CHANGES IN COOPERATION IN PROJECT MANAGEMENT

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Abstract. *Today, project management (PM) has to meet the requirements of customers' rapidly changing requirements, new opportunities arising from technical progress, the ideas of investors or the legal framework in ongoing development. Gone are the days of contracts with fixed targets. Problems are named and outlined. Changes in the approach to PM and the transfer of self-responsibility to teams through agile processes such as Scrum, eXtreme Programming, Crystal or Kanban have already been introduced 12 years ago. This already had serious effects in communication. Furthermore, the approach of the anti-fragility claims in addition to the ability to communicate co-operation, readiness and assumption of responsibility. In this paper, we focus our discussion on changes in PM on the antifragility approach and address the tasks to be tackled in the change process from the transition from agile to anti-fragile approaches. First of all, the question is which requirements are to be placed on these supporting instruments for PM and which boundary conditions must be taken into account. Are new success factors to be considered in the new PM? How do we deal with internationalization? How about virtual worlds? How about the demand for mobility? And what is the impact of increasing multicultural diversity? Are disadvantages of the previous PM minimized or are they completely eliminated? Do disadvantages have to be accepted? Which? Who are the winners in the use of our newly developed anti-fragile PM? Is it financeable? In order to answer these questions, we deal intensively with the evaluation of existing methods and techniques. Because of projects that are rated as critical - this so far concerned quality, legality, financing, time and benefits - require the special attention of top management our new recognized factors have to be included in the evaluation of a crisis to obtain a better benefit of a project.*

Keywords: *cooperation; antifragility; digitalization; mobility; virtual organization.*

Introduction

The main goals of a project management (PM) are to achieve results that consist of - partly changing customer requirements, but still keeping to planned costs, planned times, planned use of resources and employees. The project manager can sometimes be part of the company, sometimes outside the company. Sometimes he has a team of members of different companies - sometimes even from different countries - to lead. They all have a common problem to solve. Due to the rapidly changing requirements of customers, a contract with fixed goals is no longer possible. Too many new technical possibilities, new laws that allow expansion or reduce the planned chances, or new ideas of the addressed clientele influence the further development. To meet changing environments, agile PM addresses the flow of communication within teams, as well as the scope and responsibility of each team member (seen in Sutherland, 2015). To date, the manager has been tasked with organizing and controlling the use of new technologies, selecting standards and methods, coordinating interactions between colleagues or between colleagues and customers, in conjunction with the permanent,

fast - changing environment. The core idea of reducing the complexity of these challenges is to gradually divide up the entire project. Instead of following fixed plans, agile PM can act flexibly. Permanent changes are possible and accepted.

In this paper, we focus our discussion on changes from the planned via the agile to the anti-fragile approach. Essential in agile PM is the self- responsible work of team members in a decentral network with distributed responsibilities (Agile Manifest 2001).

A stable working environment and exact predictions for the continuation of the work are necessary in a plan-oriented PM, where first a work plan is set up. This one is very fragile. Therefore, the ongoing development of the project is subject to fluctuations and shocks. It's about surviving these situations. The goals of an anti-fragile approach are to have more advantages than disadvantages in stressful situations and to be profitable. Taleb (2012, pp.31-40) compares to the Hydra. The main question is: What do we have to change in agile PM to get an anti-fragile PM? To answer this question, we need to consider the process, methods, and capabilities of anti-fragile PM.

Methodology

The anti-fragile approach claims to be able to support a high co-operation, including readiness and assumption of self-responsibility of all team members. The question is: What is the right manner of cooperation and how the top management can support this?

Beforehand, we provide a brief overview of task management in PM in general, special features in multi-project management, agile features before we use this scheme to highlight the specific challenges of the anti-fragile approach in PM. Discussion elements of the organization are procedures in the project process, new tasks and new roles, and subsequently the adoption of outdated concepts. We examine the question of the needed methods, techniques, standards and IT-Support. The anchoring in the company from a corporate and strategic point of view is another point of discussion. This is intended to ensure the sustainability of a changed PM. Training concepts and further developments in the area of the anti-fragile approach must also be taken into account in order not to miss the connection to further changes. As last result we list the recognized factors which have to be taken into account in addition to financing, time and benefits to make sure that ultimately, motivation and creativity should all be maintained for a long time.

Our methodology is shown in the figure 1. We start with the discussion of tasks of different types of PM to highlight the specific challenges of a planned, agile and anti-fragile project approach, we compare the organizational possibilities to support the needed cooperation within the development of a project, we examine which tools are used to support cooperation, and we end summarizing our discussion within a short table which will content the difference between a planned, an agile and an anti-fragile PM taking into account boundary conditions.

At the end you will find out why the sole good communication flow with the view of time stamps and costs are not enough.

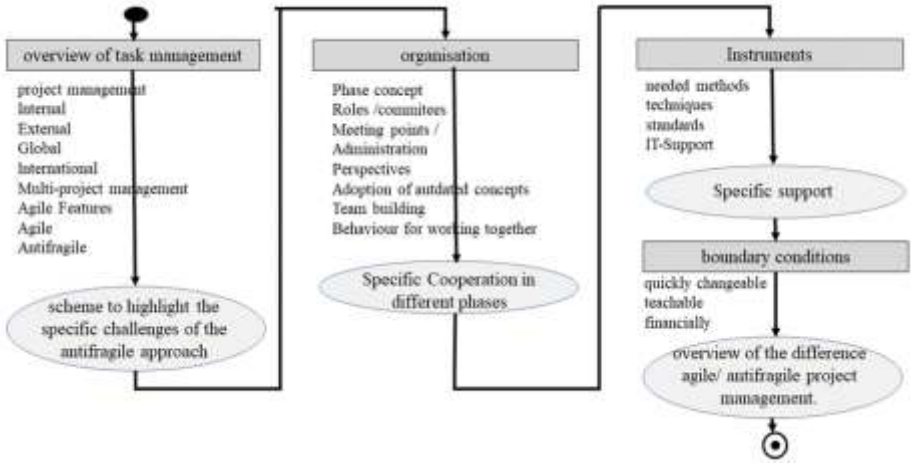

Figure 1. Methodology to show changes of PM

Tasks of PM

In this part of the paper, our goal is to figure out a scheme to highlight the specific challenges of the anti-fragile approach coming from a waterfall and an agile PM phase concept – as a process to develop products or services. In every PM the main tasks of a manager are, to plan, to decide, to coordinate and to control (as seen in Gabriel & Baier, 2003), but the tasks will be done in different phase dependent of the underlying process. In the case of PM for developing software a special subject, called Software Engineering, exist to develop specific methods and technics to make sure that the requirements of clients are right understand and the results will be done in given time and costs. The construction of a phase concept as well as each phase itself, and even each tasks within the phases following the questions first why, then what, and at last how. In this way the complexity of working on a problem is reduced. After each phase the top management can say stop or go, or they can introduce some changes. There exist more or less phases, dependent from the constellation of the type of PM, product´s boundary conditions, of the team compilation and the organization. For example, in the case of software development, waterfall PM requires separation of the phase concept into phases such as phase requirement analyses (1), phase conception of the expert view (user) for the required functions (2), user interface (3) and data processing concept (4). In the case of the desire to buy software, you only need the whole phase (1), a small part of the phase (2) and sometimes, if you have the possibility to determine the user interface yourself, a small part of the tasks of phase (3). We believe that analyzing a chess point to find out the problems is always necessary before starting the project definition. In the project definition you start to work on the specifications, and you name the goals, and the associated problems. Using phase models, you need to create a timestamp plan and resources. As shown in Balzert (2008), there are different types of plan-oriented phase models such as waterfall model (linear or cyclic), V-model, prototype model (horizontal / vertical), evolution / incremental model, object-oriented model, or spiral model. They all have the same goals in the PM – minimize the costs, times, risks, management expenses or maximize quality. The great difference in the characteristic is solving the whole problems step by step or only an increment from begin to end. Sometimes you start with the basic system and then you develop the next part - like an evolution. If you will go fast to market, you will have developed some parts of the product in such way

that you can sell it. Sometimes you begin the next part before the other part is finished, and sometimes you can work parallel on parts of your new product.

In agile PM, this recognition is the basis for the development of a product. Here, the product owner describes the requirements, sets the priorities and estimates the effort. From this, he creates Blogs with deadlines, which he discusses with the so-called master. This master manages the development process. The team is urged to answer any problems that occur immediately. With Scrum there can be daily or weekly meetings that only last a short time. In a sprint of 2-4 months the team members can working on Blogs. At the daily meeting each team member is asked for the first time which problem he wants to solve and what he will do until the next time. At the 2nd - nth time there are always exactly 3 questions: were you done until today? There were problems? What are you going to do until next time? Here is no way to hide in a group. Everyone must answer for himself. If someone has had problems, he can say so openly. Everyone helps, so there is no delay in the whole project. First, the problems are resolved before it is allowed to proceed. An old slogan says: a chain is as strong as the weakest link. And who would like to pay for a project in which one person has done a wonderful job and another does not, so that the product cannot be sold?

Agile methods are focused on the result. Now, it may be that all team members belong to the enterprise. Then it is an internal project. But if the members are from different companies - as is generally the case with developments, for example, of projects that receive funding, we speak of external projects. Contracts are necessary. In the V-Modell this was extended by extensions to document templates for the necessary tasks of the tendering and the conclusion of the contract. It then creates a decentralized network of employees with distributed responsibilities. All the more important is the division into Blogs, which must then be suitably distributed from a technical point of view. Another distinction when looking at tasks is, that the project can only be distributed in one country or over several countries. How do we deal with internationalization? With knowledge about other cultures the impact of multicultural diversity can increase. In addition, we need tasks for education in other cultures. In other words, in IT support. But this IT support is harder to realize because of different tools and the problems between the different tools. Also, the bills, especially in publicly funded projects are also not easy to do. There are extra jobs like the GIZ, which do these tasks by specialists. But this means that more documentation tasks have to be completed and contracts have to be concluded.

If we consider the portfolio of projects in a company, then a multi-PM for coordination by a committee for the decision-making of selection of project proposals, financing (budget finding), appropriate resource planning (or even during the project term advantageous allocation) of resources, the prioritization of projects, supported by risk assessment with impact on the project landscape and portfolio review of all projects including the holistic coordination with the corporate strategy as well as standardized reporting and performance control necessary (as seen in Bircks, 2009). Furthermore, according to Bircks (2009), a regulation on decision-making powers and instructions also applies to management during the course of the project, the establishment of a knowledge pool and the provision of project-relevant information during and after the project. The project teams must be trained in the tools and methods and standards to be used. These framework conditions for the implementation of many projects in a company are thus possible in a planned PM with the focus on expertise, in the agile and

in the anti-fragile approach can be made some compromises. For both, the distribution of responsibilities per se is clear: everyone is jointly responsible for the success. Resources can be requested or exchanged at any time as the situation requires. The immediate danger of success must be avoided.

While the team spirit of the agile approach to the high-performance team - in which team members trust each other and sometimes work more to help others - has evolved, the anti-fragile approach is such that everyone can act on their own to find the best solution to find. Accordingly, everyone also needs a certain budget, which he may spend.

Table 1. Highlighted tasks in planed, agile and anti-fragile PM

Tasks: PM →	planed	agile	Anti-fragile
Demand	Predetermined plan (time, costs, resources, methods, standards) from Manager/ MPM to fixed team	Blogs with timestamps from Product Owner to Scrum-Master to team, new Blogs in product Backlog	Problem to group of members, the members say how long time they need
Selection of works (operational level)	assignment from Manager to person	Free selection of an increment to work on it	Free selection of an part problem to solve it
Handling of problems occurred	Solution by manager	Solution within Team	Self-optimizing search for solution
Budget allocation	MPM/ Top manager	Product Owner	Each team member
Interchange of Instructions	Planed timestamps	Daily/weekly meeting/ Sprint	If necessary
Hindsight of finished projects	Institutionally (MPM) registration through questionnaires and forms	Every day / week or at the latest after Sprint: Discussion about mistakes	Learning from mistakes, these are openly discussed

In table 1 you will see the differences of important tasks between the planed, agile and anti-fragile PM. But how different are the manifold tasks organized?

Organization

On the basis of the analysis of task complexes described above, it can be stated that companies today carry out several projects virtually at the same time and therefore use multi PM (MPM) - also called portfolio controlling or product controlling (Krcmar 2000). This can be organized differently. It ranges from a separate department, to committees that always arrive at the same intervals, to outsourced assignments from specific companies. (Gabriel Beier, 2003, pp.136-143). And how is the project carried out from an organizational point of view? In a project, team members have to work directly on (part of) project and service team members have to document the state of a project (in plan, deviations) and to assist manager. Roles will be addressed to the team members. As seen in (V-Modell: Kap. 4, Pkt2.) roles are the description of capabilities, description of roles (name and text), tasks and powers, skills profile, casting, responsible for contributor. More details you will find in Balzert (2008, pp.5, 114, 120 ff, 255 ff, 556). Many different roles (34 in V-Modell) are distinguished in project teams' roles, project

specific roles and organizational roles (V-Modell, Chap.4/3). In agile PM the master works together with the team members (specialists) after having the blogs from product owner. For the organization there is no need for roles (and the high administration). All people work together if necessary. In anti-fragile PM everybody works on his problem in his way with the method, which he wants, and if he thinks that he needs help from a specialist, he is able to claim it. This is possible because of branding management. If you have an internal project or an external global project, it is easier to put together a team as it is within a network. In cooperation with partners from different companies, the influence of multicultural diversity will increase. The advantage is that the customer requirements in these countries are better understood through cooperation.

Table 2. Organizational elements in planed, agile and anti-fragile PM

Organization's elements: **PM →** ↓	**planed**	**agile**	**Anti-fragile**
Room for Maneuverer	Not free	Responsible for team	Self-responsible
Collaboration	Distribution according to competence, working alone within group for cooperating enterprises	collaboration among employees routinely avoid problems	Collective collaboration
Control Support Information	Project goals (operational) MPM enterprise-goals	enterprise-goals	Corporate culture, corporate strategy
Organization unit	Fixed team	High Performance Team (never change a winning team)	Each Team-member
Learning organization	Learning if necessary for the projects	Learning every time, feedback after project, motivation,	Learning every time, also from mistakes, feedback during project, Burning
Phase concepts	Planed Phases with planed results	Operation phases – no separation in construction, control and documentation – all in one	Free handling in problem solving
Roles /committees	Multiple Roles, distinguished in project teams roles, project specific roles and organizational roles, MPM, PM	Owner (Blogs), master (operational), Team	Top management with problems, solver-group
Meeting points / /steering board/	Milestones, planed timestamps, Steering board outside	Blogs with date, sprint 2-4 weeks, Team: every day	If necessary, IT supported, finished, problem solved
Administration	Very high, many documentation, project History	no documentation during development only results	For IT support only,

Organization's elements: PM → ↓	planed	agile	Anti-fragile
Perspectives	Reliability, adherence to plans,	Fast and flexible, trust	Burning for the enterprise, By stress you become better, creative, innovative
Adoption of outdated concepts	Permanent learning	Team to High Reliability team	Back to Group, Free thinking and acting
Dealing with changes	Contractually regulated, plan change before implementation	Changes are accepted by the team at any time, (Blog change)	Changes are accepted by the team at any time, (Blog change)

In table 2, we demonstrate the essential organizational elements and their changes in different pm. From setting out fixed work schedules to communicating business goals to corporate strategy, the controlling information has evolved in connection with finding a new product or solving a problem. When dealing with changes, the need to make changes at any time, from the fragile inability to make an exact plan to the development of a product or service, has made this the immediate change self-reacting to changes. Thus, minimal damage and maximum profit for a company can be achieved in the simplest and fastest way possible.

Instruments for PM

In this chapter we discuss the different methods and the necessity of special IT Support. In planed PM the manager needs many methods to decide, to plan, to document and to control the project. For the different phases exist different instruments (see more in http://www.infforum.de/) Virtual Organizations are a set of organizational that rely on multiparty co-operative relationships between people across structural, temporal and geographic boundaries. Flexibility is brought about in part by reconfigurable networks of computer based communications that allow organizations to co-ordinate their activities and in part by a management philosophy based on collaboration and innovation. The required decentralized computer-assisted collaboration of time- or space-separated teams and groups is supported by groupware.

In table 3 we answer the initially question asked after possible supporting instruments for PM. Here we show, that the tendencies of only thinking about the problems as specialist of certain subjects is today not enough. Therefore, boundary conditions as enterprise strategy, possible measurements to act or to react on different conditions have to be taken into account from all team members in anti-fragile PM. In contrast to this fact, in agile PM, on operational level only the product owner has to know a great part of these conditions, the product owner all conditions, and all others a subpart of these. In planed PM there exist no call for this knowledge.

Table 3. Some Instruments, used in planed, agile and anti- fragile PM

Instruments ↓ PM →	planed	agile	Anti-fragile
Plan tool	Gantt chart, PERT chart, Microtool, project plan	Calendrer for blogs-time stamps, Excel,	Groups Work
Control	Developing Key figures, Reporting	Daily/ Sprint – Meetings	result
Needed control information	Explain the project objective	Explain the enterprise objectives	Explain the enterprise strategy, corporate culture, explain the problem
needed methods	Strategy – a knowledge for top management, BSC, phase concept, COCOMO-Model, Function point analyses, for more see INFFORUM	Quality management, Risk management, Strategy – a knowledge for product owner,	Brain storming methods, 5 Ps for strategy, Ansoff Matrix, Porter's Competitive strategies, Theory of Constraints
techniques	Fishbone technique,	Lano-Diagram, Classification and dismantle Marketing techniques	Fishbone technique, Lano-Diagram, Classification and dismantle, Scenario techniques
standards	UML, SysML IEEE1471	UML, SysML	UML, SysML
IT-Support	Tools for planning, information, coordination	Communication, Collaboration	Communication Cooperation
platform	Collaboration platform (p.e. Mikrotool)	Collaboration platform, (p.e. Mikrotool)	High dependence, therefore ensuring high availability

Conclusion: more persons have to know about the so long hidden information about the enterprise strategy, and they work today on the bundle of strategies for implementation of the wished enterprise strategy. Because of changing environment with many unknown conditions the theory of constraints is born. In this theory the security buffers for time, costs and worker are given – only one for each – but enough - for the whole project. Gone is thinking in 100% planning. With these buffers, it is possible to think about reactions rather than just drifting. Unforeseen events can be answered quickly. Goldratt (1997) uses a half-time estimate of the durations (i.e., the most frequent durations) as a simple approximation of the durations. The temporal buffers (e.g., difference between optimistic duration and pessimistic duration) are cumulated and appended to the end of the project as a shared buffer. The common buffer is not necessarily the sum of all individual buffers, but can be shortened according to statistical laws. By actively announcing the termination of a work package, it is attempted to line up consecutive processes as possible in the relay-run principle and to avoid idling. "And without the ballast of coordination with others, resolute decisions can quickly be made in a company such as in an emergency room of a hospital (see also Techt, 2017) act. The old slogan "What does not kill us, makes us stronger" is alive.

Discussion

We discuss now our findings above the aspect of cooperation. Under cooperation we understand an exchange of information over a synchronous channel between at least 2 persons or smart objects for decision making about the disposal of a resource. Thus, for example, in the case of a bottleneck, an order can be negotiated as to when and who may use the object in dispute in which chronological order. A good communication channel is therefore necessary to conduct the negotiation well. Conflicts should be avoided. Cooperation therefore focuses on the appreciation of the individual or the negotiating skills. This includes persuasiveness, creativity, good and clear language and the use of the right communication medium. If in a project each team member is responsible for one subpart, the person responsible for the entire project has to be able to coordinate well. "The lowest common denominator is always the individual employee, the individual person and how he confidently deals with his tasks as well as into the project Team is integrated ". (Quoted Bergauer, 2018).

Armor, Phillip G: "The Laws of Software Process" states in his book that we are re-engaged in a learning process in each project. The difficulty of this learning process is that we usually have to set up a plan for a project at the beginning. Our usual solution to compensate for "unknown unknowns" is to schedule buffers. We derive their size from the experience we have already gained in terms of requirements. Since the product to be developed in the software area is to be expandable and parts to be reusable, developers are forced to look to the future and take eventuality into account. The object-oriented approach was created specifically for reusability. But as completely new technologies or knowledge can make all the work so costly lapses, the question is when and what decision should be made in this case of software development in design of architecture. For this purpose, it must be read in (Techt, 2017) that as late as possible a decision should be taken, which then inevitably narrows the options.

On the question of whether the whole thing is financially worthwhile, studies have to be mentioned. Techt refers in his article (Techt, 2016) to a study by Dr. med. Alan Barnard, about multitasking in PM with approx. 500 participants from 20 sectors, according to which 20 percent capacity and 25 percent of sales are lost. According to Wolfram Müller (referred by Techt, 2016), the methodology of critical chain PM (CCPM) can also accelerate projects by around 20 percent or more. Combining Scrum with Critical Chain (= Reliable Scrum) this leads to Lorenz (Lorenz, 2014) to more success as the only use of agile methods. Following the fact that resources are usually not available indefinitely, projects therefore have to be successively bottlenecks. CCPM gives priority to project to which the division project progress on critical chain to use buffer is the lowest. According to (Lorenz, 2014), the use of CCPM in multi-project management can lead to an increase in adherence to deadlines of 95% and to a reduction of project durations by 25%.

The new success factors arise from the consideration "to get the best out of all situations which means that the enterprise is able to serve all customers on time and without quality compromises even in times of (significantly) increased demand". (Techt, 2017) While agile ways of working focus on adapting to new circumstances, antifragility focuses development by new circumstances. First approaches of agile features - as written above - were given in evolution model, incremental model, spiral model and prototyping. In agile PM Trust in the team becomes important here in the team to

achieve maximum performance. In the anti-fragile approach, trust is also demanded from the company to the employees in order to be able to drive innovation. In the agile approach, "the most efficient and effective way to communicate information to and within a development team is in a face-to-face conversation" (cited from agile manifesto). That's why the daily / weekly meetings - in eXtreme Programming (XP) minutes / hours - are very important. In this context, the Four V's, Volume, Variety, Variation and Visibility are also very important. as seen in (McDonald, 2008), which were dealt with in the context of the tasks. Thus, the table of most important criteria looks like this:

Table 4. Comparison between planed, agile and anti-fragile PM

Criteria ↓ PM →	planed	agile	Anti-fragile
Given Plan	CPM, Fixed project plan, fragile	Blogs, flexible, robust	CCPM (Buffer), LOG-Book, Do what the situation demands
Fast to market	Not relevant after planning	Fast to market	Innovation (earlier as others), multiple Options maintain
Responsibility	Each member himself for Adherence to the plan	Responsible for the result of the team	Self-responsible, high commitment

Critical Path Method (CPM) is referred to in (Rouse,) as a "A step-by-step PM technique. “However, since as many of the options as possible have to be retained in the development of a product or service, one must "deal more intensively with the question of the last possible time of a decision than deal with the decision itself. ... CCPM no longer presents resource scarcity as an exceptional situation, but considers it a normal case "(quoted by Gerrit Beine (2015)).

Summary

While agile methods of PM require the required skills of the team members in communication, the team members in the anti-fragile approach rely more on the cooperative style of working. New success factors are considered to be action on market. To do so much more self - responsibility from the team is demanded but also more trust into team members on the side of top management. While the agile PM can survive robust surprise, the anti-fragile PM learns from it and gets even better. For example, bottlenecks are optimally utilized. Priorities that everyone can see at any time "ensure that managers have to settle fewer conflicts and put out fires." (Techt, 2017) Employees may also exceed or fall short of schedules. This then serves as experiences that will be incorporated into the next estimates. Responsible supervisors must ensure multitasking among employees. (Lorenz, 2014). In the anti-fragile approach, the right corporate culture plays an important role.

When perturbation occurs, fragile and robust systems - supported by planned PM - are destroyed, resilient systems - supported by agile PM - recover, while anti-fragile systems benefit. In cases where market conditions do not anticipate changes in project

development time (e.g. through standardized arrangements), content can be planned and defined, and projects are characterized by a short development time or are developed for a closed market, then a planned approach such as waterfall can be successfully applied. But if customers want new materials or techniques during the project, only agile PM or anti-fragile approaches can provide the necessary additional values such as freedom of choice and ownership. If your team is not as self-dependent as it is needed for an anti-fragile approach, or if the company is not yet an agile system, then an anti-fragile approach is not possible. The challenges of PM are the differences in goals: PM is seen as mastering the complexity with collateral and standards compliance (like waterfall), or PM should serve customer satisfaction taking into account the risk minimization (agile) or the project should be profitable for that Companies, even if risks have to be taken into account in a dynamic market (anti-fragile). Action is better than to be frozen in fear.

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