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Theoretical Fundamentals of Scaled Business Agility and Project Portfolio Management at Automotive Manufacturers

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Abstract

This study has the aim to explain the theoretical fundamentals of scaled agile business structures and of the traditional project portfolio management before laying out the discrepancies of agility with project portfolio management at large enterprises such as automotive manufacturers.

For the exploration of the scarcely addressed topic of agility at portfolio level, current journals were mainly consulted. Further, for the theoretical exposition of project portfolio management, current journals and textbooks about business strategies and project management were used as well as journals for information about portfolio management.

As a result of this paper, it was found that the difference of agile delivery to the traditional organization is the focus on small work packages instead of detailed long -term planning. When focusing on smaller work packages, portfolio planning becomes more iterative and bottom-up ideas have a higher impact on program level. This will positively affect the competitiveness of automotive manufacturers.

For other industries then automotive manufacturers, other company sizes, or even other automotive manufacturers, which are built from the ground up to be more agile, the findings of this paper can but must not necessarily be relevant.

Keywords: Business Agility; Portfolio Management; Project Management; Scaled Agility

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1. Introduction

Multiple disruptive megatrends affecting the automotive industry. Customers, shareholders, and governments expect innovations in the field of new mobility solutions and car-sharing, autonomous driving and connected services, as well as environmentally friendly drivetrains. Those megatrends fundamentally change the business models of automotive manufacturers. Moreover, the megatrends in the automotive industry are highly complex. In the future, the connected car will interlink all types of vehicles and infrastructure systems to offer services in the field of mobility, security, and entertainment. This indicates an increasing share of software scope and also more uncertainty and complexity in the market. In a recent article in McKinsey Quarterly (2023) Gnanasambandam et al. stated that "more and more traditional companies are realizing that to compete and grow in a digital world, they must look, think, and act like software companies themselves". Satya Nadella (CEO of Microsoft) even says that "every company is now a software company" (2019). [1, 2]

In the face of the complex and unpredictable development of the megatrends, automobile manufacturers must be more agile in their responses. For this purpose, the strategic approach of the last decades of process efficiency and focusing on the competitors is no longer viable. Agility, the ability of organizations to react quickly and flexibly to changing market requirements, has been part of the success of some companies, such as Google and Tesla. [3]

Those companies have adapted successfully to the circumstances of the VUCA world. The term VUCA world describes the basic features of this world in which organizations strive to survive. VUCA is an acronym for volatility, uncertainty, complexity, and ambiguity. This world is defined by unforeseeable fluctuations in the markets which make long-term forecasts for future developments unreliable. In addition, new technologies require shorter development times, and customers expect companies to respond to their wishes and needs more quickly. Thus, automotive companies suffer from an increased uncertainty in their decision-making in this VUCA world. Therefore, organizations are often far from keeping up with the dynamics of the market. This puts additional pressure on automotive companies to demonstrate innovation and

agility in order to meet and ultimately satisfy market needs. [4]

On top of that, the increasingly shorter time to market for new car models creates significant problems for car manufacturers. Previous models for project stages, such as the waterfall method, are no longer productive enough, since the method can result in a product that is outdated at the time of completion. The demand for agile methods is therefore logical. Further, customer and market orientation is essential in the VUCA world which requires agility in processes and organization. However, this adaptability to changing market conditions is missing at automotive manufacturers. This problem should now be solved with agile methods which should lead the companies to new strength. Having said this, many automotive companies lack the knowledge which type of agile change is the best and how agility can be adapted successfully. There are several frameworks that aim at implementing agility but these frameworks have different approaches to role allocation and organization. [5]

Business agility originates from the new age software development, which has been transformed by agile development methods. Agile methods were applied to small teams working on small projects. Organizations that build much larger systems, such as automobiles, also want to take advantage of agile product development. As a result, there is currently a growing interest in scaled agility. Scaling, which describes a change in size, addresses the difficulty of projecting the advantages of agile working in small groups to larger projects. [6, 7]

In project management, the challenges posed by increasing competitive pressure have forced automotive companies to abandon the traditional view of independent and often poorly coordinated planning processes that are executed separately from various business functions. For example, the increased market fluctuations make proceeding project forecasting unreliable, and many organizations have too many projects for their limited resource capacities. To manage this, there is the portfolio management which is a set of business processes that enable organizations to select the right projects at the right time to achieve business strategies. The project portfolio provides clear direction, priorities for budget investments, and resource allocations for the projects within that portfolio. Significant are agile projects which are more responsive to external influences and tend to enter new technological territory, giving them a potentially greater impact on the business strategy. Hence, an unexpected change in a single project could cause a change in the business strategy of an agile organization. Therefore, agility in the project portfolio management can help automotive companies to master upcoming challenges. [8, 9, 10]

Nevertheless, a company that uses agile methods is far from being agile. It must adopt the values of agile thinking and internalize them. Existing structures must be adapted to the new concept and responsibilities must be redistributed. Many organizations fail to overcome these challenges and thus fail in the transformation to an agile company.

This is particularly significant since scientific studies are focusing on demand growth, segmentation, technological advantages, supplier structures, and political changes which are affecting products and production environments in the automotive industry. However, the research area of scaled agile methods is still in its infancy with regard to automotive manufacturers. The danger that traditional automotive manufacturers will not make the leap to digital, environmentally friendly mobility service providers would mean the downfall of a large industry. New market participants could then take over the mobility market. In order to avoid this, traditional automotive manufacturers will have to act as full integrators along the value chain in the future, since the majority of value creation might no longer be in the traditional construction of motor vehicles. This leads to integrating new business models flexibly, whereas an important step for doing so is the integration of an agile project portfolio. [11, 12]

2. Research methodology

For part 1, the exploration of the scarcely addressed topic of agility at portfolio level, current journals were mainly consulted. This incorporates the definition of agility, the agile manifesto, the Scrum method, and the fundamentals of scaling agility. For part 2 the theoretical exposition of project portfolio management, current journals and textbooks about business strategies and project management were used as well as journals and current case studies for information about portfolio management. The qualitative data analysis was achieved by focusing on the recency of publication and by focusing on content about larger organizations. Lastly the differences between agile methodologies and project management are addressed in part 3.

3. Results and discussions

PART I

To understand the topic of agility, some fundamentals are essential. Agility can be seen as the fundament for scaled agile frameworks that this paper attempts to align with the project portfolio management of automotive manufacturers. In the following sections, the term agility is tried to be defined. This leads to the Agile Manifesto which represents the basic thought processes of agile methods and defines the priorities in an agile enterprise. Thereby, the concept of agile software development will be introduced using the Scrum method before looking at the theory behind scaling agility. For part 1, the exploration of the scarcely addressed topic of agility at portfolio level, current journals were mainly consulted. This incorporates the definition of agility, the agile manifesto, the Scrum method, and the fundamentals of scaling agility. For part 2 the theoretical exposition of project portfolio management, current journals and textbooks about business strategies and project management were used as well as journals and current case studies for information about portfolio management. The qualitative data analysis was achieved by focusing on the recency of publication and by focusing on content about larger organizations.

Lastly the differences between agile methodologies and project management are addressed in part 3.

3.1 Definition of Agility

Since the term agility has been described several times since the

1950s, its genesis will be explained to understand different interpretative approaches. The term agile has its origin in the Latin word *agilis* and means nimble, flexible, or fast. The term agility first appears in science as a description of a system-theoretical model from the field of sociology in Working Papers in the Theory of Action by the authors Parsons, Bales & Shils in 1953. [13, 14]

In the following, the origins of agility in the organizational environment are examined and selected definitions of agility are provided. The definitions of the term agility are manifold, especially after 1991, what can be criticized as the lack of a standard. In most cases, the term is defined by a precise definition plus explanatory attributes to do justice to the topic. [14]

Nevertheless, the Lehigh report from 1991 is considered the foundation of the concept of agility in organization theory. The beginnings of this report originate in 1986, when a commission was established at the Massachusetts Institute of Technology (MIT) to restore the competitiveness of the industry of the United States. The Lehigh report concludes that, due to the development of new computer-based technologies, new flexible forms of integrating human, knowledge, and physical resources need to be developed to improve the key performance criteria of quality, time, and cost. Already here it gets clear that the characteristics of organizations in the United States with their fixed structures and processes that are planned in detail, are no longer competitive. [15]

In the early 1990s, the number of scientific papers on agility has been increasing, and agility is seen as a fast and flexible reaction to change. Since the end of the decade, customer requirements that influence product development have been given greater emphasis. In addition, there is a deviation from earlier definitions. Whereas until this point in time the focus was mainly on reaction, proactive action is now mentioned for the first time. Definitions from the early 2000s support this, like Sambamurthy et al. which give a decent definition: “Agility is the ability to detect opportunities for innovation and seize those competitive market opportunities by assembling requisite assets, knowledge, and relationships with speed and surprise.”. Here, proactive action and the customer focus is mentioned. Within the publications of the 2000s, agility is defined on different dimensions. In addition to the organizational dimension there are the marketing, production, management, and the human dimension. While mostly the attributes human, organization, and customer orientation are included, sometimes the technology dimension is added, like agile software development for example. The agile software development and its influence on operational agility will be discussed more deeply in the next chapter. [14,16]

In accordance with the statement of many authors, it can be concluded that a unified definition of agility is very difficult. However, the term agility is continuously extending by new approaches and new attributes. On the one hand, this means that a final commitment to a uniform clear definition of agility is difficult to achieve. On the other hand, the concept of agility continuously adapts to current developments and therefore remains modern. [14]

3.2 Agile Manifesto

The latest and most appropriate definition of the term agile in a business context originates from agile software development and is known as the Agile Manifesto, which is the foundation for the scaled agility. The agile mindset was defined in 2001 in the Agile Manifesto, which was created by leading representatives and authors of agile project management and experts in software development.

The Agile Manifesto resulted from the dissatisfaction of the experts involved with the way software had been developed so far. The waterfall project management used, which was characterized by clearly defined goals and a lack of flexibility, no longer fitted the constantly increasing requirements. The waterfall model is linear and non-iterative and is characterized by successive project phases. The results of one stage are binding guidelines for the next stage which means that especially in the VUCA world, new market influences have no more impact on the project. Therefore, software was designed as a stand-alone product which was outdated as soon as it appeared on the market. The Agile Manifesto should find a dynamic, customer-oriented, and adaptable solution for software development. [17]

Despite the dissatisfaction with the waterfall project management method, the manifesto explains that agility is neither a tool nor a method, but that agility is a mindset. [18]

The first value of individuals and interactions over processes and tools means that the focus is on human interactions, and the focus on processes and tools should be reduced, as these now represent a supporting function. An agile approach therefore demands to see people as individuals with different personalities and not as a pure resource. In this sense, processes should be designed by people and for people. Nevertheless, processes and tools are not considered irrelevant here, but their significance is weighted lower. On top of that, communication and respect within a group of collaborating individuals is essential. By bringing together the most diverse perspectives possible, an optimal solution approach can be developed. [19]

The second value is working software over comprehensive documentation. Comprehensive documentation is important in this context, but the focus should be on functioning services or applications. This does not mean that documentation is superfluous but reduction to necessary components can avoid high bureaucracy and over-processing, resulting in high costs. The time gained can be invested in creating ready-to-use services which are in the interest of the customer. [20]

The third value is customer collaboration over contract negotiation. In a complex context, it is no longer possible to formulate the requirements for the desired target state of the product or service in advance. Customers usually do not know exactly what the desired service should look like because the requirements change during the design process. Therefore, it is wasteful to define the exact requirements in an early phase. The idea of this value is to work with internal and external customers closely together to define essential requirements step by step. This close cooperation strengthens the relationship. This value of collaboration is a key element of the scaled agile frameworks. [19,21]

The fourth value is responding to change over following a plan, which is also an important aspect of this paper. As soon as several individuals with different views of the solution work together with

many feedback loops, changes are inevitable during the development process. Accordingly, these changes are to be welcomed since they represent a learning effect. Without allowing those changes, a plan is pursued that meanwhile aims at a different goal. Planning is not to be completely abandoned here but only the near future should be described in detail. The more distant a step is, the less precise its outline can be because it is only a rough orientation for further action. Potential courses of action therefore remain open. This value differs significantly from the waterfall model used so far. [18,22]

It can also be noted that the VUCA world influences are visible like responding to change over following a plan for example. These above stated values are also applicable to other functions than software development.

3.3 Scrum Method

Next, the basic elements of the agile method Scrum must be described. It soon becomes clear that Scrum and the scaled methods are based on the fundamental values of the above explained Agile Manifesto. Moreover, the scaled agile frameworks are based on Scrum, respectively use Scrum as an agile method. The LeSS framework is an acronym for large scale Scrum and therefore defines itself as the scaled version of the agile approach Scrum. Moreover, the SAFe framework is also based on Scrum. The term Scrum originates from rugby, where the team presents itself as a unit and passes the ball to each other on the way to the goal. This metaphor is meant to illustrate the goal-oriented and collaborative teamwork of Scrum. Scrum can be defined as a process-control development framework. Scrum was developed by Ken Schwaber and Jeff Sutherland mainly for making software development more agile in smaller companies with small teams. Nevertheless, there are no specific guidelines to be used during the process. This is rather left to the team itself and allows freedom in the application of Scrum. [23,24,25]

The project roles defined in Scrum are the product owner, the team, and the Scrum master. What is noteworthy is the absence of the traditional role of a project manager. The product owner operates from the customer's perspective and ensures that the right product is produced. At the same time, he/she must ensure that the ideas from the team are feasible, and if not he/she has to lead the project back into the right direction. The product owner captures the customer's requirements and describes them in the product backlog. The product backlog is constantly updated and extended during the agile process. The product owner is responsible for the success of the project. He/she alone decides on functionality, costs, and deadlines. He/she creates a release plan and adjusts it, if necessary, in consultation with the team. Ideally, the product owner should allocate enough time per day to the team. The product owner also communicates with the end customer groups in order to receive feedback on new functionalities as early as possible. Therefore, it is always possible that the product backlog is adapted to current changes which is called the product backlog refinement. Those roles fit the agile values of the Agile Manifesto. [26]

Next, the team is responsible for fulfilling the requirements for a working product. According to Scrum, there is no exact definition of roles. The team organizes itself independently and decides which of the tasks are needed to be solved to successfully complete the requirements. The team is permanently in a project and does not switch between several projects. If possible, there should also be no physical separation of the team to allow proper communication. In addition, team members should accept the knowledge of others and share their own knowledge. [26]

Lastly, the Scrum master is the process responsible and acts as a contact person for questions from stakeholders. He/she provides the team with security and in the best case makes himself/herself superfluous. However, this is a rarity, as teams often tend to develop in the wrong direction. In this case, the Scrum master must intervene and adjust the direction with small corrections. Furthermore, the Scrum master protects the team from external influences and coaches the team as an expert in Scrum. [26]

In addition to the project roles, Scrum regulates the project flow in the form of Sprints which are development cycles of 1 to 4 weeks. Each cycle converts requirements from the product backlog into a deliverable product increment. With Scrum a product increment is usually runnable software. Each Sprint ends on the agreed date and may not exceed 4 weeks. The product backlog prioritizes which requirements must be delivered to reach the project goal. At the beginning of a Sprint, each team selects requirements from the product backlog and creates the Sprint backlog. This describes all activities to realize the requirements for a product increment. The team then starts to fulfil the requirements. Every day at the same place and at the same time a short meeting takes place, the daily Scrum. The daily Scrum should help to coordinate the work in the team. Furthermore, in the Sprint review at the end of a Sprint, the work results are reviewed by the product owner. Afterwards the Sprint retrospective takes place, where the team reflects and derives improvement measures. [27]

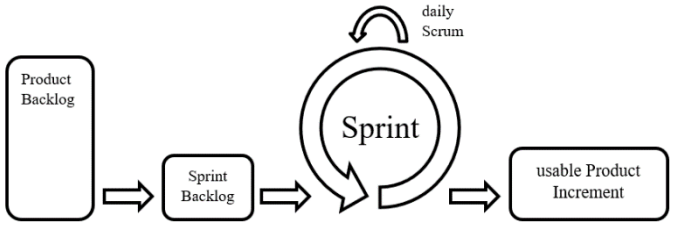

Fig. 1. Scrum overview.

Figure 1 is a visual overview of the Scrum processes explained above. Each team selects requirements from the product backlog and creates the Sprint backlog. The team then begins to fulfil the requirements in the Sprint, and each day a short meeting is held, the daily Scrum. The goal is to deliver a usable product increment.

Agile principles have been incorporated into the management of software development projects with Scrum. Many organizations experience increased productivity of their software development teams and higher customer and employee satisfaction with Scrum. Scrum has become an integral part of modern software development. Scrum is also adopted in areas other than just software de-

velopment, but it is designed to work best in small teams. One application possibility of Scrum could be that a competitor places a better product on the market. An interdisciplinary team is formed to make the own product competitive again. The team consists of specialists from different areas of the company, like production and marketing. [28,29]

3.4 Scaling Agility

Nowadays the term agility is becoming increasingly important for companies that want to adapt their project work to the VUCA world, particularly in the automotive industry. In the past agile methods were applied to small, collaborative teams working on minor projects. But organizations that build much larger systems, such as cars for example, also want to take advantage of the benefits of agile product development. As a result, there is a growing body of thought that addresses applied agility on a large. However, Scrum focuses on flexibility and adaptability, less on standardization and stability. But for large companies, such as automobile manufacturers, stability and standardization is important. Furthermore, a single team, as it is the case with Scrum, is no longer sufficient to handle the resources as soon as the development of a product gains in complexity and size. [30,31]

The scalability defines itself in this context as the expandability of a network or process. Companies want to scale agile frameworks like Scrum to a larger level to benefit from the process improvements they might already have made on a single team level. In addition, companies want to remain agile, even if the product to be created is larger. Scaling refers to several agile teams that work together to create an integrated deliverable result and thus have close dependencies on each other. If these dependencies do not exist, the teams work in parallel and there is no need to scale. Scaling agile principles means working with multiple teams which demands agile management. Therefore, it must be ensured that a common goal is understood and shared by all. In addition, the coordination of the teams must be sufficient. While self-organization and a sense of responsibility are encouraged, the goals and the alignment of the teams with the vision and established priorities must be maintained. There are many challenges of scaling agile, hence there are frameworks which try to adjust agility to a larger context. Going the path of scaling agile to a larger frame means coping with longer planning horizons, a lack of agile mindsets at management levels, and a lack of coordination. [32]

If a functioning Scrum team already exists and a new team is needed, dividing the team and adding new team members is the best way to transfer learned practices to both teams. The larger a project is, the more difficult it is to ensure coordination. Good communication and integration are easy to achieve with one team, but it becomes increasingly difficult with multiple teams. Accordingly, one problem of scaling is that also negative points are scaled. Therefore, the first step is to work sensibly with one team. Only if this works, a second team should be considered. All in all, it is of high importance that the agile mindset is understood and adapted in the whole organization for successfully scaling agility. [27,32,33]

Besides the difficulty of scaling the agile development of a project to several teams, it is particularly important for automobile manufacturers to manage a portfolio of several projects in an agile way. Therefore, we need to have a closer look on the definitions project management and portfolio management.

PART II

3.5 Definition of Project Management

For understanding how portfolios of projects are managed at traditional manufacturers, we firstly need to take a closer look on project management. Project management is broadly used at automotive manufacturers, especially for any perspective of product development facing disruptive megatrends. For defining and clarifying project management, the term project must first be distinguished from the terms process and program. A process is an activity which occurs more often and has a defined outcome. Whereas a project is a set of activities which are more unique, and the outcome is specified in the form of deliverables. A program is a network of multiple projects where the outcome is specified as goals. [34]

In addition, projects have characteristics that help to differentiate and understand the term in the business context. The first characteristic is the uniqueness of projects, which means that tasks are risky and uncertain. The next characteristic is that projects are goal oriented. This means that the desired outcome is specified, and the resource consumption should be limited. Therefore, projects have restrictions regarding time, budget, and organizational internals. Projects are also affected by uncertainty, complexity, and the dynamic market conditions of the VUCA world and are never isolated from environmental influences. The tasks and the environment around them are interrelated, interdependent, and interdisciplinary, which means that cooperation of different departments of an organization is required. It can also be said that projects are significant for the economic success of an organization. In a nutshell, projects can be considered as temporary enterprises. [34]

The following types of projects are often found in large organizations such as car manufacturers: marketing projects, strategy projects, acquisition projects, product development projects, organizational development projects, and IT-projects. In conclusion, the International Standards Organization (ISO) gives an appropriate definition of the term project: “A project consists of a unique set of processes consisting of coordinated and controlled activities with start and end dates, performed to achieve project objectives. Achievement of the project objectives requires the provision of deliverables conforming to specific requirements. A project may be subject to multiple constraints ” [34,35].

However, the origins of managing projects as we know start with Henry Gantt, who developed the Gantt-Chart to control processes, which was presumably first used during the construction of ships for the US Navy during the First World War in the 1920s. Other important milestones of project management were the Manhattan Project, which was a research project for the development of the atomic bomb starting in 1942 and the aerospace undertaking Race to the Moon in the 1950s and 1960s. Nevertheless, it can be said that project planning has existed ever since people started collaborating on large-scale projects.

Neither a military operation nor the construction of large buildings nor a maritime expedition were possible without the detailed planning of these projects. However, it was in the 20th century that these informal procedures were brought into the scientific form under which project management is practiced today. [36,37]

Further on, there are many definitions and standards for project management from different sources, although the content is largely consistent. PMI, the Project Management Institute, defines the management of projects: "Project management […] is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements". There are associations and committees all over the world that are dedicated to project management. Standardization institutes and project management associations set themselves the goal of establishing and promoting a uniform terminology. The project management consists of different system levels. There is the management of individual projects, as well as the management of a group of individual projects in the so-called project portfolio, which will be discussed in more detail in the next chapter. In addition, there are also project-oriented companies where the management of the company implies project activities as the core business. Further on, managing projects means handling a variety of trade-offs. The central conflict can be represented by the so-called magic triangle which shows that resources, performance, and time need to be managed simultaneously. [38]

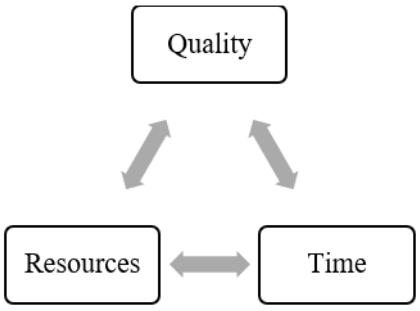

Fig. 2. Magic triangle project management.

The quality of the performance depends on the time and resources available. The resources such as costs, on the other hand, depend on the quality of the performance and the time available. Ultimately, the time required depends on the quality required and on the available resources. Therefore, the goal of project management is to achieve the highest possible quality with the least possible time expenditure and the lowest possible costs. A stakeholder, who is any person or organization which is interested in the outcome of the project, influence the magic triangle as the decisive external factor. The different stakeholders set requirements for the product, such as scope, quality, time, and resources. Managing a project has the task of meeting the stakeholders' expectations of the project as closely as possible. [39,40]

The path how to meet the stakeholders' expectations can be described with the project management phases. The first phase is the project start-up phase, followed by the planning and execution phases. Subsequently, the coordination and change phases follow, and lastly the project close-down phase is processed. In the project start-up phase, the necessary structures of the project organization and other preconditions are set. Here, the objectives are discussed, which can be seen as milestones towards the achievement of the goals. According to Peter Drucker, those objectives need to be SMART. This acronym means that the objectives are specific, measurable, achievable, relevant, and time framed. The objectives and deliverables are agreed on between the project management and the stakeholders. [34,41]

The following phase is the planning and execution phase, where the preceding planning already shows the issues that the topic of agility addresses. The planning mainly includes a detailed plan, and the execution manages the realization of the project planning steps. The focus of this phase is mainly on distribution, like the breakdown of the work. In traditional project management high significance is attached to concrete planning which is usually realized by a Work Breakdown Structure (WBS) for example. This shows how detailed the planning of the processes is executed in large organizations like automotive manufacturers. A WBS is a hierarchical table of all projects relevant activities and makes the entire project scope visible. The structure for the planning results in the definition of work packages, which are executed afterwards. Another useful tool is the Gantt chart. While the WBS makes the activities transparent, the Gantt chart can schedule the activities. The Gantt chart is an instrument that graphically displays the chronological sequence of activities as bars on a time axis and is widely used in project management for illustrating the schedule of activities and milestones. Here, the structure of the WBS should be transferred to the Gantt chart. Besides the activity bars there are also milestones which are fixed points in time. The milestones of a Gantt chart are used for quality assurance during the execution phase by measuring the achievement of the goals. The Gantt chart example shows 3 activities as bars and 2 milestones as triangles. Figure 3 shows that activities can be simultaneous during the 4 weeks. Further, figure 3 indicates that the Gantt chart uses a waterfall-like approach. [34,40]

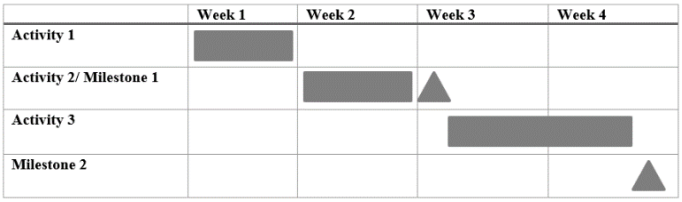

Fig. 3. Gantt Chart Example.

Next, the coordination and change phase starts. Every execution phase is concluded by a coordination phase, and the results are transferred to the following execution phase as conditions. The coordination phase includes the compilation of results and the management of deviations. The focus in this phase is on revision and correction. Finally, the project is finished with the project close-down phase. All responsible persons are released from their tasks for this project. Lessons learned are gathered in order to use the experiences made for the next project. [34]

The organization of a project, illustrated in figure 3, consists of various hierarchical levels and is closely linked to the line organization.

One part of the strict project organization are the team members which are linked to experts from the line organization and report to the project manager together with the project controller. The project controller carries out the administrative activities while the team members are responsible for the technical work. The project manager leads the project. The project owner and the advisory board are linked to the line managers of the line organization. The project manager directly reports to the project owner, who has the main responsibility for the project. At the advisory board, technical matters are decided in cooperation with the line management. Lastly, the steering committee is linked to the top management of the line organization. Here, the project's objectives are compared to the organization's objectives. [35]

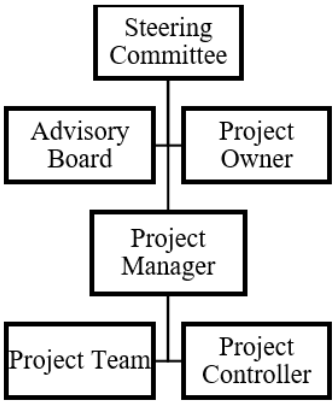

Fig. 4. Project Organization.

In summary, project management should lead to success through the execution of tasks by setting goals and objectives. The efficient use of resources is possible thanks to phased procedures like the adherence to time and cost budgets. Nevertheless, the traditional project management in many organizations still works according to the waterfall method, where information flows from top-down and therefore cannot be aligned to changing market circumstances in an agile manner. The alignment should happen at the bottom part of the organization, where the project work is done. The above explained project management theory focuses on successive and gradual workflow and high bureaucracy. The preference for expansion in width and early quality assurance means that nothing can be delivered in isolation, even if it is valuable. Work is carried out according to the original plans, even if these should prove to be obsolete. Feedback is rarely given early enough to be used to improve processes. [34,42]

3.6 Definition of Portfolio Management

As explained above, many undertakings in organizations are implemented based on projects. Especially in large companies, such as automobile manufacturers, many individual projects must be managed in a goal-oriented manner. Their number, structure, objectives, resource requirements, and their relationship to one another influence the change of the organization. To ensure transparency and controllability, a project portfolio is implemented, which takes the overall strategy of the company into account. [43]

The term portfolio comes from the description of a briefcase in which a collection of documents is stored. Artists or authors can compile examples of their work in a physical folder and adapt its contents according to their audience. Hence, a portfolio is a collection of independent elements that are grouped for a common purpose. For example, projects are often grouped into portfolios, therefore in many organizations project portfolio management is the logical term. [44]

The portfolio must also not be confused with the program. A program consists of several interdependent projects with an overarching goal which are bundled and managed collectively. A program ends with the achievement of the goals. In addition, the term multi-project management must be delimited. Kunz for example, uses the strategic multi-project management as an equivalent to the common definition of the term portfolio management. Due to the inconsistency and redundancy of the term in the current literature, the term will not be used further during the paper. [35,45]

In project management a project is analyzed individually but in portfolio management the sum of the projects is analyzed. In project portfolio management, the portfolio is checked with regard to formulated strategies and goals of the organization. Moreover, a project portfolio includes several projects that are managed to provide greater value to the organization, and handling a portfolio is more effective than treating projects independently. Hence, portfolio management includes all necessary activities to identify interdependencies between projects, to allocate resources efficiently, and to use experience from individual projects as an input for the organization as a whole. Portfolio management can be defined as a permanent, superordinate instance for the continuous planning, management, control, and adjustment of the project portfolio, whereby decisions are made in regular cycles on the inclusion and prioritization of project applications and the termination of unprofitable projects. [34,43,46]

Portfolio management enables a business to select the right projects and eliminate the wrong ones. In addition, it allocates resources depending on the importance of the individual project and aligns the portfolio decisions to strategic business goals. Also, the portfolio management creates ownership among the individuals in the teams. It can be said that portfolio management is closely linked to corporate strategy and its development. Therefore, the project portfolio management process begins with a review of the corporate strategy by management executives. The starting point for strategic positioning is the formulation of the business mission, meaning what the company is aiming for on the market. This is the basis for the vision which deals with the role of the company in the market in a medium to long-term period and includes quantitative aspects. By formulating the mission and vision, the targeted market segment and the associated requirements are defined. [41,43]

Based on this, an analysis from an external and internal point of view is performed using the so-called SWOT analysis, as illustrated in figure 5. SWOT is an acronym for strengths and weaknesses which reflect the internal factors, and opportunities and threats which includes the external factors. In the external view, the development of the market in which the company wants to operate is described with the corresponding opportunities and threats.

Parallel but separate is the internal view. The strengths and weaknesses of the company are analyzed regarding the critical success factors of the market. Based on this analysis, the strategy is then to be determined and describes the future positioning. [43]

	Advantages	Disadvantages
Internal Analysis	Strengths	Weaknesses
External Analysis	Opportunities	Threats

Fig. 5. SWOT Analysis.

Once the company's position has been clarified, goals are defined, and measures are devised as part of strategy development. Subsequently, the implementation is quantified and monitored. For this purpose, the BCG (Boston Consulting Group) matrix has been established to operationalize the strategy. The BCG matrix, illustrated in figure 6, helps in the evaluation and alignment of strategic business areas with respect to the business priorities. The external side is described by market growth, such as the increase in sales in a particular market within a specified time. The internal aspects describe the relative market share. The first category is called Poor Dogs which stands for discontinued business areas. The next category of Cash Cows are business areas that generate high cash flows. The Question Marks are business areas with potential growth and the Stars are the most promising business areas. After categorizing the business areas in the portfolio, a company can derive needs for action like investments in new business areas or the allocation of resources to the more relevant business areas. [47,48]

High Market Growth	Question Marks	Stars
Low Market Growth	Poor Dogs	Cash Cows
	Low Market Share	**High Market Share**

Fig. 6. Boston Consulting Group Matrix.

For implementing the strategy, performance measurement and controlling must be introduced. Therefore, the Balanced Scorecard (BSC) is the most fitting tool for performance management and controlling. The BSC, shown in figure 7, breaks the strategy of the company in 4 key perspectives: Finances, customers, internal processes, and potentials. The balance in the scorecard is achieved by looking at all 4 perspectives and their relationships. In doing so, both short-term and long-term goals, performance indicators and operational performance drivers, monetary and non-monetary indicators, as well as hard and soft factors are considered. By the formulation of objectives, key performance indicators, targets, and concrete measures, the strategic goals are operationalized, and their achievement quantified. [49]

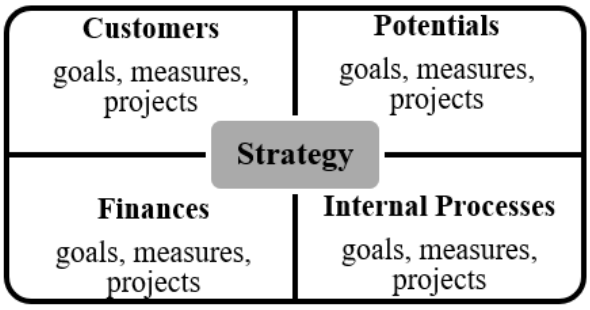

Fig.7. Simplified Balanced Scorecard.

Before the project evaluation methods regarding a project portfolio are discussed, other causes of projects are shown. Like already mentioned, the corporate strategic planning process is a source of projects, as the company's goals and strategies are the basis for projects. The strategies can be executed as individual projects or programs. In addition, changes in the corporate environment are increasingly often sources for projects, particularly in the VUCA world. New legal frameworks, new technologies, or changes in competition require an early assessment of their impact on the future of the company, especially in the automotive industry. Projects can also be initiated as product improvement or development, initiated by customers or the sales department in form of product development projects. Improvements or learning opportunities, such as becoming more agile or implementing lean management tools is especially in the automotive industry often realized in the form of projects. [34]

To manage a portfolio of projects and to select the right ones, the projects must be evaluated and prioritized. There are various criteria for this:

- Economic Return. The Economic Return is a very important criterion as it represents the economic viability of the project. The Net Present Value (NPV), which is most suitable for this calculation, represents the sum of the discounted cash flows of a project. [34]
- Strategic Benefit. Projects can be evaluated with regard to innovation potential, cost reduction, or optimization of business processes. In order to make the strategic contribution quantifiable, the effects that arise if the project is not implemented could be measured. [34]
- Operational Urgency. External influences such as legal requirements or activities of the competition usually lead to urgency. [43]
- Risk. The risk represents the possibility that an event under uncertainty could have either a positive or negative outcome. A risky project is usually less attractive because a higher risk increases the probability of termination and increases the cost or duration. This can be analyzed using a risk matrix. [34]
- Resource Intensity. This describes the number of resources required for a project. There are several types of resources that have to be considered like budgets, employees, facilities, and equipment, as well as special know-how. [34]

- Complexity. The complexity of a project is another criterion to be considered. The complexity can be measured by the frequency of changes in the conditions, interfaces to other projects, and known problems in the realization of the project. [34]

In the next step, the projects are evaluated and compared with each other to create a balanced portfolio with the most suitable projects. With comparative evaluation methods, a project is compared with one or a group of alternative projects for creating a ranking. Portfolio models evaluate projects using set criteria and classify the projects in a matrix based on two dimensions, like figure 8 illustrates. This allows to derive the prioritization. [34]

The two dimensions can be the prospects of project success and the business value, for example. In this case, the business value on the x-axis reflects various criteria and can contain monetary indicators, strategic benefit, and the duration of the project. The y-axis describes the prospects of success and represents the chances of a project being realized. High risk projects should not be included in the portfolio, as they usually end in exponential cost overruns. The remaining fields are assigned with priorities: The field in the top right-hand corner is given top priority, since here the business value is maximum, and the risk is minimum. The other fields are now assigned with ranks depending on the company. In figure 8, red is lowest priority, orange is low priority, yellow is high priority, and green in highest priority. [34]

High chances of success			Highest priority project
Medium chances of success			
Low chances of success	Lowest priority project		
	Low impact on business value	**Medium impact on business value**	**High impact on business value**

Fig. 8. Example for Portfolio Model.

Afterwards, resources can be allocated and prioritized according to the project's rank. Portfolio models can be designed differently depending on the company. Alternatively, the strategic benefit and the urgency can be compared or the contribution to the company's success and the use of resources can be analyzed. Due to the possibility to use different criteria, portfolio models can be very accurate. [34]

Besides the portfolio model, scoring models break down the evaluation problem into partial aspects and evaluate the projects separately according to previously defined criteria. An overall score is then calculated for each project. The possible weighting of the individual criteria makes it possible to vary the importance of these criteria. Qualitative criteria can also be considered by using scoring models. The advantage of using a scoring model is the clear prioritization. By quantifying all criteria on ordinal scales and forming scores, the evaluation is comprehensible, transparent, and flexible. The scores allow to compare alternatives directly with each other. Disadvantages are, as with all models, the selection of the correct criteria and their subjective weighting. [34]

Next, the organizational structures of project portfolio management are explained. The project portfolio management's main roles, which are relevant for this paper, are the project portfolio steering committee and the project portfolio controller. The portfolio steering committee consists of the executives which are responsible for making key decisions and manage the project portfolio. The control of the project portfolio by the steering committee is mainly limited to strategic aspects without any urgent need for action. This can be a disadvantage in an agile environment. The tasks of the project portfolio steering committee include selecting and prioritizing projects, identifying interfaces between projects, plus setting goals, schedules, and budgets. In interdepartmental projects, issues arise that the project team cannot decide on its own due to the strategic implications of the problems, their financial consequences, or their impact on other projects. Therefore, a project steering committee can be established. To make this committee functional, regular meetings should be held at which project managers are informed of necessary decisions. This can significantly improve direct communication and team culture. [34]

In the following, the tasks of the project portfolio controller are described. The portfolio controller is responsible for a standardized presentation of the different projects and applies tools and methods that allow efficient decisions within the project portfolio steering committee. The project portfolio controller compiles the project information at regular reporting dates, integrates it into project portfolio reports as well as prepares analyses and derives possible control measures for the decisions of the project portfolio steering committee. [34]

PART III

3.7 Differences of Agile Mindset with Project Portfolio Management

All in all, it is important to have a project portfolio management, especially for large organizations such as automotive manufacturers. Especially in the current situation of the automotive industry, which is characterized by disruptive megatrends, it is of great importance to manage the different projects in the organizations holistically.

Nevertheless, the consolidation of all decisions concerning individual projects and the portfolio in a general management committee also appears questionable. Often the projects are called together for presentation at one meeting. Only few members of the committee are really interested in the individual projects. Depending on when the individual projects are called in order, they receive more or less attention. This system of concrete measurements could stop a project that could break new technological ground, potentially having a greater impact on the overall corporate strategy. Portfolio decisions need to be made in shorter cycles to enable agility at the portfolio level. Portfolio management should not dive down like a submarine and resurface after a long time to assess the project status, but rather be close to the water surface like a dolphin to be aware of changes in the project's scope. [43]

The difference from agile delivery to traditional project management is to dispense upfront planning of the scope. In traditional project management work is carried out according to the original plans, even if these should prove to be obsolete. Feedback is rarely given early enough to be used to improve processes (cf. Wolle

2005: 31f.). One major pillar of the agile mindset is disregarding the term project with fixed end dates and seeing initiatives as value streams focusing on products. Disregarding fixed and well-defined specifications for completion at a given time leaves room of iteratively taking decisions bottom-up. Short-term planning of the work items ensure high agility. [42]

4. Conclusions

It is difficult to predict whether traditional automakers will make the leap to digital, green mobility service providers. In the past however, traditional automakers have focused on process efficiency and increasing their profits through economies of scale. This resulted in fixed structures that rarely deviated from their routines and processes that were planned in detail. However, in this VUCA world, customers expect companies to respond more quickly to their needs. To accomplish this, the automotive manufacturers need to become more agile, especially regarding portfolio decisions.

Business agility, the ability to proactively detect and seize innovations by delivering value quickly, has increased productivity of small software projects successfully in the last decades.

In portfolio management, a set of processes enables organizations to select the right projects at the right time to implement long-term business strategies. The portfolio provides direction and priorities for budget investments and resource allocations for projects. Nevertheless, the above stated challenges of increasing competitive pressure have forced companies to rethink the traditional view of portfolio management with inflexible and non-reactive planning processes.

This research made it obvious that the traditional project portfolio management is in many points difficult to combine with agile methods. An agile environment requires a more decentralized approach to portfolio management than in a traditional organization to place decision-making authority at the right level. For example, the difference of agile delivery to the traditional organization is the focus on value streams instead of project thinking and on small work packages instead of detailed planning. A value-driven approach with a calibrated measurement approach across the organization is required. Therefore, portfolio management should remove the traditional WBS as well as long-term milestone planning. In general, portfolio planning becomes more iterative and bottom-up ideas have a higher impact on program level. In addition, portfolio management can maintain control over the implementation of the strategy by increasing or decreasing the budget.

This study can conclude two recommendations for action for automotive manufacturers. Firstly, a gradual implementation of agile methods is advised. A gradual introduction should prevent agile methods from being introduced without being understood. A phased rollout implies that only when success is achieved at the team levels, it will be scaled up to multiple teams. The focus here is on proper and intensive training of employees and managers, so that implementation barriers are removed, and the important agile mindset is adopted by all.

Secondly, agile methods should be implemented in an adapted manner and not implemented simply by the book. The focus should be on the respective value. This prevents early rejection and increases the long- and short-term prospect of success. Emerging opportunities for creating value can quickly get absorbed by the organizations over the hierarchy of backlogs in the portfolio. However, transforming the processes and mindsets in a huge organization to exploit these higher levels of agility remains challenging.

Conflict of Interest Statement

The authors declare that there is no conflict of interest in the study.

CRediT Author Statement

Patrick Siegfried: Supervision, Project administration, Conceptualization,
Christian Mann: Writing – original draft, Methodology, Conceptualization,
Alex Michel: Writing – review and editing, Validation, Conceptualization.

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