Identification of Indicators to Determine the Progress in IT Projects

Seminar paper

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Abstract

Determining the progress of an IT project is a main duty of project managers in practice. However, the techniques that are commonly used in practice often mislead to a wrong determination of the status of a project. This paper reviews literature dealing with indicators that can be used to determine the progress of an IT project.

We will name these indicators and describe a general approach to identify them in the context of a project. Furthermore, it will be described what measures need to be taken in order to use the identified indicators within the project to determine the current progress of the project.

Therefore, techniques to monitor and report the indicators, as well as requirements to allow monitoring and reporting, will be described.

Keywords: project progress, indicators, monitoring, reporting.

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1 Introduction

In projects, project managers are challenged by the continuous cycle of planning, monitoring and steering their projects. In practice, a common understanding of the main task of a project manager is planning the project (Gessler, 2016). This understanding neglects the importance of monitoring in order to be able to steer the project as early as possible and therefore avert significant deviations from the original plan (Burghardt, 2018). As a basis for this, the project progress must be determined by a comparison of planned values to actual values (Patzak and Rattay, 2009).

However, determining the current progress is often conducted subjectively, without prior monitoring, or uses misleading techniques such as deriving the progress only from either the resources used, costs spent, dates reached, or *work packages* finished (Gessler, 2016).

This paper deals with suitable indicators to determine the current progress of a project. There will be research on the following research question: "What indicators can serve to measure to progress of an (IT-)project? How can these indicators be identified, monitored and reported?".

Therefore, I will describe how to identify indicators during the planning phase of a project that will be used to give an objective report of the progress of a project. Because there is a difference in the nature of the identified indicators, I will also describe what steps need to be taken during the planning phase to monitor the indicators and how this monitoring is conducted during the execution phase of the project.

In the next section there will be a short background on central keywords that I will use in this paper, as well as a clear definition of the scope of the research question. Afterwards, I will outline how I proceeded to gather pieces of information about the research topic of this paper and how I filtered relevant literature. This also includes the suitability of keywords, search terms and databases. In the findings, I will present my results that answer the given research question. The discussion will focus on the impact of my findings on the managerial practice, as well as limitations of the findings that lead to possible further research questions.

2 Background

2.1 Definitions

The most important term to define in the context of this paper is "progress". Sometimes there is a misunderstanding what this term stands for. Progress is equal to the "status of the project" meaning that it is not limited to the progress of work of a project.

Instead, it is a comparison of planned and actual cost-, time- and performance-related indicators of a project (Gessler, 2016). This comparison can either be done with these indicators separated from each other or with the help of an integrated model that considers the interdependences between the indicators (Patzak and Rattay, 2009). Only with this specific definition of progress, several questions during the monitoring of the project can be answered, e.g.: How much costs have been spent in comparison to how much costs should have been spent at a certain date? How much work has been delivered in comparison to how much work should have been delivered at a certain date? (Gessler, 2016).

In this paper, the term "IT project" focuses on IT infrastructure projects and IT outsourcing projects. However, most of the key findings in this paper won't be limited to IT projects but can be applied generally. Projects are unique and differ by their use case and various other aspects such as the content or the category of a project (Patzak and Rattay, 2009) but project management, which is where the topic of this paper originates from, can indeed be standardized to a certain degree (Gessler, 2016). I will refer to the "project" term whenever an aspect is not limited to an IT use case. Whenever there is an explicit subject that only applies for infrastructure and outsourcing projects, I will use the term "IT project" again.

It is also important to mention that in this paper, the term “indicator” does not mean “key performance indicator” which is often seen as a value to indicates a future state or is used to conduct a benchmark of a project (Kerzner, 2013).

2.2 Scope of this paper

This paper will not deal with models or techniques that calculate an integrated and comprehensive progress or status of a project. Instead, I will describe where such a model needs to be used at certain points in this paper. This is because the indicators that will be identified serve as input factors for mathematical models and techniques to determine an objective progress of a progress (Gessler, 2016; Patzak and Rattay, 2009). So, identifying, monitoring and reporting these indicators is detached from a further assessment that puts them into a context in order to determine a progress value of a project.

Also, no key figures are being reviewed that indicate the success of a project, such as quality, adherence to planned values or productive share. Moreover, project controlling as of analyzing the current state using a deviation analysis of the project in order to give a prognosis for the future state of the project is not in scope of this paper.

3 Literature Review

3.1 Initial literature approach

The subject of this paper originates from the project management. Therefore, at the beginning it makes sense to get a broad overview of lived standards for projects management. I expected these standards to deliver a list of initial approaches to answer the research question before conducting a further literature research.

That’s why I first used “project management standards” both in English and German language in several common scientific databases with an economic focus to identify the most important standards in project management. I selected the following databases:

- EBSCOhost (Business Source Complete)
- ABI/INFORM Collection
- EconBiz
- Web of Science

As this literature approach has only been conducted to identify relevant standards for project management, there will be no deep analysis of the search results. However, there is the consent that the International Project Management Association (IPMA), the Project Management Institute (PMI) and AXELOS are the leading project management foundations (Eskerod and Huemann, 2013; Michael Klotz and Susanne Marx, 2018).

The standard of IPMA is called *Individual Competence Baseline* (ICB). In this literature review, I will use a book that has been published by the *Gesellschaft für Projektmnagement* (GPM), which is a German member of IPMA, and which is based on the ICB (see Gessler, 2016). Note that I used the ICB 3.0 for this paper although ICB 4.0, a more recent version that also has a handbook (see GPM (2019)), has already been released. Still, Gessler (2016) turned out to be more suitable for this paper because ICB 4.0 has been shortened by relevant chapters and aspects that are needed to answer the research question (GPM, 2019).

The standard of PMI is the *PMBOK* Guide and the standard of AXELOS is *PRINCE2*. Both will be used in this paper according to their contribution to the subject.

From these three initial references, I used backward literature search (i.e. references that these books used in their literature list) to go, if possible, into further details where the original source didn't fully satisfy. This approach resulted in the following references:

Initial literature (Title, Author)	**Backward literature (Title, Author)**
Kompetenzbasiertes Projektmanagement (Gessler, 2016)	Projektmangement Lexikon (Motzel, 2017) Projektmanagement (Patzak and Rattay, 2009)
PMBOK Guide (Project Management Institute, 2017)	Practice Standard for Earned Value Management (Project Management Institute, 2005)
Erfolgreich Projekte managen mit PRINCE 2 (AXELOS Limited, 2014)	-

Table 1. List of backward literature references from project management standards

3.2 Further literature research

Further literature research is based on a traditional approach to identify and filter relevant literature. The focus will be on articles related to the subject, as well as books. Since literature about project management is widely spread, the need for a careful review of search terms and research databases arose. First, I used search terms that are directly related to the research question and title of this paper.

After I've removed duplicates that occurred in the search results, I further filtered the most relevant results by their title and abstract. With the remaining literature, I went even further and skimmed several passages and chapters in order to determine whether the literature will fit to answer the research question. This also helped identifying more specific search terms that were used in the next increment.

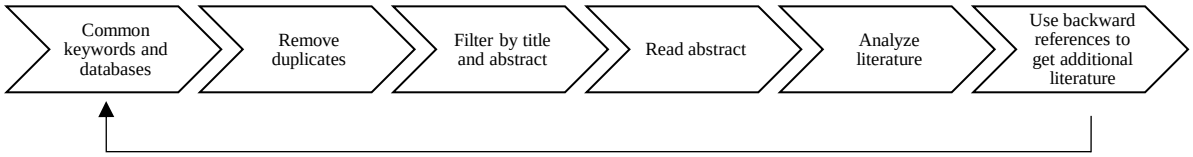

Figure 1. Research methodology (based on recommendation of Gerrit Remané)

Some search terms were also used in German language to get more results especially from local libraries (note that the number of results given in the table down below is the total number of results in both English and German language). I chose databases that focus on economics/ management. Moreover, I used a meta-search-engine *Beluga*. Beluga searches several libraries in Hamburg, Germany and, by default, also searches EconBiz.

I searched the terms in all fields of the databases. However, because sometimes the list of results was too long (around 2,000 results), and the part of potentially relevant articles/ books was too small, I decided to only search the title field. These numbers of results are marked with (TI). Also, the number of articles that I reviewed was sometimes significantly lower because there were too many results.

Table 2 shows the search terms that were entered in the databases, the total number of results (column "t") and the potentially relevant articles/ books according to the title (column "r").

Database/ Search Term	EBSCO BSC		ABI/ INFORM		Web of Science		Beluga	
	t	r	t	r	t	r	t	r
project progress	215 (TI)!	5	5,349 (TI)	3	926 (TI)	0	401 (English TI)	3
project progress indicators	6	0	166 (TI)	0	4 (TI)	1	873	1
project metrics	458	8	166 (TI)	0	148 (TI)	2	36 (TI)	1
scope con-trol	403	0	161 (TI)	2	1 (TI)	1	39	0
project controlling	371	2	216 (TI)	4	2,365 (TI)	0	1,261 (English TI)	1

Table 2. Initial literature research (adapted from Hamari, J., Koivisto, J., & Sarsa, H. (2014))

During the search, I discovered that there are a lot of results for these common search terms although they are already specific. However, only few articles were suitable to further examination. This leads me to the conclusion that literature for project management, although articles are widely spread, does not yet fully cover the research question of this paper. I will mention this again in the discussion.

3.3 Analysis of the literature

In the next step, I gained access to the potentially relevant literature whenever this was possible. After reading the article/ relevant chapters for the first time, I decided whether the literature was relevant at all. If it was relevant, I collected the main concepts of the article/ book in a concept matrix (see Appendix).

The following articles turned out to be irrelevant:

Brandl, 2004; Brennan, 2007; Colt, 1997; Hess, 2007; Kelders and Gorgels, 2017; V. Ostakhov, N. Artykulna and V. Morozov, 2018; Vanhoucke and Vandevoorde, 2007

For the articles/ books that were left, I filled in a concept matrix based on Webster and Watson (2002), that has been slightly modified as it was grouped by the three different parts of the research question of this paper. Note that Motzel (2017) is not contained in the concept matrix since this book is an encyclopedia for project management that I used at certain points in this paper to sharpen statements by a more theoretical point of view.

After I've read an article or a chapter of a book, I took notes on the concept and relevant statements that were mentioned. In the next step, I grouped the similar concepts and ended up with ten major concepts that can be seen in the concept matrix. An 'X' in a cell of the matrix indicates that a concept is contained in the corresponding article / book.

Note that there is a great difference between the number of concepts that a book contains compared to the number of concepts that several articles contain. This is because books, especially books for project management trainings, such as Gessler (2016), usually cover a wider range of subjects whereas scientific articles from research databases focus on a specific research question.

In the next section, the Findings, I'm going to present the concepts that I identified. The structure of the section follows the structure of the concepts matrix' groupings (identification, monitoring, reporting)

4 Findings

4.1 Description of identified indicators

The success of a project is constrained by three major project parameters: Scope, Cost, Time. These parameters compete and influence each other (Gessler, 2016). For example, if the project must be finished within a short amount of time, employees will need to increase their rate of productivity to finish their tasks. Subsequently, if employees work more, the costs will increase because the employees are paid an hourly rate. Alternatively, one could limit the scope of the project so that it will need less time to finish (Fiedler, 2010). Project managers are not only required to maximize the Scope of a project but also need to minimize the cost and time that the project consumes (Gessler, 2016).

Additionally, Patzak and Rattay (2009) highlight that the Scope parameter has the greatest impact on the project as the results that the project needs to achieve are the core success factors. This is because projects originate from the need of a client – for example, the client tenders outsourcing their internal IT department. The project originates from this business need whereas secondary parameters, such as the time frame, the budget, etc. are tailored to fit this overall project goals and therefore the scope that will be derived.

Burghardt (2018) goes even further as he formalizes this tailoring: There are either cost-, time- or scope-based projects which means that the scope is predefined in every case but depending on the parameter which the project is based on, the other parameters (Time and Cost) will be tailored. Scope-based projects are rare because usually there is either a restriction of costs or time. Figure 2 illustrates the tension between these mentioned main parameters.

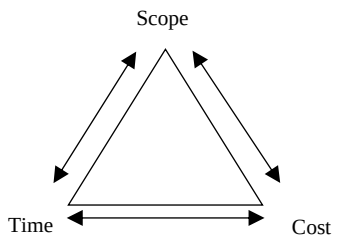

Figure 2. Magic Triangle following Fiedler (2010)

Another parameter that is occasionally mentioned in relation to these parameters is quality (Patzak and Rattay, 2009). However, quality does not satisfy as a parameter to measure the project progress. Instead, according to how authors describe the quality parameter, it serves as an indicator of the success of a project.

For example, the quality of the deliverables, the number of quality checks during the project or overall customer satisfaction may indicate the success of the project but do not indicate the progress of the project (AXELOS Limited, 2014; Patzak and Rattay, 2009). That's why quality won't be further discussed as an indicator for project progress in this paper.

To get a first approach on how to create an objective view of the current progress, we derive sub-indicators from the main parameters of the magic triangle (list of common examples from several authors):

The Time parameter can be measured as duration/ number of work hours, date and target date (expected date to finish). The Cost parameter can be measured as human resources, expenses in general (e.g. external services), material resources, percentage of money spent and financial resources. The Scope parameter is measured as deliverables completed, services established, availability, and benefits in kind (Burghardt, 2018; Gessler, 2016; Hartman and Jergeas, 1997; Kerzner, 2013; Rad and Levin, 2006).

These derivations can be grouped by static, dynamic and relative metrics. Static metrics are dependent by the project size, so you need similar-sized projects in order to compare this kind of metrics. Dynamic metrics, on the other hand, are time and size dependent. Relative metrics are not size dependent but are expressed by a percentage value (Gransberg, Badillo-Kwiatkowski and Molenaar, 2003).

In the following we will evaluate these indicators in detail.

As a basic approach, we always compare the planned values of the mentioned indicators to the actual values at a certain reference date. This comparison can be conducted at a certain level of detail, i.e. work page-, project phase- or overall project level (AXELOS Limited, 2014).

Furthermore, the comparison can be conducted using an integrated model (such as Earned Value Analysis) which considers the comparison of all the parameters that have been mentioned above together (Gessler, 2016).

In contrast, the so-called Progress Degree measures only the results (scope) of the project and does not contain any time- or cost-based parameters. Note that the Progress Degree covers both the planned and the actual scope of work and that it is, naturally, a percentage value (Gessler, 2016).

One distinguishes scope and performance: Scope describes the planned deliverables in a project, performance describes the results that have already been delivered (Gessler, 2016). We will use these terms from now on.

According to Motzel (2017), the scope of work describes the output of work or the processing of a specific task within the project. In every project there should be a Scope List that contains Statements of Work which describe the deliverables, specifications, services, benefits in kind, etc. in detail.

Where do the specifications of the scope originate?

At the beginning of the project, during the planning phase, the client creates a Requirements Specification which defines the goals and the problem statement of the project. It serves as a foundation for the Performance Specification that explains the requirements in more detail and outlines a solution concept. After the Performance Specification has been created, the subsequent Description of Scope serves as a composition of all requirements in detail. It will be used in the planning phase of the project to derive concrete tasks from it (Burghardt, 2018; Motzel, 2017).

Therefore, the Description of Scope should already provide a suitable metric to measure the desired scope both in respect to the quality and the quantity that needs to be delivered (Gessler, 2016). However, in case that there is no appropriate metric, other techniques can be used to determine the Progress Degree. These techniques will be discussed in 4.2.

Gessler (2016) criticizes that the deliverables that have been deeply described in the Description of Scope and in the work package description at the time of the project setup are often not used to measure the progress of a project even though they fulfill all requirements to give an objective view of the progress. Predefined status steps and query lists within the description of scope could be checked at completion and therefore serve as an objective indicator for the progress of the project.

For example, the client of an IT project has hired a company to conduct a hardware rollout for all the branch offices of his company. The Description of Scope contains the status steps to measure how many branches have already been updated to the new hardware. This allows a very objective status report since the performance of the project directly indicates the percentage of completion.

Let's take a closer look at the planning phase of the project.

To plan a project, the project manager should create a work breakdown structure, a hierarchical plan that contains work packages (Project Management Institute, 2005). Work packages help splitting up the project into particles that can be used as a basis for several management activities such as the assignment of responsibilities as well as resource distribution and time scheduling (Patzak and Rattay, 2009).

A description of each work package should contain the scope, time and costs of the work package (Patzak and Rattay, 2009).

Note that before planning the Time and Cost parameters, one should first consider the deliverables of the project because, as mentioned above, the deliverables (scope) are the core elements of the project – the other parameters depend on the planning of the scope (Patzak and Rattay, 2009; Watt, 2010).

The Project Management Institute (PMI) uses the Performance Measurement Baseline (PMB) as a central tool that compares planned scope, time and costs to the actual scope, time and costs throughout the project (Project Management Institute, 2017). Although the PMB is a tool that is used as input for an Earned Value Analysis which is not part of this paper, one should mention that the PMB requires a sophisticated planning of scope, schedule and costs (Project Management Institute, 2005).

The Time parameter can be measured through the dates that have been scheduled. Following the same logic as for the Scope parameter, one compares the actual dates of beginning to the planned dates of beginning and the actual dates of end to the planned dates of end. Moreover, the duration of time that was needed for a certain task to finish is also a suitable indicator (Gessler, 2016).

When considering the Cost parameter, indicators as expenses, financial- and material resources, as well as human resources and performed work can be used to measure the progress. Costs for employees result from the hours they have worked on a specific task (Gessler, 2016). Depending on the hourly rate of the employee that has been set during the contractual negotiations, there are different costs that the work will consume (Fiedler, 2010). So, you multiply the costs for one hour of work the employee by the total hours they have spent on a task. Costs for material or other resources have a direct impact on the project budget whereas the usage of material, machines, etc. does not directly result in costs but lowers the value of the resource depending on the amount and time of usage. Furthermore, costs for services from other service providers need to be considered as well (Gessler, 2016).

So not only do the three major categories affect each other within the magic triangle, but there is also a correlation between the indicators of these parameters. The Progress Value approaches this correlation more generally (Gessler, 2016; Motzel, 2017). In contrary to the Earned Value, the Progress Value also captures non-monetary values such as expenses, material resources, human resources (man-hours) (Gessler, 2016; Motzel, 2017). The Progress Value highlights the correlation between the cost parameter and the scope, performance parameter, respectively. As mentioned in the Background, further details on how to measure the progress are out of scope of this paper's research question. However, it is important to know that there must be a correlation between the identified indicators in order to measure the progress of a project.

Since every project is unique due to its individual scope and project category, there are no indicators that can always be used to measure the progress. However, a general approach that the project management team should use to identify relevant indicators, is deriving these indicators from the three main

parameters that have been mentioned (Kerzner, 2013). One should use indicators that fit the desired scope, time and costs best (Project Management Institute, 2005).

4.2 Monitoring the identified indicators

Now that we've identified the indicators that can be used to measure the progress of the project, we will look at the monitoring of these indicators. Once the project management team has identified parameters that can indicate the progress, it is critical that these indicators are constantly monitored (Gessler, 2016).

Monitoring covers the process of recording actual data (Motzel, 2017). For this, several techniques to access actual data exist that I will briefly describe in this chapter. I will also describe guidelines and approaches for the monitoring of the three major indicators as well as reoccurring difficulties during the monitoring process.

Before the project leader can monitor actual costs, time performance, and the derived sub parameters (Burghardt, 2018), the project team needs to know on which level of detail and how often the recording of actual data is conducted. These guidelines are set during the planning phase of the project (Project Management Institute, 2005). Recording data should not be conducted too detailed (Fiedler, 2010) because this challenges the project team as they may not be able to assign the results of their work to the correct planning element (Patzak and Rattay, 2009).

Because there is a correlation between the planned dates and the level of detail the scope of the project has been planned, it is recommended to record the Time parameter (dates, duration, etc.) at the same level of detail as the scope of the project (Patzak and Rattay, 2009). However, the project leader needs to evaluate whether the effort for recording and assigning data is appropriate to the benefit this detailed recording will bring. This evaluation needs to be kept in mind during the planning phase in order to keep a correlation between planning and recording of the time parameter (Fiedler, 2010; Patzak and Rattay, 2009).

For the costs, it is also recommended to record data at the same level of detail at which the costs of the project have been planned, although this should be at least the level of work packages (Gessler, 2016; Patzak and Rattay, 2009). Patzak and Rattay (2009) criticize that the planning of either costs or time have not been conducted at the level of work packages, which makes a further analysis of costs and time (e.g. a prognosis or an Earned Value Analysis) and a correct assignment of these parameters to work packages nearly impossible.

However, even if the project has been planned at a proper level of detail, recording correct data and assigning it to a planning element still occur. For example, the project team could forget to update data (especially costs) that have been recorded once or team members may try to hide/ manipulate data because they are afraid of the consequences (e.g. delays) (Patzak and Rattay, 2009). At this point it is important to mention that monitoring must not be used to judge the performance of a team member since this might interfere with the honesty of the employee (Kerzner, 2013). Instead, a comfortable monitoring atmosphere should be established within the project (Watt, 2010).

Planning the scope of the project has already been explained in chapter 4.1, which is why I won't repeat myself at this point.

In order to maintain a sufficient project controlling and establish a basis for a further analysis of the progress, recording data must be conducted continuously and permanently whereas monitoring by the project manager (gathering data from the project team at a Data Date (Motzel, 2017)) should take place at a certain frequency that has been set during the planning phase of the project (e.g. weekly) (Gessler, 2016; Ward, 1994).

Let's take a closer look at how data of the indicators can be recorded and monitored.

Ideally, an official guideline alongside a centralized system for recording data has been established at the beginning of the project (Burghardt, 2018; Fiedler, 2010). Project members should be able to assign their actual working hours to the planning element that has been set up in the planning phase using a dialog-oriented system (Burghardt, 2018). This method already satisfies recording the duration needed for an element (i.e. work package) as well as a part of the overall costs in a project: Expenses for human resources. This type of costs is being monitored with this technique because monitoring the hourly rate of an employee, multiplied by the actual working hours, results in a cost value (Fiedler, 2010; Gessler, 2016; Patzak and Rattay, 2009). Burghardt (2018) highlights that a dialog-oriented recording of actual working hours compromises the effort needed for the project manager to ask the project team for their hours of work and it allows a much detailed and less erroneous way of recording. Still, the quality of the recorded data depends on the individual support of the employee regarding honesty, completeness and accuracy (Burghardt, 2018).

In addition to costs for human resources, other types of costs, as those for material sources or travel expenses, can be easily recorded and monitored by the corresponding bills and other hard facts. As a rule, costs need to be assigned to the right booking period to avoid further problems (Burghardt, 2018; Fiedler, 2010).

Monitoring the time parameter in general should follow the project schedule and focus on a binary interrogation whether an activity has finished at a certain Data Date. This interrogation technique can be used as a technique to gather types of data that rely on hard facts whereas other techniques as team-oriented data acquisition and observation are used to gather subjective data and get a general overview of the progress (Gessler, 2016).

However, monitoring the performance of the project has not been mentioned yet. The reason for this is because it depends on the type of work whether an objective monitoring can be conducted. If the performance consists of tangible work results, it can be directly measured, e.g. using the correlation between the quantity of deliverables and the quantity of deliverables that have already been finished (quantity proportionality) with the help of the interrogation technique to report the deliverables to the project manager (Gessler, 2016; Hartman and Jergeas, 1997). If it consists of deliverables that are not tangible, other techniques, even if they may be subjective, can be used (Burghardt, 2018; Project Management Institute, 2005). Note that even though objective data is being monitored, it might still be influenced by the subjective judgement of a project member (Rad and Levin, 2006).

Keep in mind that the Progress Degree is a percentage value which is always zero percent for all work packages/ activities that have not yet started (Patzak and Rattay, 2009).

First, I will again emphasize that it is dangerous to derive a performance status from the time that passed or costs that have been used. This correlation (time proportionality) might work if the project has been well planned and all activities follow this plan exactly. Instead, the assumption of this correlation usually leads to a wrong status report of the project (Gessler, 2016). I will outline a few alternative techniques that is mentioned in most literature references in the following:

The weighted milestone technique uses steps within a task that indicate a certain level of completion. The work package owner sets predefined percentages onto these steps and describes what state/ deliverables must be achieved in order to reach the next step (Gessler, 2016; Project Management Institute, 2005). Fixed Formula techniques as the 50-50, 0-100 and other comparable techniques only consider whether a task is in progress or has been finished (depending on the technique, the processing might even be completely omitted). Fixed Formula techniques can be used for small tasks and for tasks that need to be completed in order to continue with other tasks but don't have project-scope related deliverables (Gessler, 2016; Project Management Institute, 2005).

A controversial technique that is often discussed in literature is the estimation technique. This technique relies on the subjective assessment of the progress of a task, estimated by the work package owner or other team members (Gessler, 2016). This subjective reporting may lead to a wrong Progress Degree

because it depends on the preferences of the team member and may not reflect the actual value (Abaza et al., 2014). A common phenomenon is the 90 percent syndrome (Burghardt, 2018; Fiedler, 2010; Gessler, 2016) which states that project members tend to estimate the Progress Degree at 90% which is a too optimistic value and causes severe problems within the project controlling. So, if estimation needs to be used, it should be done by experts who determine both an optimistic and a pessimistic value (Gessler, 2016; Hartman and Jergeas, 1997).

As a rule, the estimation technique should not be used for more than 20% of all tasks in a project and for a Progress Degree of not more than 80% (Gessler, 2016).

4.3 Reporting the identified indicators

In contrast to monitoring, reporting does not record data but aggregates data and visualizes it to get an overview of the current state of the project. Generally, reporting needs to take place regularly, following a schedule that has been set in the planning phase of the project. It is important that the project manager actively triggers the creation of a formal status reporting (Ward, 1994; Watt, 2010). Intervals for status reports need to be chosen as short as possible under the condition that the reporting contributes a benefit (i.e. a noticeable difference to the last report so that the addressee gets a new overview of the current state) (Fiedler, 2010). In some phases of the project, there may be a decreased reporting schedule, whereas in other phases even the creation of an ad hoc report could be triggered by the client (AXELOS Limited, 2014; Fiedler, 2010).

Two main reporting approaches can be identified: The project status report (written) and the project status meeting (Gessler, 2016). Using the project status meeting as the only reporting technique in a project should be avoided in order to satisfy the reporting accountability of the project manager (Motzel, 2017). However, a project status meeting might be a useful supporting technique, e.g. as a weekly Jour Fixe to report the status of the project if the project team follows several guidelines: The meeting can only be successful if all participants renounce to blame each other for the obstacles, challenges and the overall project progress. Instead, an atmosphere of respect and trust should be established in order to find solutions. The results of the meeting need to be documented and an Action Item List should be created that assigns upcoming tasks to the project team (Gessler, 2016).

AXELOS Limited (2014) distinguishes further written status reports such as the team status report, project status report, phase status report, etc. by their frequency, purpose, content focus and addressee. Yet, I will focus on the project status report as this type of report is mentioned in most literature and contains basic elements for all further written status reports.

Project status report the costs, performance and time of the project in a way, the specific addressee gains a benefit from this report. So, the levels of detail of these parameters differ because only data is reported that is relevant to the addressee/ stakeholder (Fiedler, 2010; Project Management Institute, 2005). Apart from the status of the main parameters, the status report contains comments to avoid misinterpretations, current obstacles, necessary measures and a description of severe deviations from the planned progress, if applicable (Fiedler, 2010; Patzak and Rattay, 2009). The overall layout of the report needs to be as short, clear and concise as possible, ideally at only one page (Fiedler, 2010; Watt, 2010). The use of symbols such as traffic lights and tachometers, as well as a cover page that focuses on the most important facts, helps structuring the report and making it more appealing to the stakeholder. Detailed facts and figures should not be reported unless explicitly requested (Fiedler, 2010; Patzak and Rattay, 2009; Watt, 2010).

The general approach to report time, costs and performance of the project is displaying the planned values in comparison to the actual values using a list, a table or other visualization as a graph (Burghardt, 2018). Depending on the stakeholder who is addressed, the data should be further aggregated – for example instead of reporting at the level of work packages, reporting at the level of a phase of the project

might be more suitable in some cases (Fiedler, 2010). If dashboard tools are being used, e.g. traffic lights and tachometers, their meaning should be defined to create a common understanding of what a given tool indicates (Fiedler, 2010; Kerzner, 2013).

To report the Time parameter, one could use the project plan (also referred to as Gantt Chart) by marking the activities that have already been finished. Comparing the marks to the current date creates an understanding of the current time status in the project (Fiedler, 2010). For the performance, markings in the work breakdown structure can visualize the progress – under the condition that the work breakdown structure contains tasks as work packages. For example, a half-crossed work package indicates the processing of a work package whereas a full cross indicates that the work package has been finished (Gessler, 2016; Patzak and Rattay, 2009).

5 Discussion

Within literature, there were no significant contradictions in their contents but rather a different perspective on a subject. I did notice a difference between AXELOS Limited (2014), Project Management Institute (2017) and Gessler (2016) since these books represented a standard for the three main project management norms. However, at a closer look, the standards did not contradict each other, they only focused on different aspects or did not mention certain aspects explicitly.

Considering the broad range of results that originated from the three standards, project managers in practice should not limit their project management on a single standard.

In future research, one could assess how the identified indicators can be used to assess and calculate an objective status of the project. For example, authors in literature describe the indicators to be used either as single values – but with great caution – or as input factors for an Earned Value Analysis (Gessler, 2016). Research on questions such as to which degree a single value analysis helps determining the progress of the project or evaluating alternatives/ adjustments to Earned Value Management may be conducted in the future using the results of this paper.

A limitation of my research is that possibly not all indicators have been identified that are suitable to serve as input factors to determine the progress of a project. There may be additional indicators that could not be found in the mass of search results that appeared for the search terms used. Furthermore, in practice, challenges for certain indicators may arise concerning the planning, monitoring and reporting, depending on the individual project.

6 Conclusion

In this paper, I have argued that there are three main parameters which can be used to indicate the progress of a project: Time, Scope and Cost. Several sub-parameters can be derived from these three main parameters. I have also described that in order to use these indicators for any model that determines the progress, a comparison of planned and actual values need to be conducted which implicates a sophisticated planning, monitoring and reporting of these indicators.

Using Time, Cost or Scope as isolated parameters, separated from another, in order to determine the progress of a project is often misleading (Patzak and Rattay, 2009). On the other hand, the comparison of each of the parameters separated from another could be possibly be used to indicate upcoming challenges in a project regarding a single parameter. For example, if the focus of the project is the delivery of results, deviations in the scope parameter highlight that steering and control of the project needs to be performed alongside a determination of the progress using all three parameters to assess where the problems originate.

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7 Appendix

	Identifying			**Monitoring**				**Reporting**		
	deriving of indicators from the magic triangle	further concrete indicators	defining deliverables for work packages in WBS	describing concrete measuring techniques	criticism on the estimation technique	general guidelines and techniques	ideally conducted at level of work packages	guidelines for reporting conditions	visual representation	project status reports
Books										
Burghardt (2018)	X	X		X	X	X	X		X	
Fiedler (2010)	X		X	X		X	X	X	X	X
Gessler (2016)	X	X	X	X	X	X	X	X	X	X
Kerzner (2013)	X	X				X			X	X
Patzak and Rattay (2009)	X	X	X	X		X	X	X	X	X
AXELOS Limited (2014)	X	X	X	X					X	
Project Management Institute (2017)	X									
Articles										
Project Management Institute (2005)	X			X		X				
Watt (2010)		X	X					X	X	
Rad and Levin (2006)		X			X			X		
Gransberg, Badillo-Kwiatkowski and Molenaar (2003)		X			X					
Hartman and Jergeas (1997)		X				X				
Ward (1994)	X	X								
Abaza *et al.* (2014)					X					

Table 3. Concept Matrix adapted from Webster and Watson (2002)