2.7	1	1.5	4	8.2
Telecommunications	11	9.9	2	3.0	2	4.1
Transportation and Delivery	1	0.9	9	13.4	3	6.1
Utilities, Energy and Extraction	2	1.8	2	3.0	6	12.2
Non-specified	2	1.8	2	3.0	1	2.0
Total	111	100.0	67	100.0	49	100.0

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