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AGILE PORTFOLIO MANAGEMENT: DESIGN GOALS AND PRINCIPLES

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Research paper

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Abstract

Digital transformation and the resulting volatile and unpredictable business environments challenge traditional enterprises to continuously fulfill and surpass customers' expectations. They need to become agile in its organization by proactively sensing the unpredictable change and responding accordingly with speed and dexterity. While many organizations are quite advanced in realizing adaptivity at the operational level, strategic agility in general and in portfolio management in particular as linking operations and strategy for satisfying the customer needs is in its nascence. To identify the baseline for portfolio management for achieving agility, we derive four design goals for an effective agile portfolio management system, six design principles on how to achieve these goals and show an exemplary setup with design features. Our results are based on a research study with empirical insights from six companies and theoretical input from thirteen existing case studies and eight frameworks for scaling agility to the portfolio level. By deriving design principles for an agile portfolio management system, our work closes a gap in existing research, which focuses on principles for adaptive IT portfolio management processes instead of proactive enterprise systems, insights on individual portfolio practices or non-generalizable blueprints for an agile organizational setup without showing alternative approaches.

Keywords: Agility, Portfolio Management, Design Principles, IT Governance.

1 Introduction

Digital transformation with its volatile and hypercompetitive business environments deeply changed corporate reality. As the balance of power shifts to the customer, who predefines the problems to be solved (Denning, 2010), enterprises need to become agile. Agility implies being able to be proactive in sensing changes and responding with speed, innovation and dexterity to fulfil and surpass customers' expectations (e.g. Sambamurthy et al., 2003). A corresponding organization affects the whole enterprise system and mind-set (Overby et al., 2006). With IT penetrating the core business processes, the change ability deeply integrates business and IT capabilities (Nissen and Rennenkampff, 2017; Melarkode et al., 2004). Organizations foster agility on the operational level with self-organizing cross-functional teams with short cycles for fast service delivery, improvement and innovation. However, the paradigm shift also calls for a portfolio management to enable rapid response to change while linking teams to the strategy, as they still need compliance to strategic and mandatory requirements (e.g. legal demands). This not only involves scaling agile methods from operational level like Scrum from software development, but also implies changes to existing project and portfolio practices.

The demand for agility imposes changes for portfolio management and governance (Luna et al., 2010; Gill, 2007; Luna et al., 2016), but best practice frameworks for portfolio management (e.g. PMI) or IT governance (e.g. COBIT or IT Infrastructure Library (ITIL)) are rather suited for stable environments and traditional command-and-control settings (Peterson, 2004, Luna et al., 2010). Existing approaches

for coordinating a multitude of agile teams via a portfolio like e.g. Scaled Agile Framework (Scaled Agile, 2018) or Disciplined Agile (Disciplined Agile, 2018) address this need by providing rather inflexible blueprints as one size for all solutions, which might not suit every organization. Others provide insights into specific agile portfolio tasks like continuous portfolio planning (Suomalainen et al., 2015), but do not embed them in an agile portfolio system with roles, structures, etc. Finally, first approaches such as Hoffmann et al. (2017) propose general design principles, but do not consider agility's systemic and proactive nature. Furthermore, most approaches miss the discussion of the intertwining of business and IT logic (Horlach et al., 2018). Hence, our research is guided by the following question:

Which principles do apply for an effective portfolio management system to achieve agility?

As contribution of our research, we derive design goals, design principles on how to achieve these goals in general as well as exemplary design features for their application (Meth et al., 2015; Drechsler and Hevner, 2018). We followed a design-oriented approach (Hevner et al., 2004) within two design cycles to derive the final goals and principles: (1) an empiric-centric cycle based on interpretative qualitative study with IT executives (CDO or CIO) of six organizations from different industries in Central Europe and (2) a theory-ingrained cycle based on a literature analysis of theoretical concepts, existing case descriptions, and frameworks addressing agility on portfolio level. For each cycle, the goals, principles and the corresponding features were derived via an inductive approach following the ideas of grounded theory (Strauss and Corbin, 1991) to gain broad insights instead of narrowing the analysis by a distinct theoretical perspective. Each design cycle concluded in an evaluation with experts, either with the CIOs from the empirical study or with experts from four additional organizations.

The paper is structured as follows. Following this introduction, the second section describes the theoretical background on enterprise agility and portfolio management as strategy execution mechanism. The third section covers the overall methodological design of our study in detail for each step. The results of the state-of-the-art knowledge concerning principles for agility in the portfolio management of enterprises are described in section four. The paper concludes with a discussion and brief conclusion as well as an outlook for future research steps in our long-term research.

2 Portfolio Management for Organizational Agility

For thriving in the volatility of the market and hyper-competition in a digitalized world with its constant changes, companies need the ability of organizational agility. Building on dynamic capabilities (Teece et al., 1997), absorptive capacity (Cohen and Levinthal, 1990) and strategic flexibility (Hitt et al. 1998) as theoretical references (Overby et al., 2006), agility involves the proactive and reactive strategic moves (Sherehyi et al., 2007) with speed and innovation (Yusuf et al., 1999) by sensing the environment (Sambamurthy et al., 2003; March, 1991) as well as the ability of continuous flexibility and responsiveness, culture of change, and mobilization of core capabilities, processes and knowledge (e.g. Lee et al., 2015; Goldman et al., 1995). The constant interaction with and scanning of the business environment, especially customers and rivals, is primary target for agility (Sambamurthy et al., 2003; Roberts and Grover, 2012; Liang et al., 2017). To reach the customer, close collaboration with business partners in networks of strategic or extended partnerships or sourcing of assets and resources (Sambamurthy et al., 2003) is key. Internally, agility requires adaptivity in orchestration of the organizational system for the right services (Denning, 2017a) with continuously being willing to take risk and act proactively and responsively in terms of scalability, (re)integration and (re)configurability (Conboy and Fitzgerald, 2004; Lu and Ramamurthy, 2011). Adaptive processes and tools (Laanti, 2008; Roberts and Grover, 2012), a flexible mind-set and a corresponding strategic management (Denning, 2017b) are essential (Doz and Kosonen, 2010) to balance continuity and change forces through the strategic channels of divert, shift, partition, and integrate (Sushil, 2015).

The agile manifesto (Beck et al., 2001) and multiple methods like Scrum or Kanban propose various solutions for satisfying the customer and welcoming changing requirements and delivering working services frequently on operational level, at least for software development. Although solutions for agility in portfolio management, traditionally conducted in a top-down centralized manner, in long-

term cycles and separated between business and IT (Jeffery and Leviveld, 2004), are also growing in number (Stettina and Hörz, 2015; Ahmad et al., 2017), most limit their applicability to only few characteristics of agility for embracing continuous change or a single portfolio management area like elicitation, selection, evaluation, and management. Common denominator for most solutions is however speed (Frey and Buxmann, 2011), mainly for services, projects or assets (Young et al., 2011) against business criteria like benefits, revenue or costs (Archer and Ghasemzadeh, 1999; Jeffery and Leviveld, 2004). This relies on business IT alignment as second key dimension in selecting (Fitzgerald and Stol 2017), allocating budget and improvement (Hope and Fraser, 2003; Bogsnes, 2009) in short cycles instead of annual events (Krebs, 2009). In regard to elicitation of portfolio items, time dynamics (Daniel et al., 2014) shall facilitate the timely, yet aligned delivery and evaluation via rolling wave planning with its detailed plans for early periods and vague outlines for later ones (Rickards and Ritsert, 2012), event-driven (Bogsnes, 2009) or continuous portfolio planning (Suomalainen et al., 2015). Creating transparency on item interdependencies with portfolio backlogs for all approved items (Poppendieck and Poppendieck, 2003) and road mapping (Saad et al., 2006; Suomalainen et al., 2015) also serves as facilitator in this regard. Self-organization on operational level regarding the scope of the realized service, its methodological and technological base is also seen as key for agility (Sweetman et al., 2014), as e.g. directly involving agile units in the strategic business decision-making process shall uncover needed changes better (Fitzgerald and Stol, 2017; Bogsnes, 2009). Finally, product portfolio management for e.g. new product development as alternatives (Cooper et al., 1999) or complementing the project portfolio (Young et al., 2011) is proposed to include the customer's perspective.

Frameworks covering the whole portfolio management process for responsiveness while governing the perfect mix of portfolio items within the organization's capacities, capabilities and constraints (Jeffery and Leviveld, 2004; Martinsuo and Lehtonen, 2007) and maximizing the business value and alignment (Cooper et al., 1999; Reich and Benbasat, 2000) are increasing, but mainly yet scale agile practices from software development and IT operations (Krebs, 2009; Poppendieck and Poppendieck, 2003). For example, the Scaled Agile Framework (Scaled Agile, 2018) or Disciplined Agile (Disciplined Agile, 2018) provide scaled blueprints with self-organized teams that autonomously elicit and prioritize their work aligned to the strategic objectives via a common portfolio process and value-oriented work packages in the portfolio (e.g. themes and epics). The portfolio is derived by common meetings with business and IT throughout the multiple organizational levels in short planning and feedback cadences to enable systems thinking (Scaled Agile, 2018) and reduce cost of delay (Disciplined Agile, 2018). The most general approach is provided by Hoffmann et al. (2017), who derived goals and principles for sustainability in IT portfolio management via adaptivity and effectiveness in its operations and strategic business IT alignment, mainly in the portfolio process. However, they assume that a central portfolio management team and cascading down items exists, which contradicts with agility's nature of pulling work by teams. This thinking also leaves out the underlying system for enabling agility. In addition, the link to practices on how to realize the principles is missing. This still leaves companies challenged on how to establish their portfolio system and what agility requires in this regard.

3 Research Methodology

To develop the baseline of portfolio management as one part for achieving organizational agility, we follow the recommendations by Gregor and Jones (2007) and Drechsler and Hevner (2018). They propose design principles as desirable design knowledge, being the general blueprint of requirements, which then serve as foundation for the instantiation(s). As the requirements need to be understood in terms of the environment in which they operate, we also developed design goals to define the purpose and scope of the developed theoretical base as well as its boundaries (Gregor and Jones, 2007; Meth et al., 2015). The set of design goals and principles are inductively developed along two design cycles (Hevner et al., 2004) following the ideas of the grounded theory approach (Strauss and Corbin, 1991). With agility being multi-faceted in nature and its blurry boundaries to other theoretical concepts like dynamic capabilities (Teece et al., 1997) or absorptive capacity (Cohen and Levinthal, 1990), theories would be blinders to our analysis (Truex et al., 2011) and prevent from grasping agility in its entirety.

The first set of two design goals – customer centricity, timeliness of decisions and alignment - and six principles were derived based on broad and in-depth empirical knowledge to not be influenced by a specific theory, approach or framework, which mainly propose certain practices and methods as 'agile'. Therefore, we conducted a qualitative cross-industry study with IT executives (CDO or CIO) from six organizations, which are actively attaining agility on the enterprise level by reshaping both (parts of) business and IT from the operational to strategic level (see Table 1). We used multiple methods for data collection to gain a systemic perspective by conducting semi-structured interviews and a focus group discussion for an overall view on the approaches towards agility in portfolio management and its environment. We also reviewed public and private documentation for the further depth on certain components of such a portfolio management system like e.g. role models, architectural documentation or process specifications, while using marketing brochures and training material to enable triangulation of results on the overall approach if possible. The participating organizations were identified and selected according the following criteria: (1) the organizations are (becoming) agile including the portfolio level, (2) participants hold a position with insights on the portfolio system, and (3) willingness for cooperation and open information sharing along the participants and with the researchers. We conducted the interviews within a four-month period from November 2017 to February 2018. Each interview session about the individual agile setting took approximately 60 minutes and was audio-recorded and transcribed. As a second step, the approaches were enriched through transcripts from a one-day focus group workshop (Krueger and Casey, 2014) with all six organizations in spring of 2018, where the participants discussed in multiple group sessions their approaches to e.g. prioritization of content, resource allocation and validating its progress and success.

The second iteration involved the theoretical validation and extension of the goals and principles based on existing research in order to achieve rigour of our results next to impact, utility and relevance from the first cycle. Therefore, we (1) used the agility concept from the existing theoretical debate (e.g. Lee et al., 2015; Sambamurthy et al., 2003; Chakravarty et al., 2013) as well as existing principles from practice like the agile manifesto (Beck et al., 2001) and (2) enriched the theoretical base with existing approaches for agile portfolio management from theory. For the first, IS, management and organizational journals and conferences served as theoretical input. For the second, we conducted a literature search (Vom Brocke et al., 2009) in academic databases ACM, AIS electronic library, EBSCOHost, Google Scholar, IEEE explore, Springer Link and Web of Science. We also conducted a Google search, as agility is currently one main trend in practice so that practice may provide deeper and broader interesting insights and additional approaches not addressed in research. For the conducted searches, we used the respective search functionality with variations of the search string ((agil* OR lean OR continuous) AND "portfolio management"). We examined the abstracts and titles to gain relevant publications, which address at least parts of portfolio management in relation to agility. This resulted in 18 contributions, which explicitly address practices for agility in a portfolio system. For these articles, we conducted a forward and backward search to identify further cases, which resulted in 11 additional articles. Out of those, 13 articles describe existing individual approaches in form of, often short and high level, case studies. During our search, we also identified general frameworks for scaling agility towards the portfolio level, which resulted in eight additional agile portfolio systems from a list provided by Horlach et al. (2018). We decided to include these frameworks as additional sources for good practices for agile portfolio management, as experienced agile practitioners with presumably in-depth insights on a plethora of organizations developed those.

We conducted an inductive qualitative analysis including the three coding stages from grounded theory (Strauss and Corbin, 1991) in the analysis tool MAXQDA. The first author first assigned codes line by line like "rolling wave over annual planning". Second, we compared the codes based on the area(s) of portfolio management to see the part(s) of the portfolio system that are addressed. Then, we inductively compared codes within an area based on how they address agility's main assumption of "embrace continuous change". This resulted in consolidated codes like e.g. "flexibility in planning process" based on the identified common character of flexibility. We then iteratively consolidated the codes between areas based on their commonalities in relation to agility to attain the resulting design goals and principles. The coding procedure for the second iteration follows the same rules and finally

merges with the first set by constant comparisons between the derived principles and goal. In case of conflicts, the authors discussed different perceptions until they arrived at a joint assessment.

Case	Size (‘000) employees	#Agile Teams	Scope of Agility (Present)	Operation	Position
BankCorp	50-100	400	Enterprise	Global	CIO
InsureCorp A	1-5	10	IT and Digital Unit	Global	CIO
InsureCorp B	1-5	10	Enterprise	National	CIO
ManuCorp	10-25	5	IT and Digital Unit	Global	CIO
PublicCorp	1-5	2	Digital Unit	National	CDO
RetailCorp	50-100	50	Enterprise	Global	CIO

Table 1. Participating organizations of the cross-industry empirical study

We evaluated both goals and principles in both cycles for validity and generalizability (Benbasat and Zmud, 1999). The first set was evaluated by all participants of the focus group within a shared telephone conference. The experts provided comprehensive qualitative feedback by breaking down the results’ structure, utility, level of completeness and detail and applicability (Hevner et al., 2004). For example, the goals should include the allocation flexibility, as it is one underlying agility dimension instead of merely acting as guiding principle for execution. In addition, the proactive side of agility with the link to innovation management needed to be addressed more. In the second iteration, we used a summative evaluation to gain a rather concluding judgement from expert interviews with three management consultants, experienced in agile transformations, and one IT manager, whose organization is also transforming towards agility on the enterprise level. Interviewees had to assess the results concerning their relevance, completeness applicability and the inter-relatedness between goals and principles. As instrument for highlighting the degree of agreement, we used a five-point Likert-scale, ranging from 5 for “Fully agree” to 1 for “Fully disagree”. We also requested qualitative feedback to identify further design goals, principles and inter-relations to refine our results once more. However, the results showed that our results are comprehensive, which is reflected by only needing minor revisions in phrase and style like e.g. refinement of principles’ descriptions. We however shifted requested patterns on concrete recommended actions to our next research cycle.

4 Design Goals and Principles for Agile Portfolio Management

In the following, we describe (1) the design goals as necessary requirements for achieving agile portfolio management, (2) the design principles as the underlying logic of an effective agile portfolio management system and (3) the resulting design features based on an exemplary instantiation of an agile portfolio management system for showing their utility. In regard to the presentation of our results, we follow the recommendations of Legner and Löhe (2012) and Meth et al. (2015). Our design goals and principles are independent from a specific organizational setup in agile organizations, so that portfolio changes can be realized in various way, e.g. via (agile) projects or via stable (cross-functional) ‘product teams’ with end-to-end focus on providing services for particular customer objectives.

4.1 Design goals as requirements for agile portfolio management

Design goals as the ‘causa finalis’ are an essential correspondent to design principles by defining meta-requirements of applicability or exclusion (Gregor and Jones, 2007), which means the requirements that are needed for agility in portfolio management. This does not exclude traditional goals of portfolio management for ensuring compliance, optimal resource allocation and solving (resource) conflicts and interdependencies, as these are still valid. Based on our theoretical and empirical knowledge base, we derived four generalizable goals along the two design cycles, which are described in the following.

As “*digitalization is nothing more than consistent customer orientation*” (CIO BankCorp), agility requires everyone to focus on providing value for the customer at any time and continuously checking

on the fit between the value and the own services (Denning, 2010). As organizations are increasingly operating in business ecosystems, customer value also includes solving business partners' and employees' needs as intermediaries to and 'voices' of the customer. Thus, companies with indirect customer proximity are also affected by this logic. For portfolio management, this requires a corresponding management logic from output-driven decisions towards outcome focus, i.e. what the services are needed for (= the customer value, not the shareholder value) (Denning, 2016). Therefore, the first design goal calls for a ***customer-value based portfolio management process*** **(DG1)** along two dimensions: ***(a) a value fit between need, idea and portfolio demand*** and ***(b) a value fit between the portfolio decision and the realized service.*** Purposeful portfolio decisions require the ability to collect, process and monitor large amounts and a variety of data for identifying the customer value (Bharadwaj et al., 2013; Nazir and Pinsonneault, 2012) and integrate this knowledge when realizing the services, e.g. by integrating data analysts or customer journey experts in the (project or product) teams. This also calls for continuous innovation, which results in a needed end-to-end 'ownership' on operational level for the whole service cycle from idea to realization and back with e.g. having a committed service owner from business in project settings or a committed product team (Bogsnes, 2009). Teams' ideas for improvement then need to flow back to the portfolio to monitor the overall customer value (Little and Karaj, 2013). Having procedures for teams for predicting customer needs externally, e.g. via close collaboration with market influencer and users (Sambamurthy et al., 2003), can also be helpful.

Since the customer value can change at any time, agility in portfolio management means speed in handling changes (Fitzgerald and Stol, 2017; Suomalainen et al., 2015). Thus, the second design goal implies a ***time-efficient portfolio elicitation and management process*** **(DG2)** with the two sub-goals ***(a) realization of portfolio items in adequate time*** and ***(b) refinement of portfolio items in adequate time***. This means a fundamental change of the traditional annual portfolio management processes to short cadences like quarterly business cycles. Time-efficiency also implies service changes to be realized on time to avoid waiting times and release delays. Thus, teams *"cannot run alone and say: 'Here I come.' No; they are swim lanes working on different things. They need parallel synchronization" (CIO ManuCorp).* In addition, the information on the service lifecycle and corresponding decisions constantly is to be transparent and traceable from elicitation to realization in the portfolio process for continuous value generation (Suomalainen et al., 2015; Little and Karaj, 2013).

With the service content and the service landscape being in a flux, portfolio management needs to handle the ongoing rebalancing its resources and capabilities (Overby et al., 2006; van Oosterhout et al., 2006). Therefore, an ***efficient setup of allocation processes*** **(DG3)** with ***(a) flexible and adaptable resource allocation*** and ***(b) flexible and adaptable budget allocation*** is essential. Flexibility implies capabilities' scalability and their ability for (re)integration and (re)configuration (Sambamurthy et al., 2003). Thus, organizations need to think of how to set up the organization to ensure resource flexibility while enabling ownership for continuous innovation of services. Flexibility in structuring should be based on a problem-centric mind-set: *"What should become better and what or who can help achieving this goal? [...] In today's situation, I have today's problem and try to solve those with today's knowledge and an anticipation of tomorrow. Will that be just as valid in the future? I don't know."(CIO RetailCorp)* This also involves flexibility in sourcing strategies, as external sources may be needed for realizing services in adequate time or manner (Sambamurthy et al., 2003). The budget allocation process also must handle flexibility, which in turn means fast and adaptive budget handling in portfolio management (Hope and Fraser, 2003; Bogsnes, 2009).

With the plethora of services and the fluidity of content and resources, portfolio management still has to face the multitude of service interdependencies and possible resource shortages for the realization. Like in traditional settings, this results in a needed business IT alignment for solving the challenges by knowledge sharing and a resulting shared understanding (Reich and Benbasat, 2000; Chan and Reich, 2007). As digital services require an even deeper IT understanding for business and vice versa (Bharadwaj et al., 2013), fast, but profound decisions require a ***continuous alignment between business and IT in the portfolio management*** **(DG 4)** by ***(a) shared awareness of service interdependencies*** and ***(b) continuous shared commitment and contribution to the capabilities of the organization***. This

leads to new ways in mind-set, process and structure to solve problems like lack of collaboration and understanding caused by terminology differences by business and IT (Melarkode et al., 2004).

4.2 Design principles

The following six design principles depict the principles of form and function (the causa formalis) (Gregor and Jones, 2007) for achieving agility in portfolio management. Thereby, we describe the abstract blueprint of the requirements for attaining such a portfolio management system by highlighting each principle and how it can realized based on specified constructs. We also show testable propositions, which represent each principle's outcomes, and the mechanisms mainly contributing to achieving this outcome. Table 2 presents the six principles, their key characteristics and mainly underlying design goals as well as an excerpt of the testable propositions with an example of its literary origins.

To achieve agility's main goal of continuous customer value ***(DG1)*** while having limited information and predictability on whether the resulting service will really fulfil their needs, **DP1** implies a **customer solution-driven portfolio management.** A solution in the context of portfolio represents the business capabilities, which are necessary for achieving the targeted customer value and the respective outcome (what are they needed for) (Steindl, 2005). Thus, solutions involve the current and envisioned services, the targeted customer segments and the value streams as the "series of steps […] that provide a continuous flow of value to a customer" (Scaled Agile, 2018). Via the value stream, the involved people and the flow of information and materials for realizing the value proposition ***(DG4)*** is mapped (Shalloway et al., 2010). Overarching topics like legal and non-functional requirements are also solutions, as they also have a certain (indirect) outcome for the customer, e.g. by investing in quality (Disciplined Agile, 2018). As the value is in flux, solutions and their selection and prioritization are undergoing changes by becoming outcome-driven with goal-oriented milestones or desirability factors (Daniel et al., 2014) for rolling forecasts (Rickards and Ritsert, 2012) opposing concrete plans for each milestone level: "*When you have a business capability or an initiative to roll out, you have a plan for one or two years, and have strategic milestones in the plan. […] You only plan in more granularity for the next six or three months. […] The scope, what we want to achieve, or, actually, the key milestones are, of course, planned long-term. But we don't plan what we want to do in January to March 2019. Instead, we say: 'You have to reach some milestones by March 2019,' and the teams have to adjust to these milestones." (CIO BankCorp)* However, the teams have the autonomy on how to commit to the strategic milestones, as they semi-autonomously plan and estimate their own work, e.g. by weighted shortest job first based on the economics of the product development flow (Scaled Agile, 2018) or the net promoter score (Little and Karaj, 2013). In principle, they can defer work resulting from the milestones, if their own topics are more urgent at a certain point or if the work requires efforts beyond the team's capacity at the time. As the teams do not work in isolation, especially regarding realizing the strategic milestones, they need to coordinate their plans with other involved parties and come to an agreement. This is mainly reflected via continuously coordinated team backlogs based on common portfolio backlogs (Poppendieck and Poppendieck, 2003), roadmaps (Saad et al. 2006) and planning, review and performance management cycles (Tengshe and Noble, 2007; Scaled Agile, 2018).

Opposing a traditional top down portfolio management process with a dedicated executive portfolio team, separated for business and IT, agility requires a decentralized enterprise portfolio system with a **multi-level cross-functional portfolio governance body (DP2).** As any to be escalated decision causes a delay in action and can be falsified based on missing knowledge of the individual context, recurring and time-critical decisions that require knowledge on the local context are to be managed and governed on the operational level within the teams as much as possible (Steindl, 2005). This also involves the allocation of additionally needed resources and material for realizing a solution ***(DG3)***. Overall portfolio management involving executives is then responsible for business critical, long lasting decisions with enterprise-wide impact (e.g. terminating a solution) (Paasivaara, 2017). Due to the high decentralization of traditional top down portfolio decisions, information sharing between the multiple 'hierarchical' levels is key to optimize the whole (Disciplined Agile, 2018) as "*we are much more involved in the content on the portfolio level, both regarding the what and the how* [,but] *the rat-*

ing system does not resemble the content of established products so that they cannot be sufficiently evaluated based on ROI and strategic points. Although we try to capture the content by reviews and retrospective, we need more. We [as executive management] need to be involved in the content-related discussion much more and know in more detail what is going on in our organization and what the teams are doing." *(CIO BankCorp)*. Organizations have implemented formal and informal multi-level communication channels to provide this feedback loop like communities of practice or interest (Little and Karaj, 2013; Power, 2011), cross-functional team structures or gatekeeper roles with business and IT expertise like (chief) product owner or solution owner. Next to being responsible for ensuring continuous optimization of service(s) delivery with resources and knowledge ***(DG2)***, they are main facilitators for the convergence of business and IT-related decisions following ***DG4*** on the multiple levels to create speed in decision-making and a shared understanding via system thinking. A converged overall portfolio decision-making with IT and business executives via an 'executive squad' (XSCALE, 2018), sometimes following a common strategy, is on the rise as enabling practice.

DP3 addresses the required **aligned autonomous portfolio decision-making** for agile settings. We identified that the selection and prioritization of topics within the solutions is to be as autonomous as possible by the teams to enable the fastest possible reaction to the customer ***(DG2)***. The executive management intervenes in case of conflicts that teams could not solve among each other. However, teams need to follow the overarching central enterprise vision and 'plan' via the portfolio for shaping their plans (Bogsnes, 2009). Therefore, the solution, more accurately its outcome, sets the boundaries for teams' decisions by setting the team's purpose (Hope and Fraser, 2003; Rautiainen et al., 2011). Organizations are using bottom-up self-commitment via self-defined objectives and measures on team level to create this purpose. The current favoured mechanism is objective and key results (OKR) with quantifiable key results developed for each team and individual based on identified objectives derived from the enterprise vision. For solutions involving multiple teams, solution 'middle-ware' domains are increasing, where teams are grouped under the same purpose to enable optimization of the whole solution instead of local enhancements. We found that the purpose has another alignment function: commitment of team members to the individual team and to the company as a whole ***(DG1)***. The purpose demonstrates to team members that the individual work is an impactful contribution to the organization, which in turn strengthens the commitment and alignment of actions to the common direction. For creating a fit between solutions in case of dependencies, teams align via centralized collaboration mechanisms, similar to scrum meetings on team level. We identified that product owners are usually the main actors in the mechanisms or some delegated specialists from the teams, depending on the topic. In addition, cross-team oriented roles like e.g. solution architects are part of the settings for providing input and continuous attention to the overall interfaces and interactions (Scaled Agile, 2018).

For fast overall decision-making with holistic information and flexible resource (re)allocation to solutions, **DP4** proposes **synchronized short portfolio cycles**. Our study reveals that synchronization is required throughout the portfolio system with multiple integration points, as little value is provided before all constituent parts of the solution as minimum viable products (MVP) are usable ***(DG2)*** (Steindl, 2005). Otherwise, value is inhibited by waiting times due to delayed integration testing, risk identification (e.g. capacity or budget shortage) and planning and allocation of content, resources and budget for the next iteration. Therefore, *"you actually need a synchronized procedure across all domains, and you eventually need a synchronization point [again]. […] It is […] important that they have no offset. The weeks need to start all the same with a Monday and use the same Monday as synchronization point. […]." (CIO RetailCorp)* The periods for the different integration points are also becoming synchronized (time boxed), resulting in a cadenced enterprise planning and validation cycle for continuous adaptation (XSCALE, 2018). The integration points are moving to much shorter periods with most preferably quarterly reviews (Little and Karaj, 2013; Power, 2011), turning away from the traditional annual cycles. This continuously (re-)aligns and commits all stakeholders to the common technical and business vision ***(DG4)***, both near- and long-term, as well as flexibly (re)allocates the required resources ***(DG3)***. With decentralization of decision-making, synchronization helps minimizing uncertainty in solution delivery, as sharing the planning and control empowers teams to create the best possible plans to achieve the best possible solution within the given constraints.

Design Principle	Testable propositions (selection) and exemplary origin
DP1: Customer-solution-driven portfolio management: Definition, management and evaluation of the purpose of present/ future solutions against expected customer value (Addressed design goals: 1, 4)	**TP1.1** Awareness for customer-solution orientation is fostered via vision and purpose based on value (Poppendieck and Poppendieck, 2003) **TP1.2** Agile units are committed to overall organizational goals and strategic direction via customer-driven KPIs (Scaled Agile, 2018) **TP1.3** Understanding of units' own share towards corporate success is fostered by value stream (system thinking) (Steindl, 2005)
DP2: Multi-level cross-functional portfolio governance body: Continuous involvement of stakeholders from business and IT from multiple organizational levels in whole portfolio management process (Addressed design goals: 2, 3, 4)	**TP2.1** Alignment between business and IT stakeholders is fostered via shared understanding, learning and proficiency along the multiple organizational levels and disciplines (Little and Karaj, 2013) **TP2.2** Decision-making is faster and comprehensive due to less needed additional information acquisition via set purpose (Daniel et al., 2014) **TP2.3** Resource allocation is effective based on completeness of information on necessary skills for demand realization (Power, 2011)
DP3: Aligned autonomous portfolio decision-making: Transfer of decision rights solution specification and resource allocation to realizing organizational units aligned to the overall strategic vision (Addressed design goals: 1, 2, 3)	**TP3.1** Fast changes to solutions based on evaluation of actual data are enabled by monitoring skills within teams (Little and Karaj, 2013) **TP3.2** Entrepreneurial spirit and behavior by units is facilitated by responsibility (ownership) of teams for their solutions (Krebs, 2009) **TP3.3** Shift of teams towards new topics is simplified based on outcome-based purpose instead of output-based scope (Saad et al., 2006)
DP4: Synchronized short portfolio cycles: A series of defined information points for common planning and reflection of the status of the solutions' realization status (Addressed design goals: 2, 3, 4)	**TP4.1** Waiting times in solution realization are minimized by synchronized timeframes (Steindl, 2005) **TP4.2** Overall information completeness is improved and faster via common information points (Heje and Krohn, 2017) **TP4.3** Transparency of consequences in case of shifting priorities is facilitated based on continuous monitoring (Saad et al., 2006)
DP5: Alignment of portfolio management with adjoining strategic management processes: Continuous information exchange and activities between portfolio management and adjoining strategic management processes (Addressed design goals: 1, 3, 4)	**TP5.1** Evaluation of strategic planning is flexible and adaptive via continuous internal and external feedback flows on changes between portfolio and strategic planning (Laanti and Kangas, 2015) **TP5.2** IT landscape is manageable and its development is controlled by continuous check of architectural baseline (Rickards and Ritsert, 2012) **TP5.3** Faster response to changing customer needs is enabled by flexible and adaptive budget allocation, based on short feedback flows from the operational units (Laanti and Kangas, 2015)
DP6: Extension towards innovation management capabilities integration: Integration of explorative and exploitative portfolio demands in decision-making and management with information flows to various innovation origins (Addressed design goals: 1, 3)	**TP6.1** Informed evaluation of possible technology investments for the portfolio is facilitated based on actual data through the application in a concrete context (Little and Karaj, 2013) **TP6.2** Business opportunities are identified, realized and tested early of in a limited (non-critical) environment based on teams focusing on continuous service improvement and innovation (Krebs, 2009) **TP6.3** The (re)integration of ideas and solutions, developed by third parties, into the portfolio management process is enabled by continuous improvement of (future) customer value (Little and Karaj, 2013)

Table 2. Agile portfolio management design principles and excerpt of testable propositions

With agility being an enterprise-wide spanning activity, an **alignment of portfolio management with adjoining strategic management processes (DP5)** like strategic planning, budget and investment, architectural planning and decisions on sourcing (strategies) is required to not inhibit portfolio management's speed (Suomalainen, 2015; Disciplined Agile, 2018). Our study reveals that these management processes therefore undergo a transformation towards agility themselves. For example, we identified that budgeting and investment is changing its nature by (1) faster and shorter feedback loops for more efficient budget reallocation and identification of budget deficits ***(DG3)***, (2) decentralization of

decision-making with budgeting on teams instead of individual thematic initiatives ('money-boxing'), which results in teams having the right to allocate necessary capabilities (Laanti and Kangas, 2015) and (3) converged investments for business logic and IT-specific operational expenses, which were traditionally separated in change and run budgets ***(DG4)***. A similar development is evident in strategic planning, which reduces its learning cycles, converging business and IT strategies towards a capability-based strategic vision ***(DG1)*** to handle the economic uncertainties by focusing on the organization's core competencies (Little and Karaj, 2013; Laanti and Kangas, 2015; Paasivaara, 2017). As the IT landscape is in constant change along the solutions, architecture management for guarding its efficient development is also becoming fluid. Most prominent, the role of architects are transforming from giving directions from the 'ivory tower' to consulting teams in their ongoing work and continuously update the overall architecture (Heje and Krohn, 2017). Architectural thinking also becomes more engrained in portfolio decisions with enterprise architects becoming portfolio adviser for solutions' technological feasibility and influence the often-complex IT landscape (Scaled Agile, 2018). In addition, they develop enterprise-wide architectural recommendations instead of presetting regulations.

DP6 advises the portfolio's **extension towards innovation management capabilities integration**. Based on a higher commitment by the agile teams towards their realized solutions, they increasingly focus on its optimization or deriving completely new ideas and initiate endeavors (Disciplined Agile, 2018). Actual customer data then serves as rapid feedback and consequently allows fact-based decision making on progressing on the innovation or not. Thus, the teams with their 'ear to the customer' increasingly become a major innovation source and motor ***(DG1)***. We realize that actively enforcing teams' drive for innovation seeking and e.g. dedicating shares of worktime for own ideas, is gaining more and better results. As these ideas may possibly be valuable for the whole organization and show a possible threat to changes in customer needs, an extensive exchange of insights between teams and the portfolio is required for ongoing business success. Due to teams' knowledge on customer behaviour and consequent new business potentials, either continuous or disruptive, originally separated ideas and project portfolio (Young et al., 2011) merge in an agile world. Especially the integration of disruptive thinking is essential for being able to create a real competitive value for organization and shaping the future instead of simply evicting visionary ideas from the portfolio because of their high risk. For effectively handling the differing requirements, the portfolio is becoming ambidextrous (Krebs, 2009). Differing demands are specified in their rough sequence of tasks based on their capacities and teams can choose and switch their state between exploration and exploitation within the delivery cycles based on the requirements they prioritized for the upcoming time ***(DG3)***. We see that due to teams still being in an early stage of expertise, exceptions are yet made for disruptive ideas such as e.g. blockchain solutions. These are realized with specialists within (newly set up or existing) innovation teams.

4.3 Exemplary instantiation at RetailCorp

In the following, we highlight the design features on how RetailCorp as an organization quite advanced in transforming their whole enterprise has shaped an agile portfolio management system (see Figure 1). This instantiation of our artefact serves as "theory representation or exposition" (Gregor and Jones, 2007) and shows how organizations can follow our baseline to establish a portfolio system instead of randomly combining agile practices.

RetailCorp has continuous customer-centricity (**DP1**) deeply engrained, both in its processes and in its structures. For achieving a customer-centric structure, the teams are organized by the business capability-based solutions like e.g. "order to cash" along the value chain. Each team focuses end-to-end on autonomously solving the assigned problems through the portfolio process and includes all the key functions needed to create value, i.e. marketing, product management, customer journey experts, UX/UI, data analysts, or dev and ops engineers, resulting in a structure that is genuinely customer-centric. The purpose like e.g. "deliver and maintain robust back-end services to verify and register information for new customers and guarantee high quality data" is setting the direction and boundaries for the team, which also supports the aligned autonomy principle (**DP3**). As the solutions involve both the technological and functional logic, these teams are cross-functional 'BizDevOps' teams with

members from business and IT continuously working together (**DP2**). Each of the team has its own budget in order to flexible allocate the budget to personnel and resources to the changing incoming topics (**DP5**). Overall budgets are annually distributed and allocated to teams based on the estimated needed amount via the enterprise portfolio.

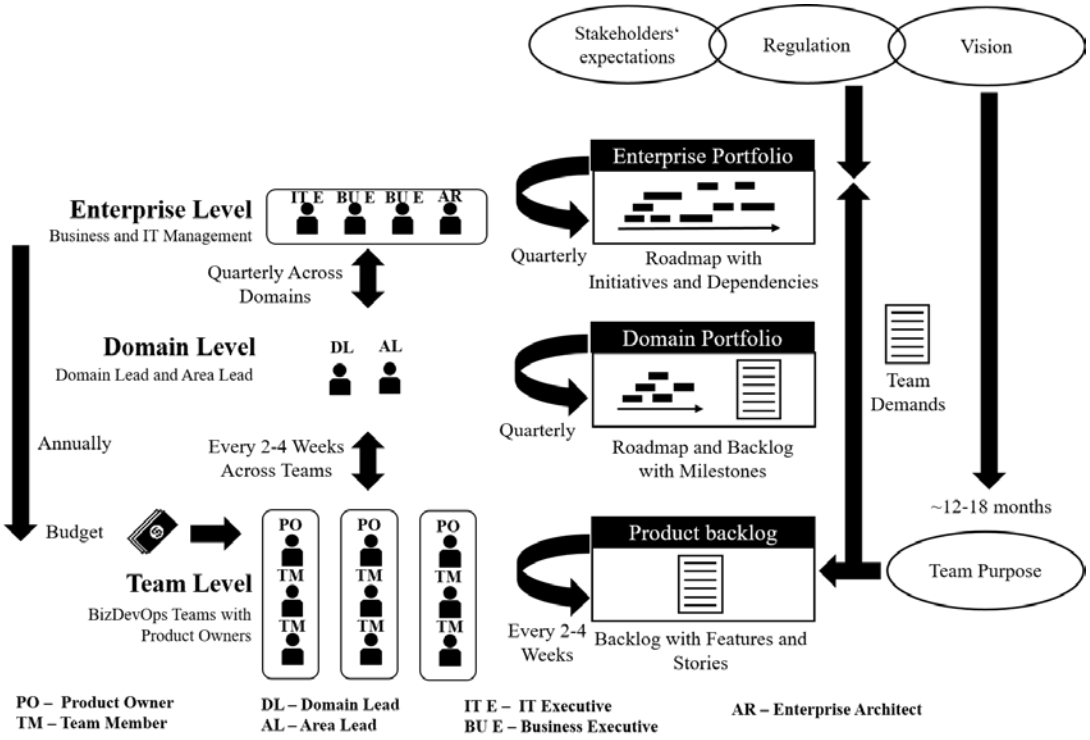

Figure 1. Agile portfolio management system at RetailCorp

Continuous customer-centricity is also key along the management process. RetailCorp's employs a multi-level portfolio system with a bottom-up and a top-down stream deriving the workload for the teams. Bottom up, each team starts the process by deriving their own topics, e.g. based on customer feedback data, experienced non-functional difficulties or radically new ideas. Cross-functional teams are yet in a rather nascent phase regarding identifying radically new business opportunities and rather focus on IT-related improvements at RetailCorp. With teams increasingly maturing in relation to customer-centric and business thinking as well as taking responsibility for their own actions, this supposedly changes in the near future (**DP6**). For each topic, the team estimates the expenses and identifies dependencies to other teams. Sometimes, the teams develop an estimated business case to strengthen the value for the individual idea (e.g. in case of innovation). The resulting calculations are sent to the 'domain lead', who then prioritizes and preselects all calculations. The domain lead sends the pre-prioritized list to the enterprise portfolio function and escalates identified challenges in the list like e.g. shortages in capacity or skills, which may result in additional teams or budget. The final prioritization is conducted in the enterprise portfolio, where business and IT executives discuss the topics, their feasibility and architectural integrity and prioritize the demands according to their strategic importance and urgency in unison (**DP2**). Before that, the executives also elicited their new demands in a top down manner based on e.g. external business, legal and technological trends and identified topics based on analysing the strategic objectives, which is in turn based on the enterprise vision as the 'self-conception' and identity of the company and its core business capabilities. For the technical feasibility and integrity analysis, an enterprise architect is part of this process as he has the overview on the interdependencies between the potential and current solutions and surveys the efficient development of the IT landscape (**DP5**). The prioritized portfolio solutions are communicated to the teams by a JIRA board, together with defined strategic milestones on a high-level roadmap. Teams and domains commit themselves to those solutions according to their capacities in a common meeting (**DP3**). During

this meeting, individual plans are discussed, dependencies are identified and coordinated and prioritizations are aligned across all domains and teams. Common ground rules for the work are also set. In case of impediments, executive management is informed in a separate meeting, which results in e.g. additional budget for teams. Resource shortage within the single team is solved through the 'area lead', who is responsible for the personal development of the team members. This role also has the disciplinary responsibility by being able to hire or fire team members.

RetailCorp employs different planning horizons with only the enterprise vision and its core business capabilities are fixed for a rather longer cycle. Starting from the resulting strategic objectives to realize the capabilities with assigned customer-oriented KPIs (including the net promoter score and traditional metrics such as ROI), all other plans are under continuous monitoring and revision at least on the quarterly cadences. The cycles in RetailCorp are synchronized across the teams and levels, which results in the same cadences organization-wide. Quarterly synchronization cycles have been chosen to evict or reduce waiting times and redundancies, but leave time for teams to work in peace on the topics. As the cycles are this short as **DP4** advocates, this results in a drastic change in the plans' nature as well. In contrast to traditional extensive planning, RetailCorp plans only their first quarters in detail, leaving all remaining plans more tentative. At the end of the quarter, plans are conducted for the following three months. For initiatives with fixed, sequential execution schedules (e.g. rollouts), the planning is more defined, but still depicted via a solution roadmap. On the enterprise portfolio level, all solution roadmaps are combined with their strategic milestones and corresponding KPIs.

As the portfolio topics involve business and IT-related content, executives and management require extensive knowledge on what is happening within the organization. In RetailCorp, information sharing within the organization is perceived as key for effective decisions and facilitate their approach by e.g. introducing cross-functional 'discussion groups' for exploring ongoing solution and possible future opportunities, such as voice technology (**DP2**). On operational level, the team setting as 'BizDevOps' teams and the corresponding cross-functional domain logic with representatives of business and IT in continuous collaboration with each other is a further facilitator of convergent thinking and acting.

5 Summary and Conclusion

Our contribution for agility in portfolio management are six design principles for achieving four design goals to establish an effective agile portfolio management system based on qualitative analyses within two design cycles with empirical and theoretical evidence from scientific and practitioner-in-use literature. Experts from ten organizations contributed and validated both goals and principles.

Our research extends, integrates and complements the existing theoretical and practical debate by combining an underlying baseline with concrete actions instead of proposing only one of them. By emphasizing the underlying goals and principles of agility regarding the portfolio system, including the processes, but also giving indication for structures and roles, our research goes beyond existing work that mainly focuses on giving specific guidelines for scaling agile software development. While our results confirm earlier research on goals to be attained like alignment, adaptivity and effectiveness (e.g. Hoffmann et al., 2017) in relation to agility, we also combine how to achieve these goals with design principles, possible practices and testable propositions. For example, we give insights on how Hoffmann' et al. (2017) recommendation of "decomposing large-scale projects into distinct projects" (p. 1511) can be achieved with forming products based on the enterprise vision and business purpose via value streams and roadmaps, which serve as benefit assessment from the beginning to align teams to the strategic objectives and outcome. Furthermore, we also address the proactive side of agility and the resulting connection to innovation management, instead of portfolio management being reactive in nature by being responsive to changing strategic trajectories (Hoffmann et al. 2017). The formulation of design goals, design principles and their context of application allows for condensing prescriptive knowledge to derive different instantiations for specific organizational settings, while focusing on the most critical design characteristics. Thereby, it supports practitioners in agile organizations to define their individual portfolio management approach with highlighting necessary changes to structures, processes as well as communication and information models. Research may use our design principles

for further empirical studies by analyzing different instantiations in order to refine and validate the underlying mechanisms and identify contextual factors for boundary spanning of the applicability. Furthermore, we address some of the existing weaknesses of the agile portfolio management research with our systematic development and formulation of our research findings by integrating the either empiric-focused and/or theory-ingrained existing prescriptive knowledge in the field. Especially our findings on a convergence of business and IT in the agile portfolio management system is contributing to the ongoing debate on how business IT alignment as one of executives' central goals can be achieved. Our results further show how agility can be expanded beyond the software development by involving the remaining organization in this organizational setup.

Our research is not without limitations. Most importantly, we build our results on knowledge gained in an empirical discourse with six organizations and existing case studies and frameworks on portfolio management in agile environments. Since the number of existing approaches are quite low, such studies do not achieve the universal validity of our research. To address this issue, we evaluated our design principles at the end of each design cycle by reflecting with the experts from the empirical inquiry and with four additional organizations. Furthermore, enriching our results with extended knowledge based on existing case studies and frameworks shall extend the limited knowledge base due to only six organizations participating. For achieving a further generalizability of our results, we strongly encourage future studies for empirical validation of our findings. We will also continue to follow this path with extending our study as well as enriching the results via patterns on concrete recommended action for a tighter alignment between the provided baseline by the design goals and principles and the specific (agile or traditional) portfolio practices and frameworks. A second limitation of our research is the immaturity of agility in research and practice in relation to governance in general and portfolio management in particular. Our analysis is mainly based on the integration of both concepts by their theoretical constructs, enriched with literature from practitioner publications, as we could not rely on scientifically grounded definitions or conceptualizations in this field spanning our whole research field. Since many companies are in the early stage of introducing agility on portfolio level, we yet lack widespread experiences with the concept and demonstrated proofs of design effectiveness. Thus, we recommend to gain extend existing knowledge on portfolio management and connectivity and interrelations with other governance processes such as investment decisions, architecture and sourcing management in relation to agility. With extending agility outside software development, we also strongly encourage analyses on how to integrate support functions like HR, accounting or legal in this setup.

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