

Agile project management under the perspective of dynamic capabilities

Gestão ágil de projetos sob a perspectiva das capacidades dinâmicas

Lisiane Sassi Ferreira¹ , Farley Simon Nobre¹ 

¹Universidade Federal do Paraná – UFPR, Escola de Administração, Programa de Pós-graduação em Gestão de Organizações, Liderança e Decisão – PPGOLD, Curitiba, PR, Brasil. E-mail: sassilisiane@gmail.com; f.nobre@ufpr.br

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Abstract: There is a growing academic and industrial interest in how firms can adopt agile project management to meet the demands of dynamically fast-moving environments. However, organizations face difficulties using agile methods in developing a physical product, like the companies found in the automotive industry. This article aims to study agile project management from the perspective of dynamic capabilities. It presents a strengthened analysis of the adoption of agile methods needed for developing physical products in the automotive industry. To address this issue, we formulated the following research question: “*what are the dynamic capabilities associated with the agile project management of product development in the automotive sector?*”. The article presents a case study of a multinational organization in the automotive sector that implemented concepts and practices of agile methods in the project management of new vehicles. Results evidenced the manifestation of dynamic capabilities in the organization’s agile project management scope at sensing, seizing, and reconfiguring levels. Furthermore, findings showed the presence of agile methods in the projects and their implications for the organization regarding benefits (like communication, time, effectiveness, autonomy, and motivation gains) and challenges (like resistance to organizational changes). Finally, we propose a framework for analyzing relationships between dynamic capabilities’ microfoundations and agile project management practices to guide the choice and implementation of agile methods in the automotive sector.

Keywords: Agility; Agile project management; Agile methods; Dynamic capabilities; Automotive sector.

Resumo: Há um interesse crescente na literatura e em diversos setores industriais sobre a adoção de gestão ágil de projetos para atender a demandas de ambientes caracterizados por rápidas mudanças. No entanto, organizações encontram dificuldades associadas ao uso de métodos ágeis no desenvolvimento de um produto físico, a exemplo da indústria automotiva. O propósito deste artigo é estudar a gestão ágil de projetos sob a perspectiva das capacidades dinâmicas e suas relações por meio do desenvolvimento de um quadro conceitual sobre a adoção de métodos ágeis para o desenvolvimento de produtos físicos da indústria automotiva. Por conseguinte, formulou-se a seguinte pergunta de pesquisa: “*quais são as capacidades dinâmicas associadas à gestão ágil de projetos de desenvolvimento de produto no setor automotivo?*”. O artigo apresenta um estudo de caso de uma multinacional do setor automotivo que implementou métodos ágeis na gestão de três projetos de desenvolvimento de novos veículos. Constataram-se indícios de capacidades dinâmicas no escopo de

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gestão ágil de projetos da organização nos níveis de sensing, seizing e reconfiguring. Identificaram-se métodos ágeis nos projetos estudados e as suas implicações na organização em termos de benefícios (a exemplo de ganhos em comunicação, tempo, eficácia, autonomia e motivação) e desafios (a exemplo de resistência a mudanças organizacionais). A partir dos resultados, elaborou-se um quadro conceitual que relaciona microfundamentos de capacidades dinâmicas à adoção de práticas de gestão ágil de projetos, com o intuito de nortear a escolha e implementação de métodos ágeis em organizações do setor automotivo.

Palavras-chave: Agilidade; Gestão ágil de projetos; Métodos ágeis; Capacidades dinâmicas; Setor automotivo.

1 Introduction

There is growing interest in the literature on adopting agile project management¹ in several industrial areas related to environments characterized by rapid changes (Teece, 2018, 2019). Starting and consolidating itself successfully in the software industry (Conforto et al., 2016; Rigby et al., 2016; Sutherland & Sutherland, 2014), the use of agile project management has become a subject of study and application in other sectors, extending to other areas such as agricultural and food (Rigby et al., 2016), civil engineering (Albuquerque et al., 2020; Arefazar et al., 2022), pharmaceutical (Azanha et al., 2017) and telecommunications (Kurniawan et al., 2020).

In this context, the software industry has been experimenting with new management models with multiple and parallel activities related to each other in a “looser” way. However, with a high degree of coordination, called the “agile” model, the criterion agility is the leading competitive factor (Leybourne, 2009; Conforto et al., 2016). Nevertheless, to achieve project management processes improvement in technological environments, it is necessary to use alternative methods, which can accommodate agility and flexibility criteria for the development of capabilities that contribute to the project processes improvement and the creation of the organization’s competitiveness – by considering the reduction of deadlines and product delivery cycles, cost control, multifunctional teams trained through self-management and collective learning involving groups of projects, employees and customers (Rigby et al., 2016, 2018; Takeuchi & Nonaka, 1986).

In this regard, previous research indicates that it is possible to have success with this model in agricultural or food industries (Rigby et al., 2016), in the civil industry (Albuquerque et al., 2020; Arefazar et al., 2022), in the pharmaceutical industry (Azanha et al., 2017), in the telecommunications industry (Kurniawan et al., 2020) and manufacturing industries (Zuzek et al., 2020).

However, some studies have pointed out difficulties in adopting agile project management in other industrial classes due to differences between the development of software and physical products (Rigby et al., 2016; Dikert et al., 2016; Albuquerque et al., 2020; Stare, 2014; Conforto et al., 2014). Some challenges are associated with the organizational transition process from a traditional methodology to agile management, in addition to factors directly related to the product characteristics (Dikert et al., 2016; Highsmith, 2001). In this

¹Agility is “the capacity of an organization to efficiently and effectively redeploy/redirect its resources to value creating and value protecting (and capturing) higher-yield activities as internal and external circumstances warrant (Teece et al., 2016, p. 17). At the operational level, agility is “Agility is the project team’s ability to quickly change the project plan as a response to customer or stakeholders needs, market or technology demands in order to achieve better project and product performance in an innovative and dynamic project environment” (Conforto et al., 2016, p. 667).

sense, some authors have suggested the need to develop research on the conceptualization and application of agile project management based on experiences acquired in the software sector in the task environment of industries that develop physical products (Conforto et al., 2014, 2016; Rigby et al., 2016; Stare, 2014; Ciric et al., 2018; Bergmann & Karwowski, 2019; Zuzek et al., 2020). Additionally, there is a need to study project management from perspectives that can explain microfoundations of dynamic capabilities that can foster the process of agility in organizations (Teece et al., 2016; Teece, 2018, 2019).

This article aims to study agile project management from the perspective of dynamic capabilities and their relationships through the development of a conceptual framework for adopting agile methods for the development of physical products in the automotive industry. Dynamic capabilities constitute an organizational phenomenon (Teece, 2007, 2012; Teece et al., 1997) and they foster agility (Teece et al., 2016) in terms of construction (sensing), integration (seizing), and reconfiguration (reconfiguring) resources and skills in environments characterized by rapid technological change and high uncertainty, such as the automotive industry (Teece, 2018; Teece et al., 2016). In this way, we proceed to relate agile project management to the activities of creating and composing micro-foundations of dynamic capabilities that are constituted by groups of activities that include sensing (detecting - shaping opportunities and threats); seizing (seize - capturing the opportunities); and reconfiguring (reconfigure - maintaining competitiveness through the reconfiguration or transformation of the company's intangible and tangible assets) (Teece, 2007). In more detail, the microfoundation patterns of dynamic capabilities can comprise practices such as (i) sensing – realizing the need for change by directing projects to generate improvements in their operations and create market opportunities-, (ii) seizing – deciding on the creation of departments responsible for the agile transformation in the company - and (iii) reconfiguring – reconfigure project resources related to governance, operations, hiring, among other activities in the organization (Teece et al., 2016). Therefore, the research question was formulated: “what are the dynamic capabilities associated with the agile project management of product development in the automotive sector?”. As a methodology, the article presents a case study of a multinational in the automotive sector that implemented agile methods to manage three new vehicle development projects. The organization's operationalization of the agile method was carried out through the Scrum model. It offers an agile management structure and processes based on short cycles and continuous learning, differentiating itself from traditional methods that sequentially organize activities (Sutherland & Sutherland, 2014). The results showed signs of dynamic capabilities in the organization's agile project management scope at the sensing, seizing, and reconfiguring levels. Agile methods were identified in the organization's projects and their implications, in terms of benefits and challenges, for the studied organization. A conceptual framework was developed that relates microfoundations of dynamic capabilities to agile project management practices. The article explains agile project management through dynamic capabilities and guides decisions on adopting agile methods in organizations in the automotive sector.

This article is structured in five sections: (1) Introduction; (2) Theoretical foundation on agile project management, Scrum method, and dynamic capabilities; (3) Methodology and presentation of the case study; (4) Results and Analysis; (5) Discussions and Propositions; and (6) Final Considerations.

2 Theoretical foundation

2.1 Agile project management

Agile methods became better known in 2001 with the creation of the “Agile Manifesto”, which was prepared by professionals and software development theorists who introduced the term “agile” and questioned traditional project management techniques (Highsmith, 2001; Sutherland & Sutherland, 2014). The principles enunciated in this manifesto generated requirements to deliver high-quality software agilely. Some of these requirements include self-organizing teams; customers actively involved in the development process to receive regular feedback; the ability to respond to changes over following a fixed schedule; and people and their motives must be above processes and tools (Dingsoyr et al., 2012; Rigby et al., 2016).

Agile project management practices include: prioritization (Cocco et al., 2011; Rigby et al., 2016; PMI, 2017; Sutherland & Sutherland, 2014; Zuzek et al., 2020); iterative planning (Conforto et al., 2014; Sutherland & Sutherland, 2014; PMI, 2017; Rigby et al., 2016; Highsmith, 2001); holding Scrum ceremonies (Conforto et al., 2014; Cervone, 2011; Sutherland & Sutherland, 2014; PMI, 2017; Saisa et al., 2019; Zuzek et al., 2020); agile mindset (Dikert et al., 2016; Albuquerque et al., 2020; Conforto et al., 2016; Nicholls et al., 2015); multidisciplinary and self-managing teams (Nicholls et al., 2015, Azanha et al., 2017; Dingsoyr et al., 2012; Rigby et al., 2016; PMI, 2017; Sutherland & Sutherland, 2014; Conforto et al., 2014; Takeuchi & Nonaka, 1986); decision making at the team level (Rigby et al., 2016; PMI, 2017; Sutherland & Sutherland, 2014; Conforto et al., 2014; Ruark, 2015); teams located in a single physical space (Cervone, 2011; Sutherland & Sutherland, 2014; PMI, 2017; Saisa et al., 2019; Hidalgo, 2019; Ruark, 2015); and visual management (Conforto et al., 2014; PMI, 2017; Sutherland & Sutherland, 2014). Implementing agile methodologies in companies is a significant challenge, as it implies a transformation movement involving several processes and individuals. Some challenges encountered during the transformation from the traditional methodology to the agile method were reported in the study by Dikert et al. (2016), such as general resistance to change, lack of team training, difficulty in interpreting agile concepts, use of traditional and agile methodologies at the same time, and correct Product Owner's role performance - customer representative and other parties project stakeholders and responsible for feeding and setting priorities.

2.2 Scrum

Scrum was created in 1993 by Ken Schwaber and Jeff Sutherland for faster, more reliable, and efficient software development (Sutherland & Sutherland, 2014). Its conception was inspired by the work of Takeuchi & Nonaka (1986). They present characteristics of successful teams identified through interviews with executives and engineers from large companies in Japan and the United States. These authors presented six main characteristics: built-in instability; self-organizing project teams; overlapping development phases; “multilearning”; subtle control; and organizational transfer of learning. These characteristics are described in the Scrum model as cross-functional teams – having the various skills needed to execute a project; transcendent

- beyond the ordinary and trivial, are guided by a common goal; and autonomous (self-organizing), with authority to make their own decisions. In this context, the role of the management or leader is to be a facilitator removing obstacles from the team's path instead of just giving orders and exercising control (Cervone, 2011; Sutherland & Sutherland, 2014).

One of the basic principles of Scrum is to conduct the project through cycles called sprints, which usually last from one to two weeks. Sprints are not just a way to deliver faster but constitute a process of carrying out learning cycles and testing prototypes during the project.

At the beginning of each sprint, there is a meeting to plan the activities that will be carried out in this period, called Sprint Planning. At this meeting, the team determines the amount of work it believes it can accomplish during the sprint and the delivery criteria. The work themes are called stories, and tasks are associated with each of them. The stories selected to make up the sprint and that are available in the sprint backlog² are chosen from a list called the product backlog, in which all the work necessary to ensure deliveries throughout the project is listed (Sutherland & Sutherland, 2014).

The selection of stories in the backlog for the next sprint follows a prioritization pattern in which the Product Owner is responsible for ordering the items in the backlog by priority. Unfortunately, a bad habit in companies raised by Sutherland & Sutherland (2014) is the lack of prioritization of activities (Rigby et al., 2016) and the culture that “everything is a top priority”.

During the sprint, a daily meeting is held to check the progress of activities. In these meetings, the Scrum Master – the manager responsible for maintaining the processes and ensuring the application of the Scrum method – verifies which activities were carried out and which were not and identifies the obstacles that block the team's work (PMI, 2017; Cervone, 2011; Sutherland & Sutherland, 2014).

At the end of the sprint, team members meet with the Product Owner and show what they have accomplished in that time in a meeting called the Sprint Review. The Sprint Retrospective meeting is held to capitalize on the errors and successes of the executed sprint.

The main actors of the Scrum team and their primary responsibilities are as follows (PMI, 2017; Sutherland & Sutherland, 2014): Scrum Master, Product Owner, and the team (called an agile team).

The Scrum team is usually cross-functional and consists of a few people who work on the project with complete dedication. It is self-organized, has the autonomy to make decisions, and builds the solutions and strategies necessary to act (Cervone, 2011; PMI, 2017). All these characteristics broaden organizational experiences and create trust and mutual respect among team members (Rigby et al., 2016). This research focuses on the Scrum method because it is the method used in the cases studied, in addition to being based on the concept of Sutherland & Sutherland (2014), who present Scrum as an agile framework for application in project management that is not restricted to software development, including the automotive sector.

²The backlog is the ordered list, according to the Product Owner's prioritization, of all the work for an agile team (PMI, 2017).

2.3 Dynamic capabilities

An initial definition of dynamic capabilities was presented by Teece et al. (1997, p. 516) “[...] as the firm’s ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environment”. The term “dynamics” refers to developing and renewing competencies in response to the rapidly changing technological and market environment. In contrast, the term “capabilities” emphasizes the key role of strategic managers in adapting, integrating, and reconfiguring skills, resources, and organizations’ competencies to meet the requirements of these changes (Teece et al., 1997).

The concept of dynamic capabilities was influenced by ideas from theories of the company’s growth through its internal resources (Penrose, 1959) and the Resource-Based View (RBV) (Wernerfelt, 1984) that seek to explain the advantage competitive as a result of the confluence of value-generating assets, resources and dynamic processes of organizations (Barney, 1991). A sustained competitive advantage is understood as the company’s ability to devise value creation strategies that are not implemented simultaneously by another competitor, that last for a particular desirable period, and that can be replicated by the company (Barney, 1991). The distinction between dynamic and ordinary capabilities has been discussed by Teece (2007, 2014). Ordinary capabilities are associated with administrative and operational functions that are technically necessary for an organization. On the other hand, dynamic capabilities are related to “higher level” activities that organize ordinary activities and result from managerial skills in detecting opportunities, building solutions, and reconfiguring resources to create long-term values for the organization and its stakeholders.

Dynamic capabilities are capable of (Teece, 2007): detecting and outlining opportunities and threats; taking advantage of existing opportunities; and maintaining competitiveness by improving the company’s intangible and tangible assets. They commonly favor the development of new products and processes and the creation of viable business models (Teece, 2007). Groups or patterns of activities constitute them, also understood as microfoundations (Teece, 2007) that involve processes of sensing (detecting and shaping opportunities and threats); seizing (shaping and capturing the opportunities); and reconfiguring (integrating and generating elements of competitiveness through the reconfiguration or transformation of the company’s intangible and tangible assets).

Teece et al. (2016) state that organizations that develop solid dynamic capabilities have highly effective management teams, have robust and flexible organizational designs and foster agility. It is noteworthy that agility “[...] is costly to develop and maintain and sometimes even more costly if it is nonexistent” (Teece et al., 2016, p. 17). Therefore, it is an organizational attribute valuable in environments with deep uncertainties.

2.4 Microfoundations of dynamic capabilities and the agile management

To clarify the microfoundations, also called dimensions, of dynamic capabilities (Figure 1), Teece (2007) presents them in three items: (1) detect opportunities (sensing); (2) seizing opportunities detected; and (3) reconfigure/transform assets as needed (reconfiguring/transforming). Sensing comprises an organization’s processes to sense, filter, shape, calibrate, and analyze opportunities and external information to learn about competitors and customers. Seizing comprises the mobilization of

resources to meet the needs and opportunities obtained in detecting (sensing) activity and researching and developing opportunities through new products, processes, or services that better serve the market. Furthermore, Teece (2014) describes reconfiguring, which is called transforming, comprises the capabilities to recombine and reconfigure organizational assets and structures to improve the organization's internal processes and generate competitive advantages.

Therefore, it is believed that the Dynamic Capabilities perspective fosters agility (Teece et al., 2016) and constitutes an organizational phenomenon to be researched in organizations concerning the construction, integration, and reconfiguration of resources and competencies, including- procedures and processes, in environments with rapid technological change and characterized by uncertainties, as is the case of the automotive industry (Teece, 2018). Likewise, agile project management can be related to the activities of creating and composing microfoundations of dynamic capabilities (Teece, 2007), putting into practice the theoretical concepts of Teece (2007) and Teece et al. (2016) when studying a practical case in the automotive sector.

It is understood that agility can improve projects as it can deliver greater value to stakeholders. In addition, a hybrid approach can bring contributions and better maturity to project management (Gemino et al., 2021).

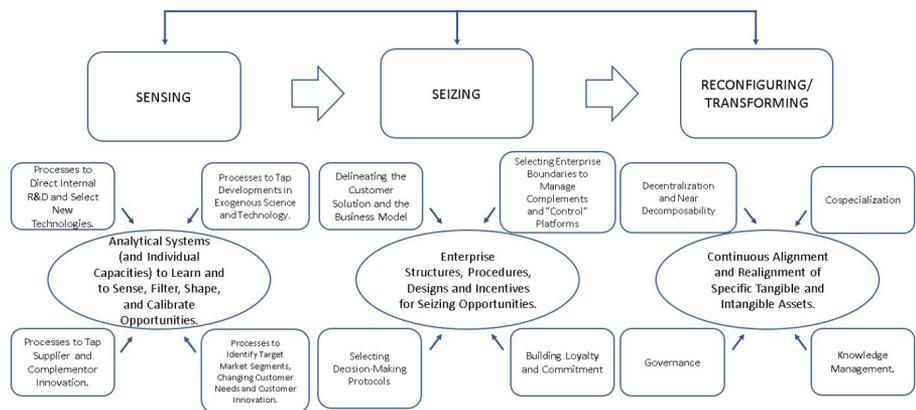


Figure 1. Foundation of Dynamic Capabilities Model. Adapted from Teece 2007).

3 Methodology

This article is grounded in qualitative and exploratory research. The authors conducted a case study of multiple projects (Eisenhardt, 1989; Seuring, 2008; Yin, 2014) in a multinational company in the automotive sector.

3.1 Case study

The company studied is a multinational in the automotive sector with industrial plants located in the Latin American region and projects for developing new vehicles. The company studied will be called by the pseudonym Automov SA to preserve its anonymity.

Automov SA was intentionally selected and is representative of the phenomenon studied and has complex and dynamic environments conducive to the dynamic

capabilities' manifestations (Teece et al., 1997) and the use of agile project management (Conforto et al., 2016; Sutherland & Sutherland, 2014). It was also selected for being a reference in its segment with more than 120 years of history, encouraging and supporting the use of agile project management and enabling the conduction of research through participant observation and interviews.

The project sampling was also defined intentionally, non-probabilistic way, in which three new projects of new vehicles were selected, with launches scheduled between 2021 and 2024. These projects were chosen because they involved improving processes in turbulent and dynamic environments, which are favorable elements for manifesting dynamic capabilities and adopting agile management (Teece et al., 1997; Sutherland & Sutherland, 2014; Conforto et al., 2016). Additionally, these projects were selected because they are the three main avenues for the development of new vehicles in Automov SA's engineering that used the agile methodology, in addition to presenting the convenience of availability of interviews with directors, managers, and employees.

3.2 Data collection

Data collection was carried out through documentary research, semi-structured interviews, and participant observation between 2020 and 2021. Data were collected on the company's history, vehicle projects, the project management model used, the company justifications regarding the agile transformation, and other elements. The interviews took place between September 2020 and April 2021 and participant observation between January 2020 and April 2021.

Fourteen people from two different groups called A and B were interviewed. Group A involved three company directors who were interviewed to identify the dynamic capabilities present in the company and explain managerial motivations and organizational objectives for the adoption of agile methods. As high-level managers in the company compound it, this group's contributions to identifying activities at the sensing level were highlighted. Group B involved three to four members from each of the three projects. Its members were interviewed to identify the manifestations of dynamic capabilities, the agile methods used, and their implications for the organization. The interviews were carried out until data saturation was observed when new significant patterns no longer appeared in response to the questions asked.

The interviews were transcribed using the Google Documents "Voice Typing" tool, with automatic transcription of videos recorded by Microsoft Teams. To correct possible erroneous transcriptions of the tool, the researcher listened again to the interviews and revised the transcript to obtain a reliable result of the content of the speeches. The 14 interviews had a total duration of 07 hours, 55 minutes, and 35 seconds, resulting in a total of 128 transcribed pages. At the same time, the participant observation technique was used to obtain information about the three selected projects through the insertion and direct contact of one of the researchers in the environment of the studied organization, observing the activities developed by different actors in the project (Bogdan, 1973; Angrosino, 2009; Yin, 2014). Observations were carried out in meetings and recorded using notes in a field diary, in Word® files organized by date, list of participants, and observed content. In the documentary research, data was collected from internal documents of the organization, such as PowerPoint® presentations, meeting

minutes, Excel tables, and internal emails. Materials from the company's new strategic plan released in early 2021 were also used.

Data analysis was performed based on the content analysis technique (Bardin, 2016). Validation and reliability were performed by triangulating different sources of material (Voss et al., 2002; Yin, 2014). Triangulation of data from documental research, theoretical framework, interviews, and participant observation was chosen.

4 Results and analysis

4.1 Dynamic capabilities identified at Automov SA

Table 1 presents the three classes of microfoundations of dynamic capabilities identified at the sensing, seizing, and reconfiguring levels, along with some fragments of the interviews, documentation, and/or observations that showed their manifestations at Automov SA.

For the construction of Table 1, the actions were separated into three parts, according to the data from the subgroup “microfoundations” of the coding performed for evidence of the sensing, seizing, and reconfiguring codes obtained by excerpts from interviews in Group A, excerpts from documents during the documentary research, or excerpts from field diary notes during participant observation. After rereading these excerpts, the actions identified in the second column of Table 1 were summarized, and some evidence that emerged from the interviewees' reports, excerpts from documents, or observation notes was added to the third column.

Table 1. Dynamic Capabilities Identified at Automov AS.

Micro foundations	Activities/Actions	Empirical Evidence
Sensing	<ul style="list-style-type: none"> - Company's understanding regarding the need for change to adapt to the market; - Monitoring the mobility and connectivity market; - Identification of customer needs; - Identification of benefits of agile methods for the company; - Visits to Silicon Valley in the USA to detect technological trends and new forms of management; - Company's understanding of the need for learning and adopting agile methods; - Understanding agility as an opportunity to improve and sustain the company's operations; - Understanding of the company regarding the lack of agile mentality and culture in the organization and employees' environments. - Identification of threats or barriers that may prevent the development of agility in the company. 	<ul style="list-style-type: none"> - “[...] the President of the company had an experience with agility and saw good results. [...] he called me and said “I would like you to come work with me to help transform the company”. [...] and in that he brought the agile and said to research about it” (I1) - “I believe that agility is directly linked to the company's need to transform itself in search of improving its performance and a more agile organization and I would say with fewer layers and more dynamics in the face of so many transformations and changes” (I2) - “Agility [...] is no longer a choice, but a necessity for organizations to survive the speed at which changes are occurring. [...] So there is a great need to read and adapt our business model about customer needs so that we can ensure the future of the company and the business model we have” (I2)

Table 1. Continued...

Micro foundations	Activities/Actions	Empirical Evidence
Seizing	<ul style="list-style-type: none"> - Strategic decision to gradually develop agility through POCs and in specific departments; - Creation of a department to lead the agile transformation (BTO); - Decision to implement an agility program (Delta); - Outline solutions through agile methods that can generate benefits such as flexibility, time-to-market agility, and operational performance improvement; - How to develop agile project management in the company study; - How to change the culture and mindset against agility in the organization study; - The readjustment of the organizational structure and culture study; - Reformulation of functions and organizational design study. 	<ul style="list-style-type: none"> - “[...] arrived at the beginning of 2018 and we first defined that we would work with support for agile and with concrete success cases to create positive dynamics about the new way of working. So, we created the BTO (Business Transformation Office)” (I1) - “In parallel, this movement was created through a corporate program, which is Delta, which was precisely when they started to deploy this organization in 2019” (I2) - “The objective of this group is to prepare the engineering department to be able to carry out a complete project in an agile format to build our future through performance” (PowerPoint document general slides)
Reconfiguring/ Transforming	<ul style="list-style-type: none"> - Decision to acquire an agile company as a way of absorbing knowledge and learning; - Hiring agility specialists (“agilists”); - BTO department creation; - Delta program implementation; - Investment in certifications and training on agile methods for employees; - Creation of agile teams in projects that used agile methods and organizational redesign; - Incentive to create multidisciplinary agile teams and end-to-end responsibilities; - Implementation of Product Owner and Scrum Master roles; - Establishment of governance for agility; - Continuous learning and knowledge transfer through the Scrum method; - Strategic planning focused on agility; - Gradual transformation of the company's culture and values to an agile concept. 	<ul style="list-style-type: none"> - “About training [...] we go a lot as needed, so we do not provide training for the sake of training, but we seek where there is a need” (I1) - “(...) a few years ago Automov SA decided to buy a company in the IT area in Europe, it acquired this company with an agile structure already, to learn exactly this methodology” (I2) - “With the arrival of our new CEO, he presents us with the new strategic plan of Automov SA and the basis of this program is in agility, in a much flatter organization, very clear accountability process, [...] So I would say that today the implementation program is through our new strategic plan and we are going to try 100% within this agile mentality” (I2) - “The company started to develop a program called Delta precisely trying to make agile methods more corporate” (I3) - “Between 2020 and April 2021, 240 employees were trained in agile basics training” (PowerPoint document general slides)

I1, I2, and I3 = Three interviewed directors from Group A.

Therefore, Table 1 shows that Automov SA understood the need for change by adopting agile methods to better adapt to the external environment. This understanding was observed during the participation of one of the researchers in the organization and reported by the three directors interviewed, citing this perception of the company's president in Brazil.

The organization monitored the market, especially regarding new solutions in the field of mobility and connectivity, and identified customer needs. Some of its managers visited Silicon Valley in the United States to learn about and identify new technological trends and other forms of management that could help some changes in the company to better

adapt to the market and generate superior performance over competitors. This market monitoring follows precepts proposed in Teece (2018), where the author presents connectivity as one of the four major sources of change in the automotive sector.

Managers at Automov SA identified some factors necessary for organizational change, such as flexibility and agility (Teece et al., 2016). After dedicating time and resources to studying how to achieve these factors, it was understood that agile methods could create opportunities and improve the company's operations.

Through the manifestation of sense, the company understood the need to develop an agile culture and mindset in its environments and employees, gradually abandoning traditional methods. However, as presented by Teece et al. (2016), in large and traditional organizations, transformation can be more difficult, although not impossible, and requires breaking paradigms and conventional ways of thinking, and demands encouragement from leaders for a culture open to change.

In the same way, microfoundations of seizing (Teece, 2007) were evidenced at Automov SA through the movement of resources to meet the needs of organizational changes at Automov as. At the seizing level, incentives were identified for the study and adoption of agile methods in the company and the creation of a new department to drive agile transformation (BTO - Business Transformation Office) and a program to develop agility (Delta program). The microfoundation of seizing (Teece, 2007) is present at this stage.

Also, as a seizing action, the organization decided to gradually implement agility in its task environments through POCs (proofs of concept), in specific departments, to generate value first in certain engineering sectors and then share knowledge with other areas that could benefit from agility.

It can be seen that the dynamic capabilities manifested from activities carried out at the high organizational level (Teece, 2012, 2014), from the skills of managers in Group A. The ability of managers at the highest level of the company to orchestrate and combine new processes and technologies within a flexible and rapidly changing framework supports Teece et al. (2016).

Consequently, microfoundations at the reconfiguring level (Teece, 2007) are present in the organization's ability to recombine assets and resources to improve its processes, such as the acquisition of an already structured company in an agile manner and the hiring of 'agilists' or specialists in agility to provide consulting and team training. Also classified at this level of reconfiguring is the company's new strategic planning in 2020, which was directed towards the development of agility.

The creation of agile teams or multidisciplinary teams in engineering departments that involved new roles such as Product Owner and Scrum Master exemplifies manifestations of capabilities at the reconfiguring level (Teece, 2007) at Automov SA. By Teece (2019), the manifestation of dynamic capabilities at the reconfiguring or transforming level includes processes, organizational structures, and effective governance mechanisms.

Corroborating concepts from other publications, the activities in Table 1 reinforce the understanding that Automov SA has integrated and renewed its resources and capabilities to better adapt to and anticipate changes in the market (Wang & Ahmed, 2007; Kurtmollaiev, 2020) and renewed its routines to improve their operational performance (Zollo & Winter, 2002; Davies et al., 2016).

It is also understood in this article that dynamic capabilities can be used strategically in the development of new products, resembling a process that uses resources to create new strategies for generating value for companies in dynamic markets (Eisenhardt & Martin, 2000; Peteraf et al., 2013).

4.2 Advantages and challenges in adopting agile methods

The adoption of agile project management involves advantages and challenges as identified in the three projects studied (Alfa, Beta, and Gama) at Automov SA, through documentary research, participant observation, and interviews. For the construction of Table 2, agile practices were classified into nine categories based on data obtained from interviews with Groups A and B, reports collected during documental research, and field diary notes recorded during participant observation. After re-reading, agile practices were summarized, as well as their advantages and challenges, identified in the first, second, and third columns of Table 2.

Table 2. Benefits and Challenges in the adoption of Agile Project Management.

Agile Practices Categories	Benefits	Challenges
Prioritization	<ul style="list-style-type: none"> - Reduction of waste and time; - Focus on activities that generate value; - Unified and synchronized teams. 	<ul style="list-style-type: none"> - Not having a dedicated team led to the need to work on other non-priority topics outside the agile team. - Lack of clarity about prioritization by the Product Owner.
Iterative Planning	<ul style="list-style-type: none"> - Better organization of tasks; - Reduction in response time; - More assertive planning. 	<ul style="list-style-type: none"> - Able to correctly carry out the Sprint Planning; - Monitoring the project and other departments that still used the traditional management model.
Conducting Scrum Ceremonies	<ul style="list-style-type: none"> - Reduction of meetings and time; - Improved communication. 	<ul style="list-style-type: none"> - Being able to perform all ceremonies with non-dedicated people.
Agile Mindset	<ul style="list-style-type: none"> - Encourages people to question themselves about the form of work and its added value; - Value creation; - Improved team motivation and empowerment. 	<ul style="list-style-type: none"> - Difficulties related to the overlapping of the existing culture in the company; - Learn the agile method without previous experience in the company; - People are resistant to implementation.
Multidisciplinary Teams	<ul style="list-style-type: none"> - Breaking of "silos"; - Greater autonomy of the teams; - Reduction of human resources, generating savings for the project. 	<ul style="list-style-type: none"> - Breaking down departmental silos; - Being able to work with the agile method without having people 100% dedicated to the project.
Self-Managing Teams	<ul style="list-style-type: none"> - People more protagonists, with greater openness to participation and suggestion of ideas; - Increase people's motivation. 	<ul style="list-style-type: none"> - Being able to manage people with different maturities for self-manageable work.
Decision-Making at the Team Level	<ul style="list-style-type: none"> - Empowerment of employees; - Faster decisions based on available data per sprint. 	<ul style="list-style-type: none"> - Hierarchy interference; - Need for culture change;
Teams Located in a Single Physical Space	<ul style="list-style-type: none"> - Fluid, organic, transparent, daily, people-centered communication. As a way to integrate the team and help in carrying out priority tasks. 	<ul style="list-style-type: none"> - Achieve exclusive dedication to the agile project; - Restrictions on physical presence in times of COVID-19;
Visual Management	<ul style="list-style-type: none"> - Transparent communication; - Information is shared at all levels. - Improved communication and organization of teams working from home through tools such as Microsoft Teams. 	<ul style="list-style-type: none"> - COVID-19 context and loss of resources.

It is evident, therefore, that for each agile practice there are advantages and challenges as shown in Table 2. The main advantages identified in the three projects through the three data sources are presented in Figure 2.

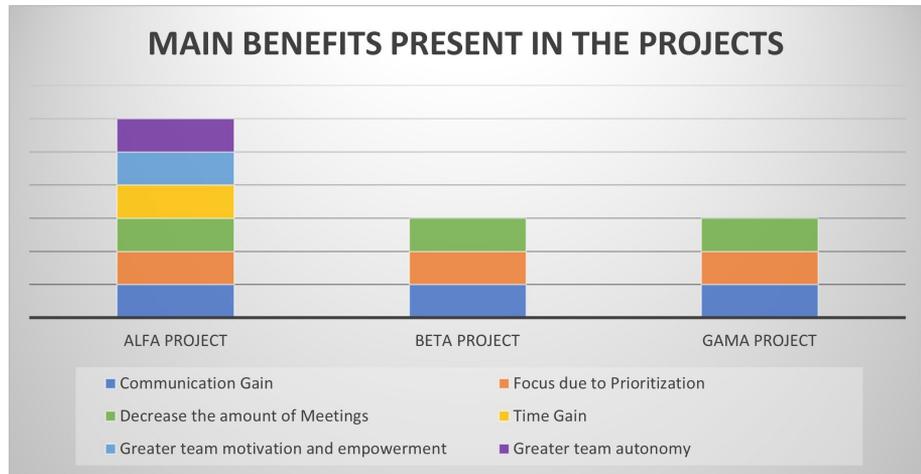


Figure 2. Main Benefits Identified in Automov SA Projects.

The Alfa project stands out in terms of perceived advantages and corroborates the observation made by the researcher that this POC has advanced far beyond other project practices that were conducted in a traditional or sequential manner. This also relates to identifying the factors needed during an agile team launch to be successful (Rigby et al., 2018).

The main challenges identified in the three projects are shown in Figure 3. The Gama project stands out in terms of perceived and faced challenges during the implementation of agile project management, corroborating the observation made by the researcher that this POC was the most difficult to implement in addition to having the challenges pointed out by Dikert et al. (2016), being well present and poorly managed.

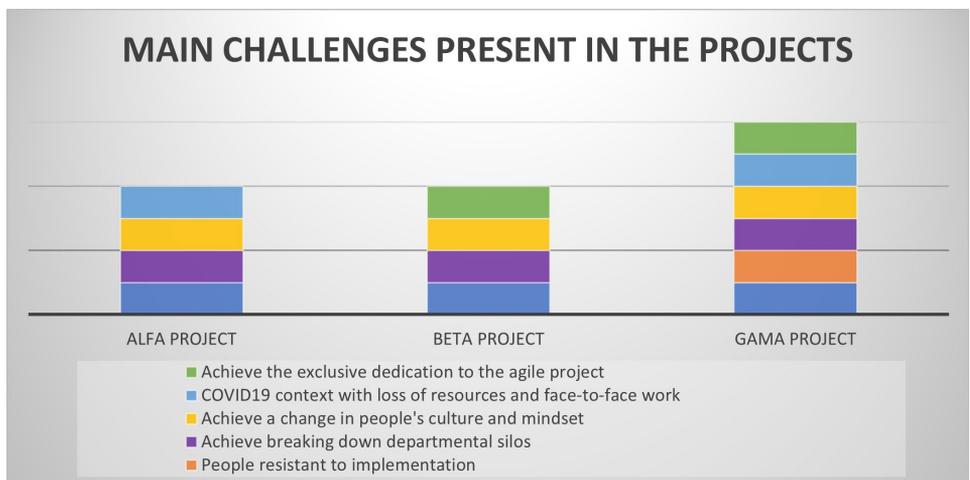


Figure 3. Main Challenges Identified in Automov SA Projects.

4.2.1 Prioritization

Starting with the agile practice of prioritization, the bad habit existing in the organization of lack of prioritization of activities and focus (Sutherland & Sutherland, 2014; Rigby et al., 2016) was improved with the use of agile project management. There was a prioritization of topics that generated greater value and, with that, waste was reduced, time was reduced and the focus of the team was raised, which became more united and synchronized. These factors have already been discussed and presented as advantages by several authors (Cocco et al., 2011; Rigby et al., 2016; PMI, 2017; Sutherland & Sutherland, 2014; Zuzek et al., 2020).

Scrum already presents some tools that help with this planning, such as sprint poker (Sutherland & Sutherland, 2014), in which the backlog is refined with the priorities to be carried out by estimating the effort required to complete each activity and story. At this point, the team can estimate the story by scoring the action using the Fibonacci sequence (1, 2, 3, 5, 8, etc.), with the higher the number, the longer it takes and the greater the level of difficulty to finish the story. Consequently, having a relative difficulty level for each action, it is possible to effectively plan each sprint so that the team has the confidence to carry out the actions during its sprint period.

4.2.2 Iterative planning

As for the agile practice of Iterative Planning, it was noticed that with its use, projects gained greater organization, shorter response time to respond to activities, and more assertive planning. Corroborating the understanding of some authors (Conforto et al., 2014; Sutherland & Sutherland, 2014; PMI, 2017; Rigby et al., 2016), that this is one of the bases of agility, even present in the agile manifesto (Highsmith, 2001).

4.2.3 Conducting Scrum ceremonies

As for the agile practice of holding Scrum ceremonies/events, there was a lot of time gained as an advantage with the reduction of meeting agendas and communication gains due to the format and regularity of Scrum meetings. These advantages have also been defended by several actors (Conforto et al., 2014; Cervone, 2011; Sutherland & Sutherland, 2014; PMI, 2017; Saisa et al., 2019; Zuzek et al., 2020). The practice of daily meetings was presented in this research as a great provider of active communication of teams and gain in response performance and completion of activities. Regarding the associated challenges, the Beta and Gamma projects presented some difficulty in carrying out all the Scrum ceremonies/events with non-dedicated people. But they managed to get around the situation by making the team's participation more flexible only when they had issues addressed to them in the daily meeting, and by holding the sprint planning and review meetings with assertiveness and objectivity to occupy less time for the participants.

4.2.4 Agile mindset

Regarding the agile mindset, there was a strong incentive from the company for people to question themselves about the current way of working, what can be improved, and how to work with what generates value. There was even greater motivation and empowerment of teams (Koch & Schermuly, 2020).

It was clear the enthusiasm of some with the use of agile methods and this openness to work with their activities in a more agile mindset. This corroborates the studies of some authors who present constructs such as innovation, learning, creativity, and motivation as components of agile project management (Leybourne, 2009; Gonzalez, 2014; Koch & Schermuly, 2020; Saisa et al., 2019) and that, in this context, agility is not a practice or method in itself, but a mindset, a state of mind and performance of a project team (Conforto et al., 2016; Nicholls et al., 2015). However, the challenge associated with this factor was the difficulties related to the strong traditional culture of the company, in which some resisted this new mentality (Dikert et al., 2016; Albuquerque et al., 2020), believing that the form of the traditional approach that it always performed was the most correct, and there was no need for change, even with the company encouraging change.

Additionally, as it was something new for the people who participated in the Alpha, Beta, and Gama projects, this was a challenge that was overcome through training and lectures on the agile mindset.

4.2.5 Multidisciplinary and self-managing teams

As for the agile practices of multidisciplinary and self-managing teams, there was a strong breakdown of organizational “silos”, reduction of human resources needed in the project, greater autonomy of the team, people development to be more protagonists, motivated, and greater openness to participation. and suggestions of ideas.

These advantages have already been defended by some authors (Nicholls et al., 2015, Azanha et al., 2017; Dingsoyr et al., 2012; Rigby et al., 2016; PMI, 2017; Sutherland & Sutherland, 2014; Conforto et al., 2014), which meet one of the bases of agility, of people and individual motivations above processes and tools, present in the agile manifesto (Highsmith, 2001).

The big challenges related to these agile practices are, being able to manage people with different maturities, being able to break the departmental “silos” and working with teams without having all the people with exclusive dedication to the squad. To overcome this situation, it is necessary to have a strong figure of the Product Owner, knowing how to perceive the different levels of maturity present in his team, and knowing how to negotiate with the departments the exclusive dedication of key actors of the project, exemplifying the improvements that this will bring to the company, such as greater employee personal performance and greater focus.

4.2.6 Decision-making at the team level

As for the agile practice of decision-making at the team level, an excellent application was noticed in the Alfa Project, resulting in greater employee empowerment and faster decisions. This is in line with the understandings of several authors on agile project management (Rigby et al., 2016; PMI, 2017; Sutherland & Sutherland, 2014; Conforto et al., 2014; Ruark, 2015). The challenges identified related to this practice include interference from the hierarchy in decisions and the need for a culture change, facts that must be circumvented by explaining the need for team autonomy in decisions to their hierarchies, and encouraging them to welcome the decisions of teams and the trust factor.

4.2.7 Teams located in a single physical space

Another agile practice present in the Alfa project was related to the team being located in a single physical space. So, the physical resources were redirected to allocate the people of the squad in a single environment, facilitating fluid, organic, transparent, daily, people-centered communication, as a way to integrate the team and help in carrying out tasks and unlocking items. needed.

This corroborates studies that advocate the use of agile project management as a means of gaining communication (Conforto et al., 2014; Cervone, 2011; Sutherland & Sutherland, 2014; PMI, 2017; Saisa et al., 2019; Hidalgo, 2019; Ruark, 2015). The associated challenges were to obtain the exclusive dedication of some employees to the squad and to continue with the physical presence in a single environment in times of COVID-19. This situation was circumvented with remote work and the use of online tools that made possible this face-to-face feeling of the team through technology, such as Microsoft Team, or Microsoft Planner, which helped in the continuity of the squad with the use of rituals/ Scrum events.

4.2.8 Visual management

Finally, there is the agile practice of visual management, which promoted transparent communication and information being shared at all levels of the team. Also in times of COVID-19, it contributed to the communication and organization of teams in the home office, through tools such as Microsoft Teams and Microsoft Planner. And the challenge associated with this practice was precisely related to the pandemic context, with the loss of work and face-to-face resources. But that was circumvented with this “new normal” of remote work facilitated by agile online tools.

5 Discussions and propositions

5.1 Conceptual framework of agile project management

This section presents a conceptual framework containing the three groups of dynamic capabilities activities and their relationship with the adoption of agile practices, their associated advantages, and challenges, which is presented as an application proposal to guide the implementation of agile methods in the automotive industry, as shown in Figure 4.

The conceptual framework was built from the content analysis of the interview data, participant observation, and documental research. The manifestations of the microfoundations of the dynamic capabilities most present in the cases studied and the main advantages and challenges associated with the projects studied were selected.

The conceptual framework associates dynamic capabilities with agile project management, characterizing the adoption of resources, such as agile methods, as a consequence of the development and application of dynamic capabilities by the company, which used agile methods to transform the project management model in the environments of the organization's task. It was understood that dynamic capabilities fostered agility (Teece et al., 2016), enabling the confrontation of agile project management with the activities of creating and composing microfoundations of dynamic capabilities at the levels of sensing, seizing, and reconfiguring (Teece, 2007). In other words, it was understood how dynamic capabilities guided the adoption of agile methods in the organization, relating the external environment to the internal (task) environments.

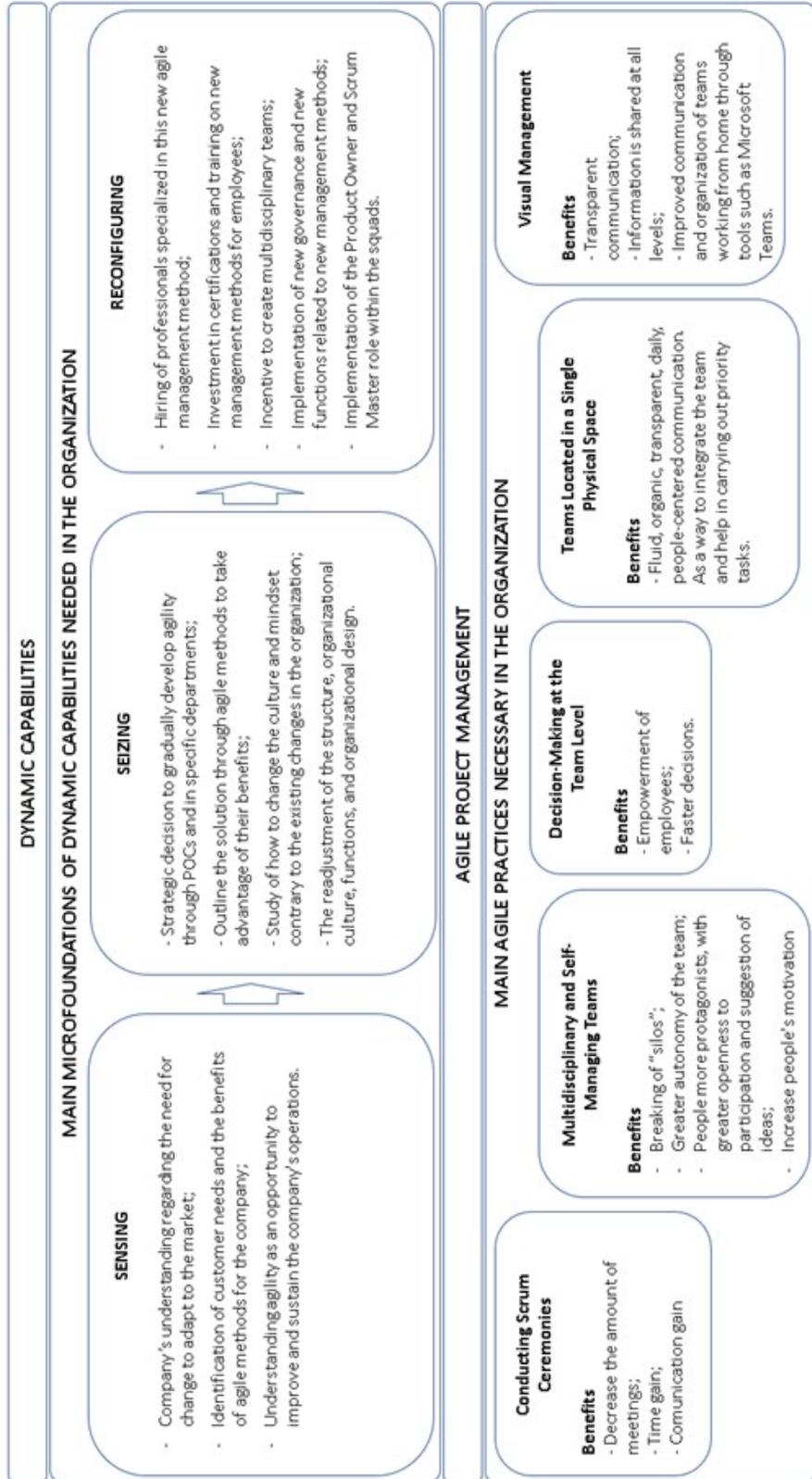


Figure 4. Conceptual Framework for Implementing Agile Project Management.

The results found were also synthesized based on the conceptual scheme of Teece (2007), superimposing Figure 1 with the empirical data obtained according to Figure 5. For the construction of this figure, the actions identified in the three levels of sensing, seizing, and reconfiguring were selected. More were mentioned in the interviews, described in the documentation collected or observed by the researcher.

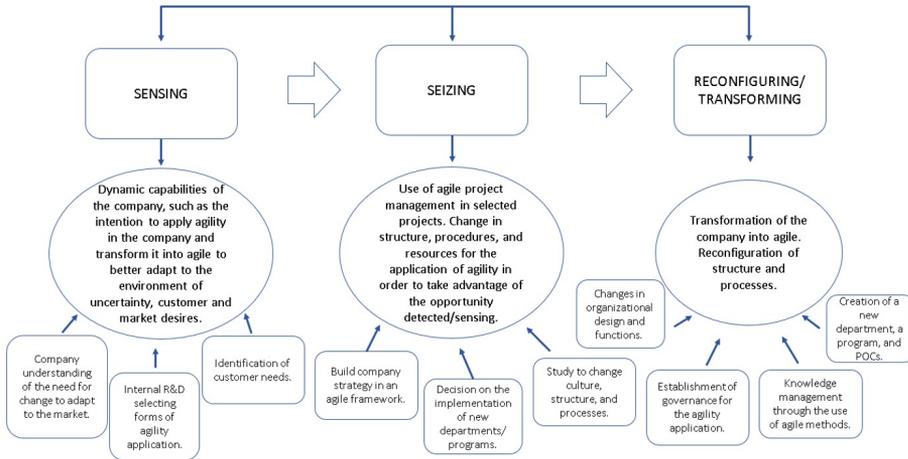


Figure 5. Foundation of Dynamic Capabilities Model Found at Automov SA.

From Figure 4 and Figure 5, conceptual relationships are proposed between the results of the manifestations of dynamic capabilities and the implications of using agile methods (in terms of advantages and challenges). In this way, possible analytical generalizations of this study are discussed as a theoretical implication. This discussion aims to guide project managers who need to implement agile project management in their organization.

In dynamic markets, organizations need to sustain competitive advantages to remain present in the market, generating new ways to quickly make new products available (time-to-market). Automotive industries, which have a long period of development of a new product, such as a new vehicle, need to perceive opportunities to develop their products in a more agile way and generate greater value.

Through the case study presented here, it was identified that the organization's understanding of the need for change to adapt to the market brought significant gains in terms of improving communication, agility, and value generation, preparing teams and projects to develop their products faster to market.

Proposition 1. The more elaborate the organization's capacity is at the SENSING level to perceive the need for change and adaptation to the external environment, the greater its ability to create agility through new perspectives of agile project management and communication

Industries that want to adapt to the market to sustain themselves in the competition, can manifest micro-foundations of dynamic capabilities such as at the sensing level, identifying new ways of managing their projects, such as with the use of agile methods, to ensure good communication and facilitate efficiency. and success of actions.

Therefore, from the perspective of dynamic capabilities, it is understood that by using agile methods in the management of new product development projects, companies can adapt

more quickly to changes in the market and create competitive advantages from improvements in their processes (Teece et al., 1997; Sutherland & Sutherland, 2014).

When the organization senses the opportunity (sensing) and starts to take advantage of it (seizing), it must quickly study and outline how the new perceived solution should be implemented in the company in the most correct way without causing major challenges such as changing culture and mindset of employees.

The organization must gradually implement these changes, such as the application of agile project management, through small groups that generate value and start to set good examples for other projects.

In this way, being able to implement a new form of management, which provides improvements in the work of employees, the company generates positive results for the motivation of employees because they perceive the company's incentives to improve the way of managing a project.

Proposition 2. The more elaborate the organization's ability at the SEIZING level to create opportunities and take advantage of the benefits of agility through new perspectives of agile project management, the greater its ability to cultural and structural change, motivate and empower its employee collaborators

With the implementation of agile project management, the employee's empowerment and protagonism are evident, as they start to adopt an agile structure of multidisciplinary and autonomy, leading to greater openness to participation and suggestion of ideas.

To sustain a dynamic capability, the leadership skills of top management are needed (Teece, 2007), which would have the function of managing assets and corporate renewal, including changes and adaptations of routines. The Product Owner and Scrum Master figures must play this leadership role, however, always making it easier for the team to be self-managing.

The manifestation of the microfoundations of the dynamic capabilities of decentralized decision-making (Teece, 2007), is present in an agile team because everyone has the same level (no hierarchy) and decisions are made by the team, and no longer by a single one. boss. This way, you can get different managers looking at different information and controlling different decisions (without needing to communicate with a single central decision maker), all to improve business flexibility and responsiveness.

An organizational design within the projects in the form of multidisciplinary and self-managing teams encourages the autonomy of employees in the proposal of new ideas and decision-making, providing greater team performance in the necessary project deliveries.

Changes in resources and processes in dynamic environments, as in the case of the automotive industry, were essential for improving communication between departments, breaking existing departmental 'silos'.

Proposition 3. The more elaborate the organization's capacity at the RECONFIGURING level to transform resources through new perspectives of agile project management, the greater its ability to adopt agile methods, departmental integration and flexibility, formation of autonomous and cross-functional teams, and performance improvement in project processes

Also concerning resources, it can be inferred that the dynamic capabilities defined by Eisenhardt & Martin (2000), such as company processes that use dynamic

resources as organizational routines to monitor market developments, can be associated with the dynamic routine suggested by the Scrum framework. For example, in the realization of sprints and daily meetings, in the adjustment of human resources to have a cross-functional team with all the necessary skills to perform the tasks and be autonomous, or even in the visual resources of project progress and deliveries such as the Scrum board or Kanban.

It is also suggested the relationship between dynamic capabilities presented by Zollo & Winter (2002) as the routines developed through the accumulation of experiences and learning and the Scrum Sprint planning method, which are known as learning cycles, because it can be applied to the lessons learned from the last Sprint into the next Sprint, thus accelerating the use of new knowledge and the awareness of errors along the project path.

Still, concerning the conceptual framework in Figure 4, it can be seen that the Alfa Project, studied in this research, had all the main agile practices necessary for an organization, managing to overcome the challenges they faced during agile project management. Practices defended by authors such as Rigby et al. (2016, 2018), Conforto et al. (2016), and Sutherland & Sutherland (2014). Consequently, causing their agile team to advance much further than the rest of the project, other departments or even the other Beta and Gamma Projects studied.

6 Final considerations

The purpose of this article was to study agile project management from the perspective of dynamic capabilities and to develop a conceptual framework for adopting agile methods to develop physical products in the automotive industry. Therefore, this research was guided by the research question: "what are the dynamic capabilities associated with the agile project management of product development in the automotive sector?"

Understanding the relationship between dynamic capabilities and agile project management helps explain the manifestation of micro-foundations at the sensing, seizing, and reconfiguring levels that provide the organization with the skills necessary for its survival, adaptation, and competitiveness. Additionally, this article empirically justifies the applicability of the theoretical model of dynamic capabilities proposed by Teece (2007), relating it to agility Teece et al. (2016) in the field of agile project management. The article also informs managers and organizations about essential dynamic capabilities that should be developed to favor the development of agility and agile transformation in the enterprise. In addition, agile management studies carried out in the software industry were extended to the automotive sector.

More specifically, this article contributes a new perspective on the manifestation and influence of dynamic capabilities and agility in the context of project management of new vehicles in the automotive industry. It could be said that the studied organization had dynamic capabilities that favored the development of highly effective management teams, robust organizational designs, and agility (Teece et al., 2016). From the results, it was possible to suggest propositions that connected the three levels of microfoundations of dynamic capabilities to agility in the organization's projects. The propositions can be tested in future empirical studies through qualitative and quantitative studies focused on adopting agile project management in organizations inserted in uncertain and fast-moving environments.

The results of this research can help managers who want to implement agile project management in their organization, guiding them to identify micro-foundations of dynamic capabilities. The results can also support the organization that aims to know in advance which agile practices would be interesting for adoption in its projects. Organizations can take advantage by knowing the benefits and challenges they will face with the use of agile project management. Other relevant research results refer to the confirmation in the field that (a) projects that are not organized to face the possible challenges – that exist during the implementation of agile management in an organization, as reported by Dikert et al. (2016) - have greater difficulties, like the Gama Project, in obtaining the advantages and good results with the use of agile methods; and (b) there is a need for the presence of some factors during a squad launch to be successful, as reported by Rigby et al. (2018), as was the case of Alfa Project, which had the factors highlighted by the authors and was considered a successful POC by the organization.

For future research, it is recommended to carry out additional case studies that can empirically test, in other organizations and sectors, the conceptual framework and the propositions suggested in this article. Research that can explore the limitations of adopting agile methods is also recommended. We also suggest conducting empirical studies to understand better the impacts of using agile methods, from the perspective of dynamic capabilities, on the performance of projects in manufacturing industries.

Authors contribution

Lisiane Sassi Ferreira was responsible for the conceptualization, data curation, formal analysis, investigation, project management, validation and writing this study. Farley Simon Nobre in the same way, was responsible for the conceptualization, data curation, formal analysis, investigation, project management, validation, writing, and supervised the study.

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