BUDGETING FOR AGILE PRODUCT DEVELOPMENT

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ABSTRACT

Recent reports and predictions indicate a consistent and continuous growth in the field of Research and Development. Such growth leads to increased resource investments, which have to be managed effectively to eventually achieve value maximization. This management is cohesive with budgeting. In changing environments, said effectiveness can be difficult to attain.

Agile development is supposed to provide the necessary flexibility for uncertain situations and has recently seen a stark adoption incline. Unfortunately, budgeting and resource allocation have not yet been resolved for agile approaches: a comprehensive research including recent publications showed a lack of models and frameworks for the adoption and application of budgeting with agile development. Due to this lack of a comprehensive approach, as well as limitations and restrictions of existing research, this paper describes the design of a budgeting approach suitable for and compatible with agile product development. The developed solution, the Structured Agile Budgeting Process, provides a holistic and interdisciplinary way to allocate resources while still allowing the flexibility and benefits of agile development.

Keywords: Budgeting, Agile, Design management, Design costing, Organisation of product development

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Cite this article: Vierlboeck, M., Gövert, K., Trauer, J., Lindemann, U. (2019) 'Budgeting for Agile Product Development', in *Proceedings of the 22nd International Conference on Engineering Design (ICED19),* Delft, The Netherlands, 5-8 August 2019. DOI:10.1017/dsi.2019.223

1 INTRODUCTION AND RESEARCH OBJECTIVE

The field of Research and Development (R&D) has been recently growing globally: the latest UNESCO Science Report states an increase of the global R&D intensity from 1.57% in 2007 to 1.70% in 2013 (Soete *et al*., 2015). In addition, the most recent data shows a predicted ongoing growth on a global scale (cf. Innovation Research Interchange, 2018; R&D Magazine, 2018). Such continuous growth leads to increased resource investments that have to be managed effectively. This effectiveness is crucial when for-profit organizations are concerned, whose main objective is continued existence and progress (Rieg, 2015), since finite resources have to be invested in order to maximize value (Berk & DeMarzo, 2017). To achieve this maximization, the right investments have to be made at the right time. In a changing environment or market, the right investment decisions can be difficult if the future value can hardly be predicted. In such situations, the flexibility to adapt is critical. Agile development is supposed to provide such flexibility as it allows for overall adaption, proactive reactions, and even last moment changes to unexpected environmental influences (Rumpe, 2017).

Agile approaches have seen a stark adoption incline in software engineering since 2008 (Komus, 2013) and are now being applied throughout organizations across all industries (Denning, 2018a; Hron & Obwegeser, 2018). Recent reports and results of agile projects depict desirable benefits (cf. Gonçalves, 2018; Komus, 2017) and the success rate of agile projects is considered predominantly high with 80% (Komus, 2017). Despite the success, the application and transition towards agile models is not without risk of failure (see Cohn, 2010). In case of such failures, the effects can be critical since they do not contribute to, nor facilitate value maximization.

Regarding monetary affairs, allocation for value maximization is cohesive with budgeting, which represents the financial aspects of funding and investing decisions (Moreira, 2017). Unfortunately, agile approaches do not work well with traditional accounting and budgeting (Knaster & Leffingwell, 2017). The only existing applications of budgeting for agile development documented are agile projects for which the budget and time frame were predefined and later attained (Jalali & Wohlin, 2012; Serrador & Pinto, 2015). General problems regarding the application of Agile can also be found in numerous publications (cf. Moreira, 2017; Serrador & Pinto, 2015). Due to this current situation, budgeting for agile development can be described as an important, yet challenging task (see Hogue, 2014).

Based on the preceding descriptions of the situation, the objective of the research project on which this paper is based was to create a budgeting approach compatible with and suitable for agile product development. This objective was addressed by developing a model for the application of budgeting with agile development.

2 INFORMATIONAL FOUNDATION

The following section of this chapter will outline the researched fundamentals regarding budgeting and agile development, as well as the state of research.

2.1 Fundamentals of budgeting

When researching budgeting definitions, the findings vary substantially in their specificity. This is due to the long time-span throughout which budgeting has been existing and evolving. Based on pre-existing and partial definitions of budgeting, the following definition has been conflated for the research project and the content of this paper (cf. Blumentritt, 2006; Peterson & Fabozzi, 2002; Dayananda *et al*., 2002; Kengatharan, 2018; Brealey *et al*., 2013): Budgeting is the process of operational allocation for financial resources to an organization's units, as well as the analysis and selection of investment opportunities/possibilities in order to create value and a record for subsequent measurement.

Since the definition of budgeting is rather comprehensive, it can be interpreted and executed in various ways. Therefore, a number of different budgeting approaches have emerged over time. The most prominent ones (cf. Lalli, 2012) were assessed and summarized with a focus on the respective characteristics and concepts of the distinctive approaches regarding the aforementioned definition. Hence, the following budgeting approaches were researched: Bottom-Up Budgeting, Top-Down Budgeting, Hybrid Approaches, Incremental-Based Budgeting, Zero-Based Budgeting, Activity-Based Budgeting, and Beyond Budgeting (cf. de Campos, 2018; Michael, 2007).

2.2 Fundamentals of Agile development

The term Agile in the context of development first appeared concretely in 2001 when the "Manifesto for Agile Software Development" (Beck *et al*., 2001) was published. Agile development poses as an "umbrella term" (Denning, 2018b) since an affiliation of various approaches is subsumed under the same notion. The figurative umbrella covers approaches which collectively share the "Manifesto for Agile Software Development" (Beck *et al*., 2001) as a foundation. Although some approaches were created before the manifesto, they still demonstrate its pertinent features and are therefore considered agile.

Agile poses an alternative to longer existing models like the Waterfall Model by Boehm (1981) and Stage-Gate Model by Cooper (1990). These models are wholly based on phases executed successively in a certain order and way. Agile development on the other hand is defined and characterized by iterations. Instead of utilizing predefined phases, agile development converges towards solutions in increments. Additionally, agile approaches advocate self-organization, cooperation, and emergence, rather than a pre-defined plan (Abrahamsson *et al*., 2002).

In order to comprehensively research the fundamentals of Agile, the core values and principles (cf. Beck *et al*., 2001) as well as the most important approaches were researched and assessed. The approaches were assorted according to their popularity described in the yearly survey about agile development, which is conducted by VersionOne Inc. This survey involves responses from every continent and includes a wide range of industrial fields (VersionOne Inc., 2018). The following approaches were assessed: Scrum, Extreme Programming (XP), the Lean Mindset and Toolkit, Kanban, and additional miscellaneous approaches (cf. Cobb, 2015; Poppendieck & Poppendieck, 2003; Stellman & Greene, 2015).

2.3 Current and existing research regarding budgeting for Agile development

In order to determine the current state of publications and studies, a comprehensive literature research was conducted. No existing research directly concerning the objective of the research project was found. The only results discovered were limited case studies or compatibility assessments restricted to particular approaches. The publications which are most closely related and relevant to the objective of the research project are summarized hereinafter.

2.3.1 Research summary

The first relevant work was published by Sahota *et al*. (2014). Herein, the authors evaluate the compatibility of Beyond Budgeting (BB) and agile culture. Sahota *et al*. claim that BB intends for a change of the traditional management and describe these changes as necessary in order to allow the exploitation of the flexibility and benefits of agile development. The authors further outline changes in leadership and in process, both induced by BB's guidelines. Based on the rules and guidelines, Sahota *et al*. argue that there are key similarities between Agile and BB, for example, in values, customer focus, and transparency. In conclusion, Sahota *et al*. state that Beyond Budgeting and Agile are generally compatible, and BB can compensate for the lack of organizational perspective of agile development.

The second relevant publication comes from Smeekes *et al*. (2018); it addresses various aspects of agile portfolio management projects, based on seven case studies conducted in large Dutch organizations. Although these studies focused on IT portfolio management projects, they contain general descriptive and contextual information relevant to the objective of this paper. According to Smeekes *et al*., the core issue regarding allocation is that conventional management approaches and their control (which includes budgeting) are not compatible with agile ways of working (also see Cram & Brohman, 2010; Moran, 2015). Consequently, when firms transition to Agile, control is reduced. The authors give four propositions they deem necessary for the transition to Agile. These propositions, which were assessed in the case studies, are described as confirmed. Furthermore, the following conclusions were drawn by Smeekes at el.: when transitioning to agile development, the focus shifts from process control to outcome control by emphasizing business values; additionally, budget controls are adjusted to work with the autonomous teams and even shift completely towards value creation, instead of static business cases. These results were furthermore found to be in accordance with other publications describing cultural shifts (cf. Cram & Brohman, 2010).

The third publication, by Cao *et al*. (2013), describes the results of case studies regarding how IT funding decisions adapt for agile development. The authors discovered two separate types of adaptions which they observed during case studies: appropriation of structures and an appropriated funding process. The appropriation of structure concerns the structural changes necessary for agile projects and was found to contain a wide range of adoption and adaption possibilities throughout case studies, which is why the appropriation is not defined in a characteristic way; it rather states that structural changes will occur. In contrast to the appropriation of structures, Cao *et al*. defined eight specific propositions for the funding process regarding the adoption of Agile (see Cao *et al*., 2013, p. 198 ff.). In summary, Cao *et al*. defined a framework for the transition to and the adoption of agile projects. They focused on the mutual alignment necessary for the transition since such processes require changes and adjustments all throughout organizations. Through the combination of case studies and their model, the authors were able to derive independent practice propositions. Nevertheless, Cao *et al*. consider their findings limited solely to agile development in combination with the applied funding processes and its circumstances.

2.3.2 Conclusion and research gap

The results described above show that although research to some extent relevant to the objective of the project exists, no comprehensive model nor framework for the adoption, combination, or application of budgeting and agile development was found. Therefore, no structure exists that could be built upon directly. Furthermore, the lack of a comprehensive approach for the compound application proves that budgeting has not yet been resolved when it comes to agile development. In addition, the assessed publications regarding pre-existing research were limited to case studies or specific situations and industries, which makes them not universally valid nor encompassing. In addition to the lack of an existing structure, the literature research results show that a combined use of budgeting and agile development poses conflicts and requires adaptations on both sides as well as organizational changes.

The only general condition discovered was the compatibility between Agile and BB, as described by Sahota *et al*. (2014). After assessing BB regarding the given research project though, it was found not in compliance with the project objective. Since the objective was to develop a budgeting approach suitable for and compatible with agile development, comprehensive operational allocation is implied per the definition stated above. Comprehensive allocation is not provided by BB as it is inherently not-allocation based. Therefore, BB was considered incompatible with the objective and not further pursued.

In conclusion, the lack of a holistic approach, the limitations and restrictions of existing research to certain fields, transitions, or approaches, and the incompatibility of BB with the research objective validated the importance and relevance of the objective of the project: the design of a budgeting approach suitable for agile development. With this conclusion, the next chapter will describe the application of a structured process successively designing the solution for the objective at hand while satisfying the claim for comprehensiveness and universal applicableness.

3 PROBLEM ANALYSIS AND RESEARCH PROCESS

With the results and findings from the previous chapter, it was possible to address the inherent problem underlying the objective. Since the objective originates from an incompatibility, it was necessary to first specify the problematic aspects that had to be resolved by the solution approach to design. In order to identify these problems, the two sides, budgeting and Agile, had to be compared in a structured way regarding their requirements, which enabled the elicitation of specific discrepancies.

For such a comparison to be possible, it was essential that the requirements on both sides share a mutual basis. To form such a basis, requirements for Agile were first developed as a framework and then used to elicit the conditions of budgeting. The framework for Agile was developed first because the objective was to design a budgeting approach that fits the requirements of Agile and therefore these requirements posed the main and primary conditions. By deriving the requirements of budgeting from the framework designed for Agile, a consistent mutual basis could be ensured. The analogous elicitation process was overall enabled by structural similarities, which were discovered through separately analyzing the structures inherent to Agile and budgeting respectively.

The framework and elicitation yielded a list of requirements on both sides. Enabled by the mutual basis, the subsequent comparison could be carried out in a juxtaposed way by comparing the corresponding aspects on each side. For some of the agile conditions, no correspondent part on the side of budgeting could be found. Thus, a comparison of requirements was impossible for some aspects.

By conducting the described comparison between budgeting and Agile, the problems and discrepancies were defined. Thus, two core discrepancies were discovered, which are as follows:

- Modifiability does not allow for precise predictability and static allocation.
- The decision-making entities for budgeting and agile approaches are not congruent.

These discrepancies encompass the compatibility issues between agile development and budgeting. They also show that the problems lie predominantly in two areas: predictability/allocation and decision making/governance. Given the objective of the research project, this meant that the solution to design had to solve both areas and discrepancies in a holistic way. Moreover, since the discovered aspects were manifold, the solution had to address all these points individually as well as on a compound level.

With the defined discrepancies at hand, the design of the solution approach was conducted following the Process Cycle for Problem Solving (Ehrlenspiel & Meerkamm, 2013). Hence, in the first step, individual possible solutions for both discrepancies were defined separately. In the second step, these partial solutions were evaluated and selected in order to form compound solutions for each discrepancy. In the third and final step, the compound solutions were conflated and supplemented where suitable and or necessary, forming a final comprehensive solution approach.

The design of solutions in the first step yielded various options for both discrepancies between budgeting and Agile. After the evaluation of the solutions in the second step, it was discovered that none of the solutions were mutually exclusive. Therefore, the solutions could be used alongside each other. This meant that for each discrepancy all defined solutions had to be considered for the compound approach, which was fused in the third step. The holistic solution is described in the next chapter.

4 SOLUTION AND CREATED APPROACH

The approach that resulted from the research process described above is called the Structured Agile Budgeting Core Process (SABP) and is depicted in Figure 1. As explained, the SABP consists of various sub-processes that resulted from the different solutions to the discrepancies. The following section explains the components of the approach following their order of application as indicated in Figure 1 by the numbers 1 through 4:

1. Multi-Level Budgeting (MLB): Level Structure
2. Agile Responsibility Model (ARM)
3. Multi-Level Budgeting (MLB): Budget Structure
4. Extended Partial Budgeting Process (exPBP)

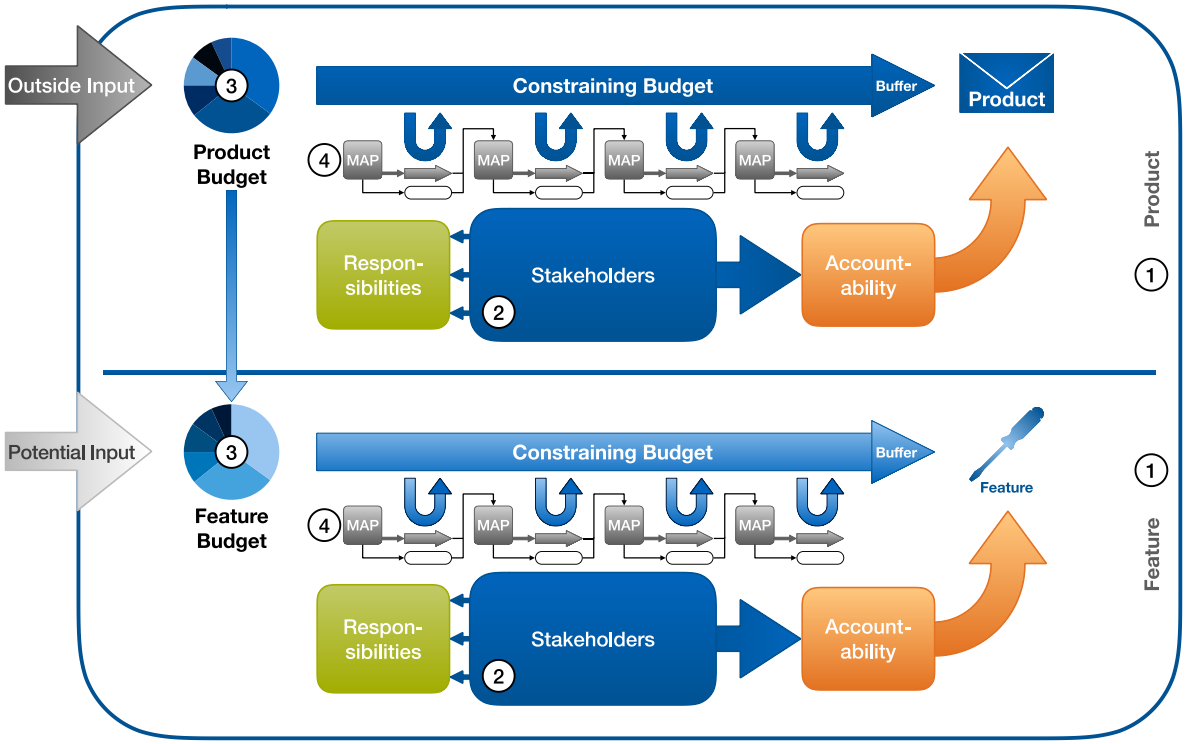

Figure 1. Structured Agile budgeting core process (SABP)

The first step and component of the SABP is posed by a model derived from the research of Knaster and Leffingwell (2017) and the Scaled Agile Framework (Scaled Agile Inc., 2018). The designed model, called Multi-Level Budgeting (MLB), first divides the development into levels and thus defines the vertical structure (see 1 in Figure 1). The number of the levels can be chosen depending on the product and or organization structure; Figure 1 shows product and feature levels, for instance, but component or module levels are possible as well, amongst others. It is important to note that the final budgeting process is not contingent on the layer structure and similar on every level, regardless of the respective position.

The second step is posed by the designed Agile Responsibility Model (ARM; see 2 in Figure 1). The ARM is built upon the fact that allocation decisions can be discussed mutually and collaboratively involving, amongst others, the entities responsible for the subsequent budgeting decisions. Hence, the model contains interdisciplinary units which encompass all necessary stakeholders for the development on each of the prior defined levels. These units share a mutual accountability towards the development while at the same time comprising particular responsibilities for each stakeholder entity. These responsibilities are distinctly assigned and include the budgeting responsibly for the correct entity while allowing for collaboration with other entities. Such collaboration enables the aspects of self-organization (mutual discussion and accountability) without reducing responsibilities of the decision-making entities as they eventually decide and still possess the respective responsibility.

The third aspect and step are posed by the second part of the aforesaid MLB. Herein, a budget is assigned for the top level. This budget, in addition to its inherent resource allocation purpose, is used to derive the budgets on the levels below (see 3 in Figure 1). This step includes outside input, which is necessary, at least on the top level, as the definition of the budgets requires the inclusion of economic factors. If and how far down the levels outside input is needed, strongly depends on the situation and circumstances, which is why Figure 1 shows potential input on lower levels. The top-level budget poses a restriction for the levels beneath, but does not dictate or delegate them, which leaves room for flexibility, while still allowing predictability overall. The subjacent budgets are approached on the respective levels individually. This is enabled on each level by the assigned interdisciplinary stakeholder units with the respective accountability and responsibilities provided by the ARM. With the levels and units, the budgets can be defined for each level with the top budget representing the overlying constraint. Hence, the levels make their own decisions to the maximum extent, while the responsibility of the budgeting decisions is not taken away from the respective entities as they are represented in the interdisciplinary units on each level. This addresses the assurance of self-organization throughout the structure and adheres to the required responsibilities.

In conjunction with the budgets, the value to develop has to be defined on the respective levels. This value serves as a non-monetary measure for the content of the development. It supports the decision making and represents a reference towards the constraining budget. Furthermore, a value matching the assigned budget allows for the assessment of output, which subsequently is used to extrapolate progress and assure the adherence to the resource constraint.

The fourth step and component of the SABP contains the development resource allocation and is represented by the designed Extended Partial Budgeting Process (exPBP; depicted in Figure 2). The exPBP iteratively allocates resources and is conducted on every level individually (see 4 in Figure 1). The budgeting process provides a way of flexibly assigning and allocating resources while at the same time enabling an overlying budget. To enable the flexibility, the process bases the allocation on forecasts, which allows for changes to be incorporated.

The iterative process in the exPBP consists of the designed Modifiability Assessment Process (MAP) and Partial Budgeting Process (PBP). The iterations are initiated by the MAP, which is derived from the ISO Risk Management Cycle. The MAP contains the following three phases: Modifiability Assessment, Integration, Monitoring & Review. Therein, the first phase incorporates the three actions of Modifiability Identification, Modifiability Analysis, and Evaluation. With these three actions, potential modifiability and changes are identified and gathered before being analyzed and evaluated, which eventually yields a clear understanding of the situation and provides probable future development possibilities to an extent possible beyond reasonable doubt. Hence, with the MAP, modifiability insecurities can be clarified and analyzed regarding the extent of their impact and criticality, which results in a reduction of the unpredictability. The insights are consequently utilized to predict the next period of the process throughout which the Monitoring & Reviews are conducted to provide a source for continuous improvement.

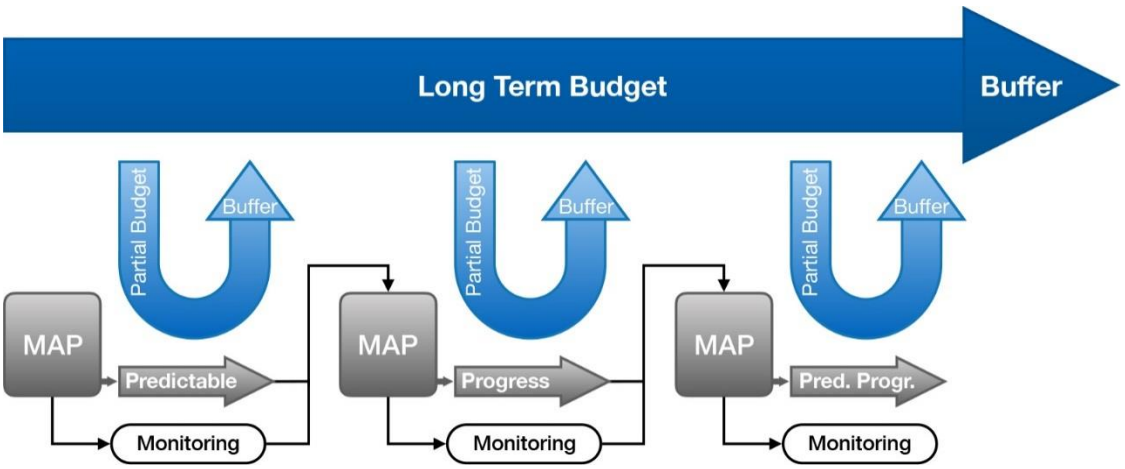

Figure 2. Extended partial budgeting process (exPBP)

With the predictable progress at hand, the allocation is conducted in the designed Partial Budgeting Process (PBP; see Partial Budget in Figure 2), which divides the long-term budget into smaller partial ones. These partial budgets are defined and assigned based on the periods of predictable progress resulting from the MAP. As aforementioned, the partial budgets are closely tied to the stipulated value since the allocation has to reflect the outcome in order to allow for further predictions and direct extrapolation. This connection ensures the adherence to the respective constraining budget as otherwise the total of partial budgets could exceed the long-term total. The iterative allocation enables flexibility throughout the development while at the same time predictability is assured by the long-term budget.

The duration of the iterations is not fixed and can be adapted. Overall, the exact time frame should always follow the extent of the predictable progress. While it would be possible to conduct allocation on a more continuous basis and not apply an iteration-based process, we discovered during our research that a continuous allocation process does not allow for significant one-time expenses to be easily incorporated. A huge one-time investment might consume a significant amount of the budget and therefore introduce a considerable perturbance. However, if said one-time investment produces an appropriate amount of value as defined at the beginning of the process, it can be incorporated in the iterations and handled accordingly. Due to this reason, the iterations provide the opportunity to allocated resources based on the predictable progress while always adhering and referencing the overall scope. Therefore, the application of the PBP provides all the necessary formulas and also visualization charts (derived from agile burn-down representations; see Scrum, for example) to properly allocate resources, predict trends, and incorporate major expenses in an appropriate and structured way.

In addition to the MAP and the PBP, resource buffers (cf. Moran, 2015; Romeike & Gleißner, 2018) can be allocated a priori to hedge any remaining uncertainties which are impossible to assess in the MAP. A buffer is a set of resources not directly allocated but used as a safety measure. Buffers allow for the compensation of expenses not foreseen and for which the magnitude and impact would be too severe to be solvable by mere reallocation. Such resource buffers can be applied to the partial budgets, as well as the long-term ones (see Figure 2) as a way to mitigate a remaining lack of predictability to a limited extent. If buffers are applied on multiple levels, the top buffer always has to integrate the existence of the subjacent ones. Nevertheless, an aggregation of buffers is possible and multiple buffers can share a common resource pool as it is unlikely that every allocated buffer will be used up completely (Romeike & Gleißner, 2018). Therefore, the top buffer does not have to necessarily be the sum of all the ones underlying it. When it comes to the iterative allocations inside the exPBP, buffers only have to be assigned where insecurities exist. If the progress predictions are precise and the allocations can be made without uncertainty, buffers can be scrapped for the respective budget allocation iteration.

Since the SABP as a whole is an abstract construct, application demonstrations and templates were additionally developed including all necessary formulas and a flowchart in conformance with the ISO 5807. Furthermore, a catalogue of exemplary guiding questions is provided to determine the crucial points of the respective steps described above and depicted in Figure 1. The questions are not mandatory, but simplify the application, further explain the direction of the steps, and support the elicitation.

Overall, the application and questions can be split into two major parts: the setup part, which defines the required structures and features, and the process part, which addresses the actual development and allocation. The setup part begins with the vertical and outer frame of the approach, i.e.

the Multi-Level Budgeting and Agile Responsibility Model structure. In order to determine the levels of the development, it is important to only define as many levels as necessary and as few as possible. Due to the interdisciplinarity of the entities on separate levels, a division into more levels than necessary would lead to a potential split of entities into less functional and potentially non-autarchic units.
The following questions apply for the setup part containing the MLB and the ARM:

- Definition of the vertical levels of the development - as many as necessary, and as few as possible
  - Which vertical interfaces inside the development structure exist, and do the adjacent units work towards the same direction or different objectives? In the first case, a consolidation on one level is recommended, the latter can be an indicator for a level distinction.
  - Can different development objectives be assigned to one level with mutual overlying entities?
  - Which departments follow the same development stream and where do combinations pose benefits?
- Definition of the accountable stakeholder units and responsible entities on each level
  - Which departments must be included to form autonomous and autarchic units?
  - What responsibilities do the respective roles and parts of each formation have?
  - Which roles can be assigned level-overarching, for example, for communicational reasons?
  - Which concrete responsibilities does each unit or entity have and not have?
- Definition of the values for each level/entity and subsequently the value dependencies across levels
  - What produced values can be connected to the objective of an entity?
  - Can mutual values be defined for more than one level to enable comparisons and collaboration?
  - How can value be defined and estimated?
  - How can value be represented and connected on sub- and superjacent levels (if existent)?
- Definition of the budgets for each level and or entity
  - Is input from outside sources needed? If yes, which sources have to be consulted and or collaborated with?
  - Which budget dependencies exist across levels regarding the outside input?
  - How can the provided resources be represented regarding the value and vice versa?
- Reconciliation of value and budgets if necessary
  - Do the derived budget and the planned value generation align?
  - Are adjustments necessary?
  - Is the result in accordance with the sources of the outside input?
  - Which budget dependencies exist across levels inside the defined structure?

For the second part, the allocation and development in the exPBP, the following questions apply:

- Conduct of the first MAP to prepare development initiation
  - Are there already existing priorities and or backlogs which have to be included or considered?
  - Which factors affect the development overall and have an influence on the modifiability?
  - For what period(s) can a predictable progress be defined without reasonable doubt?
- Assignment of the first Partial Budget based on the MAP results
  - Can the budgeting be aligned with the iteration of the development?
  - What period can be reasonably assigned?
  - How can the budget be divided based on the predicted progress and respective value?
- Iterative Repetition of the Partial Budgeting Process with included analysis to correct the progresses if necessary
  - Is the extrapolated trend following the objective?
  - Are corrections necessary?
  - Are the effects of existing dependencies being considered?

The provided process model of the SABP with the additions marked the completion of the solution design for the objective of the research. With the contained solutions, based on the discrepancies between Agile and budgeting, the SABP can be deemed holistic. Throughout the design, no specific approaches were targeted, which is why the solution is applicable to both, Agile and budgeting, universally and not limited to certain methodologies. Hence, the SABP completely satisfies the objective of the research project as well as the claim for comprehensiveness and universal applicableness.

5 EVALUATION AND OUTLOOK

Since the core result of the research project, represented by the SABP, is predominantly theoretical and abstract, an evaluation was conducted in the form of an interview study to obtain information from outside standpoints and increase the reliability & objectivity of the conclusions (see Eisenhardt, 1989). The interviews were conducted with a structured interview guide to yield comparable results. The five interviewees were picked from the fields of Component Development for Mechanical Engineering, Department Management for Mechanical Engineering, Product Management for Mechanical Engineering, and Innovation Consulting. During the interviews, after being presented with the SABP described in the previous chapter, the interviewees were asked qualitative and quantitative questions. Due to the limited number of interviewees, the quantitative data, although showing distinct trends, does not allow for statistical relevancy. Therefore, a summary of the qualitative data will be given hereinafter.

The responses of the interviewees were predominantly positive. The SABP was considered promising regarding the core incompatibility issue and objective of the research project. Furthermore, the process was considered advantageous due to the interdisciplinarity and holism of the design. Points of criticism were expressed regarding the applicability to different situations as no real-life case studies have been conducted thus far. These studies were suggested in order to retrieve valuable additional experience and information, which could then be applied and considered for further research. Real-life case studies also pose a valuable source for insights regarding the scalability of the designed approach.

When looking back at the summarized research in Chapter 2, in addition to the results from the interview study, it becomes clear that the results of this research project, in the form of SABP, show key similarities to the propositions provided by pre-existing publications. Furthermore, the SABP poses a comprehensive and structured frame and model for the objective of the research project while also extending the pre-existing research. Hence, the results included in the pre-existing publications can be seen as further validation for the SABP.

For the produced results, the authors see two important possible connection points for future research, which are planned to be pursued. First, additional and extensive case studies will yield more insight regarding practical application knowledge about the SABP. Second, an expansion of the SABP beyond what has been considered in the research project will be assessed as outside interplays can play an important influencing factor and should thus be evaluated. The SABP is not exclusive or encapsulated and, for instance, poses potential to include higher management or investment levels.

All in all, the objective of the research project was achieved successfully, and a budgeting approach compatible with and suitable for agile development was proven possible. Given the discovered research gap, the developed SABP provides a comprehensive way to apply agile development and allows for budgeting, including concrete resource allocation. The approach is not limited to certain scenarios or environments. With the SABP, all the requirements for both sides, Agile and budgeting, are fulfilled, and no adjustments or restrictions have to be made on either side. Therefore, the developed approach poses an overall successful, holistic, and novel solution with potential for future research and expansion.

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