Shaping the IT Function For the Digital Age - Re-designing and Re-Conceptualizing IT Governance Decision Areas and Business IT Alignment for Organizational Agility

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Zusammenfassung

Motivation: Das digitale Zeitalter verändert Märkte und Unternehmen nachhaltig. Kunden können nunmehr mithilfe von digitalen Produkten und Services ‚mit einem Klick' ihre Wünsche erfüllen. Darüber hinaus ermöglicht eine Vielzahl an neuen ‚digital native' Unternehmen ein reichhaltiges und stetig wachsendes Angebot an Dienstleistungen, aus denen Kunden wählen können. Die Wettbewerbsintensität und die damit verbundene hohe Geschwindigkeit an Veränderungen in den Märkten stellt jedoch viele traditionelle Unternehmen vor große Herausforderungen. Um mit dem digitalen Wandel mitzuhalten zu können, benötigen sie nicht nur Wissen rund um die Entwicklung entsprechender Produkte, Services und/oder Geschäftsmodelle. Vielmehr brauchen sie auch innerhalb der Organisation Schnelligkeit und Flexibilität, um zeitnah Änderungen in den Bedürfnissen von Kunden- und Märkten zu erkennen und auf diese zeitnah mit der Weiterentwicklung bestehender und/oder der Innovation neuer Produkte und Dienstleistungen reagieren zu können – die Fähigkeit zur (organisatorischen) Agilität.

Da digitale Produkte und Services untrennbar mit Informationstechnologie (IT) verbunden sind, hängt die Agilität der Organisation stark von der Agilität der IT selbst und der traditionell zuständigen IT-Funktion ab. Dementsprechend stellt sich die Frage, wie die IT-Organisation gestaltet sein sollte, um nicht nur traditionell die effektive Bereitstellung und Stabilität der IT zu gewährleisten, sondern auch gleichzeitig auf Änderungen schnell und flexibel zu realisieren zu können. Eine zunehmende Anzahl an Ansätzen liefert Möglichkeiten für einen solchen organisatorischen Aufbau der IT-Funktion, beschränkt sich jedoch zumeist auf die Softwareentwicklung oder die Koordination zwischen Teams. Andere Ansätze skalieren die agile Softwareentwicklung bis zur Ebene der IT-Strategie, aber sie zeigen kaum auf, wie sich die Zusammenarbeit der IT-Funktion mit der Fachseite verändert. Da die Transformation hin zu Agilität jedoch das unternehmerische Handeln in seinem Kern beeinflusst, benötigt es die Betrachtung etwaiger Änderungen im gesamten Unternehmen – Geschäfts- und IT-Strategie, Geschäftsmodelle sowie die organisatorischen Strukturen, Prozesse und IT-Architekturen. Daher verfolgt diese Arbeit zwei Forschungsziele: (1) die Ausgestaltung der IT-Funktion für Agilität zu identifizieren und beschreiben zu können, vor allem in Hinblick auf IT Governance und Business-IT Alignment, sowie (2) IT-Governance und Business-IT Alignment für Agilität gestalten sowie die Hintergründe für Designentscheidungen erklären zu können.

Forschungsansatz: Diese Arbeit folgt einem phänomen-basierten Ansatz, um die Ausgestaltung von IT-Funktionen für Agilität sowohl zu verstehen als auch die bestehende Wissensbasis zum Design von agiler IT-Governance und Business-IT Alignment zu erweitern. Aufgrund dieser zwei Forschungsziele durchläuft die Arbeit zwei primäre Aktivitäten: (1) das Phänomen mithilfe von ‚Explore' und ‚Distinguish' zu beschreiben und dessen Hintergründe zu erklären und (2) mithilfe von ‚Design' und ‚Theorize' das agile Design (ausgewählter) IT-Governance Entscheidungsbereiche und Business-IT-Alignment aufzuzeigen und zu erklären. Für beide wird ein Forschungsdesign mit mehreren Methoden angewendet, um verschiedene organisatorische Kontexte in der Tiefe zu untersuchen. ;Explore' und ‚Distinguish' umfasst mehrere Literaturrecherchen sowie eine qualitative branchenübergreifende Studie, um die Ausgestaltung der IT-Funktion zur Erreichung von Agilität anhand bestehender Ansätze in Theorie und Praxis beschreiben zu können. Das Ergebnis ist die Entdeckung von zwei generellen Trends zur agilen IT: eine bimodale IT mit einem agilen Modus für die zeitnahe Entwicklung kundennaher (digitaler) Produkte, Services und/oder Geschäftsmodellen sowie einen traditionellen Modus für klassische Aufgaben der IT-Funktion oder eine 'large-scale agile' IT-Organisation mit einer kohärenten agilen Struktur der IT-Funktion für beides. Für die Aktivitäten von ‚Design' und ‚Theorize' wird erneut eine Mehrzahl an Methoden mit Literaturrecherchen, Interviews, Fokusgruppen und Feldbesuchen genutzt. Anhand von ‚Sense-Making' und ‚Design Theorizing' wird das Phänomen in Bezug auf die theoretischen Konzepte IT-Governance und Business-IT-Alignment näher beleuchtet, um aufzuzeigen, wie (Teile der) IT-Governance Entscheidungsbereiche und Business-IT-Alignment hinsichtlich organisatorischer Agilität neu konzipiert und gestaltet werden sollten.

Ergebnisse: In der Arbeit entstanden zwei Arten an Ergebnissen. Zum einen beinhalten sie deskriptives und erklärendes Wissen zur Ausgestaltung der IT- Funktion, um Agilität zu erreichen. Dieses umreißt einerseits die beiden Trends bimodale und 'large-scale agile' IT-Organisation für den Aufbau agiler IT-Funktionen. Darüber hinaus zeigen die Ergebnisse, dass der agile Modus in bimodalen IT-Funktionen nicht einheitlich ausgestaltet ist. Während einige Unternehmen einen bimodalen Modus ausschließlich in ihrer Softwareentwicklung einführen, errichten andere neben der IT-Funktion eine agile Einheit zur Analyse und Entwicklung neuer und vorrangig kundenorientierter Services. Einige Firmen führen hingegen Agilität in ihrer gesamten IT-Abteilung ein, die auch zunehmend Teile der Fachbereiche umfasst – jedoch mit

einer bimodalen IT-Architektur. Letzteres entspricht einer ‘large-scale agile’ IT-Organisation, da die gesamte IT-Funktion agil arbeitet und steuert.

Die zweite Art an Ergebnisse beinhaltet vor-theoretisches gestaltungsorientiertes (‚Design Knowledge‘) sowie erklärendes Wissen (‚Explanatory Knowledge‘) über agile (ausgewählte) IT-Governance Entscheidungsbereiche und agiles Business-IT-Alignment. Das gestaltungsorientierte Wissen beinhaltet detaillierte Designziele und -prinzipien für agiles Portfolio- und Unternehmensarchitekturmanagement sowie bereichsübergreifendes Designwissen zum agilen Buiness-IT-Alignment insgesamt. Dazu liefert das erklärende Wissen Beschreibungen und Hintergründe, wie sich IT-Governance und Buiness-IT-Alignment neu konzeptualisiert. Diese zeigen auf, dass trotz der unterschiedlichen Ausgestaltung von IT-Organisationen Gemeinsamkeiten in Hinblick auf die IT-Governance und das Business-IT-Alignment zur Erreichung von Agilität bestehen. Da Fachbereiche und IT-Funktionen in zunehmend cross-funktionen Teams zusammengeführt werden, die digitale Produkte und Dienstleistungen realisieren, können Silos und daraus resultierende Reibungen zwischen Geschäfts- und IT-Bereiche verringert werden. Dieses neue Alignment zwischen der Geschäftsseite und der IT-Funktion, die sogenannte Fusion auf funktionaler Ebene, führt dann dazu, dass die IT-Governance als integraler Bestandteil der Unternehmensführung gedacht wird, um ein gemeinsames Verständnis für die gegenseitigen Abhängigkeiten von Geschäfts- und IT-Belangen zu entwickeln. Um die Geschwindigkeit innerhalb des Unternehmens zusätzlich zu beschleunigen, wird die operative Ebene darüber hinaus ermächtigt, autonom Entscheidungen zu treffen – sowohl technologische als auch zunehmend Business-Entscheidungen. Falls ein traditioneller Modus neben dem agilen existiert, werden die Modi entweder innerhalb kürzerer Planungs- und Managementzyklen synchronisiert oder sie werden so unabhängig wie möglich voneinander konzipiert.

Agilität beinhaltet auch einen neuen gemeinsamen Blickwinkel auf IT-Governance, um der Volatilität der Märkte gerecht zu werden: den Wert (‚Value‘), den die Organisation für das Geschäftsökosystem (‚Business Ecosystem‘) schafft. Da die Digitalisierung durch die Vormachtstellung der Kunden in vielen Märkten die Orientierung an den Kundenbedürfnissen beinhaltet, benötigen Unternehmen eine Outside-In-Perspektive innerhalb ihrer IT-Governance. Der Kundennutzen (‚Customer Value‘) rückt somit in den Mittelpunkt der strategischen und operativen Planung und Weiterentwicklung, sowohl von Business als auch von IT. Da jedoch viele Dienstleistungen Geschäftspartner für ihre Realisierung benötigen, müssen auch deren Nutzen (‚Partner Value') sowie ihre Verbindung zum Erreichen des Kundennutzens in der Betrachtung enthalten sein. Darüber hinaus ist es nach wie vor wichtig, die Maßnahmen der Konkurrenz zu verstehen und Änderungen im verbleibenden Geschäftsumfeld wie zum Beispiel rechtliche Entwicklungen kontinuierlich zu beobachten, da sie die Bereitstellung von Produkten, Dienstleistungen und/oder Geschäftsmodellen auf indirekte Weise schwächen können. Zunehmend haben Unternehmen nicht nur ein Bewusstsein über die Vormachtstellung dieser kundennutzenbasierten Ökosystemarchitektur in heutigen Märkten, sondern nutzen sie auch aktiv als Ordnungsmoment innerhalb der Organisation. So werden zunehmend Strategien und Plänen nach dem Kundenwert ausgerichtet. Darüber hinaus richten immer mehr Organisationen ihre Unternehmensstrukturen entlang der Wertströme ihrer Kunden aus, in denen die internen Services, deren Prozesse sowie die zugrundeliegende IT-Landschaft jeweils zusammengefasst sind.

Da kontinuierliche Änderungen immer mehr die Regel anstatt die Ausnahme darstellt, zeigen die Erkenntnisse schließlich, dass Agilität ein kontinuierliches 'Governing', 'Aligning' und 'Organizing' der internen Geschäfts- und IT-Fähigkeiten mitsamt adaptiver Strategie, Strukturen, Prozessen und IT-Architektur anstatt der traditionellen stabilitätsorientierten Organisationslogik benötigt. Dies beinhaltet zudem die kontinuierliche Evaluierung und Anpassung der Organisation im Falle von Veränderungen, sowohl innerhalb des einzelnen Service als auch über die gesamte Service-Landschaft hinweg. Infolgedessen wird architektonisches Denken zu einer wesentlichen Governance-Aktivität in allen Geschäfts- und IT-Funktionen, um kontinuierlich zu bewerten, ob die internen Geschäfts- und IT-Fähigkeiten, die Services und den angestrebten Kundenwert optimal koordiniert sind.

Forschungsbeitrag: Die Thesis liefert mehrere Beiträge zur Forschung und Praxis. Zum einen erweitert sie das Verständnis zum Zusammenhang zwischen der Gestaltung der IT-Funktion und Agilität durch den dedizierten Fokus auf die Governance der IT und ihr Alignment mit der Fachseite. Dies erweitert die vorrangig konzeptionelle Forschung zur organisatorischen Agilität sowie bestehende Analysen zur Skalierung agiler Methoden und Werte, die bisher auf den Aufbau agiler Teams und die Koordination zwischen Teams beschränkt sind, und verknüpft zudem beide Forschungsstränge miteinander. Dazu bietet die Arbeit, auf Basis von Erfahrungen aus der Praxis mithilfe von grauer Literatur und empirischer Analysen, einen ersten Überblick über die notwendigen Maßnahmen zur Gestaltung einer agilen IT-Funktion und aktuelle

Ansätze zu deren Realisierung. Dies liefert einen der ersten Forschungsbeiträge zur Analyse derzeitiger Trends zu agilen IT-Funktionen, bimodale IT und 'large-scale agile' IT-Organisationen, und stellt die Vielfältigkeit dieser Ansätze heraus. Darüber hinaus leistet der dedizierte Fokus auf die IT-Governance und das Business-IT-Alignment in agilen IT-Funktionen einen Beitrag zur Forschung zur organisatorischen Agilität sowie zur Skalierung agiler Methoden und Werte. So gibt die Darstellung der verschiedenen Ansätze erste Erklärungen zur Einbettung der IT-Funktion in die Organisation, damit die IT ihre neue Rolle als ‚Business Enabler' erfüllen kann. Dies kann zusätzlich auch anderen Organisationen dabei helfen, Agilität in ihre individuellen organisatorischen Kontexte einzuführen und die IT-Funktion dementsprechend anzupassen.

Zweitens liefern die Ergebnisse einen Beitrag zur Forschung zur IT-Governance und zum Business-IT-Alignment. So erweitert die Verbindung beider theoretischer Konzepte mit Agilität bestehende Ansätze zur IT-Governance und zum Business-IT-Alignment, die sich bisher primär auf traditionelle (IT) Organisationen fokussieren. Einen Beitrag dazu leistet eine Reihe an design-orientierten Guidelines zur Ausgestaltung agiler IT-Governance, vor allem zum Portfolio- und Unternehmensarchitekturmanagement, und Business-IT Alignment. Diese erweitern die bestehende Wissensbasis der agilen Ausgestaltung beider Konzepte, indem sie einerseits die zur Erreichung von Agilität notwendigen Anforderungen und Prinzipien an Governance bzw. Alignment identifizieren. Andererseits setzen sie bestehende einzelne Mechanismen und Praktiken zu einem zugrundeliegenden Governance- bzw. Alignment-System zusammen. Darüber hinaus liefert ‚pre-theoretical explanatory knowledge' einen weiteren Beitrag zur IT-Governance als auch zur Business Alignment-Forschung durch die Veranschaulichung der Neukonzeption beider Konzepte durch das Streben nach Agilität. Da Änderungen in den heutigen volatilen Märkten eher die Regelmäßigkeit als eine Ausnahme darstellen, offenbart die Neukonzeptionierung insbesondere die neuartige IT-Governance- und Alignmentlogik des kontinuierlichen ‚Organizings' der Geschäfts- und IT-Fähigkeiten mitsamt ihren Strategien, Strukturen, Prozesse und Systeme. Das trägt zur Erkenntnisse bei, dass Agilität die konsequente Abkehr der traditionellen Organisation, um Stabilität zu erreichen, erfordert, um dauerhaft agil zu sein. Zusammengefasst bieten die Erkenntnisse somit eine Grundlage für die Erweiterung bestehender als auch für neue Ansätze und Analysen zur Ausgestaltung von Agilität in der IT-Funktion, der IT-Governance und zum Business-IT Alignment.

Limitationen: Diese Thesis unterliegt einer Reihe an Limitationen. Während die empirischen Analysen Einblicke in eine Vielzahl an Unternehmen verschiedener Branchen und Länder ermöglichen, erfordert die Komplexität von Agilität sowohl Wissen über ihre Einbettung auf operativer und strategischer Organisationsebene als auch fundiertes Wissen über die ebenen-übergreifenden horizontalen und vertikalen Abhängigkeiten– vorzugsweise in allen analysierten Unternehmen. Umfassende Einblicke in alle Organisationen ermöglichen die Ergebnisse jedoch nur in begrenztem Umfang, obwohl Interviewpartner aus verschiedenen Organisationsebenen und mehreren Unternehmen beteiligt waren. Zudem ergeben sich weitere Einschränkungen, da die Interviewpartner vorrangig IT-orientierte Rollen in den Organisationen ausüben und somit nur begrenzte Einblicke aus der Fachseite gewonnen werden konnten. Darüber hinaus decken die Ergebnisse nicht den gesamten theoretischen Rahmen von Agilität ab, denn das Ziel der kontinuierlichen Innovationskraft ist nur in begrenztem Maße Bestandteil der Thesis. Somit fehlen konkrete Leitlinien für Wege zu einer proaktiven Denkweise, um Innovationen für die schnelle Reaktion auf sich ständig ändernde Märkte entwickeln zu können. Schließlich sind die Erkenntnisse nur in einem bestimmten Kontext anwendbar. Obwohl in der Arbeit die unterschiedlichen organisatorischen Ansätze zur Ausgestaltung von Agilität mithilfe von bimodaler IT und 'large-scale agile' IT-Organisationen beschrieben werden, fehlen in den Analysen Aussagen zu den Umständen, wann einer der Ansätze (nicht) anzuwenden ist. Ebenfalls zeigen sie nicht, inwiefern bzw. wie sich der gewählte Ansatz im zeitlichen Verlauf ändert bzw. ändern sollte, da nur ein kurzer Zeitraum der Organisationsentwicklung der beteiligten Unternehmen analysiert wurde.

Ausblick: Die Limitationen dieser Arbeit dienen als Ausgangspunkt für zukünftige Forschung. Erstens bietet die Dualität der schnellen und flexiblen (Weiter-) Entwicklung von Produkten, Dienstleistungen und/oder Geschäftsmodellen sowie der kontinuierlichen Neuerfindung und Innovation Möglichkeiten für weitere Analysen, z.B. zur effektiven Einbettung eines Mindsets für (kontinuierliche) Innovation innerhalb des Unternehmens. In dieser Hinsicht bietet das Konzept der Ambidextrie ein mögliches theoretisches Fundament für zukünftige Untersuchungen, welches auf die Exploration neuer Geschäftsmöglichkeiten (durch radikale oder disruptive Innovationen) bei gleichzeitiger Nutzung und Weiterentwicklung der vorhandenen Ressourcen und Fähigkeiten (inkrementelle Innovation) abzielt. Weitere Möglichkeiten für zukünftige Forschung bietet der Fokus auf (ausgewählte) IT-Governance-Bereiche in dieser Arbeit. Da die Dissertation vorwiegend das agile Design der

Unternehmensarchitektur- und des Portfoliomanagements adressiert, sind die anderen Bereiche der IT-Governance wie die IT-Prinzipien, die IT-Infrastruktur sowie die IT-Budgetierung und Priorisierung nur teilweise berücksichtigt. Dies lässt Raum für weitere Analysen zur bestmöglichen konkreten Gestaltung dieser Bereiche, sowohl das Design der einzelnen Domäne als auch die effektive Kombination der Bereiche, um Agilität zu erreichen. Schließlich sind die Zusammenhänge der Ansätze zur Ausgestaltung von agilen IT-Funktionen, vor allem ihre Entwicklung im Zeitverlauf sowie mögliche Kausalitäten zwischen den Ansätzen, mithilfe von longitudinalen Studien zur Entwicklung agiler Organisationen vielversprechende Forschungsgebiete. Quantitative Analysen können zudem Einblicke in eine Vielzahl von Organisationen liefern.

Keywords: Organizational Agility, IT Agility, IT Governance, Business IT Alignment

Abstract

Motivation: The digital age both spurs and challenges many organizations today, as it enables new ways of doing business with digital products, services and/or business models, whilst also broadening and accelerating markets with a variety of new and sometimes unexpected competitors. As those competitors are increasingly able to provide faster service or even create new services in a flexible way, firms are (perceived as) being pressured to have the same abilities. Thus, organizations search for corresponding organizational responses in order to foster and improve their ability to be proactive in sensing customers' expectations and other movements in the market, and to respond with speed and dexterity with existing or radically new innovative products and services. Such qualities constitute the ability known as (organizational) agility.

Since digital products and services are inextricably linked to their underlying information technology (IT) infrastructure, organizational agility relies on the agility of IT and the IT function as its traditional internal custodian. This raises the question of how to shape the IT function for facilitating speed and flexibility in order to IT being able to fulfil its role as business enabler. A variety of approaches and frameworks strive to address this ability, but are limited to software development and inter-team coordination. Other approaches scale agile software development to the IT strategic level, but do not answer the question of how to align with the business. However, as the transformational journey towards agility affects the corporate way of how to do business at its core, agility involves (re)evaluating the organization as a whole – business and IT strategies, business models as well as organizational and IT structures, IT architectures, and methods. Thus, this thesis follows two research goals: (1) an analytical goal for describing and explaining how agility shapes the IT function, particularly concerning its governance and its alignment to the business side, and (2) a design-oriented goal for designing and explaining how IT governance and business IT alignment change for enabling agility on organizational level.

Research Approach: This thesis follows a phenomenon-based approach in order both to describe and explain the shaping of the IT function for agility, and to derive advancements of the current knowledge on agile IT governance and business IT alignment. Following the two research goals, the thesis consists of two interlinked main activities: (1) exploring shaping the

IT function for agility and distinguishing it from adjacent occurrences for highlighting the identity of the phenomenon, and (2) design and theorize the changes caused by agility on selected IT governance decision areas and business IT alignment. For both, a multi-method research design is applied to cover the breadth of multiple organizational contexts and the depth of the individual outline of the IT function. Exploring and distinguishing include multiple literature reviews and a qualitative cross-industry study for exploring how agility shapes the IT function, examining its governance and alignment to the business, in particular. This resulted in identifying and describing two main trends for shaping the IT function for agility: a bimodal IT organization with split structures for balancing speed and stability, or a large-scale agile IT organization with a coherent structure of the IT function (and beyond). Designing and theorizing also includes multiple methods with literature reviews, interviews, focus group discussions and field visits. By applying sense-making and design theorizing, this resulted in showing how (selected) IT governance decision areas, in particular portfolio and enterprise architecture management as well as business IT alignment, are to be designed when striving for organizational agility and the reasoning behind the design.

Findings: Following the two research goals, the research findings are twofold. First, the thesis includes descriptive and explanatory knowledge for an understanding of how to shape IT functions for achieving agility by outlining the two identified main trends of bimodal IT and large-scale IT agile organizations. To be concrete, the findings show that the agile mode within bimodal IT organizations is designed in various ways. Whilst some organizations solely introduce bimodality within their software development, others establish an agile unit next to the corporate IT function for analysing and developing new and often customer-oriented and/or innovative (digital) services. Finally, some firms introduce agility within their whole IT department whilst having a bimodal IT architecture – sometimes even beyond moving towards the business side. The latter can also be depicted as large-scale agile IT organizations, as this involves one way of working and governing throughout the (IT) organization.

Second, the thesis includes pre-theoretical design and explanatory knowledge that shows how to design IT governance and business IT alignment for agility and the reasoning behind the design decisions. To be specific, this includes detailed knowledge of the design of the IT governance decision areas of portfolio and enterprise architecture management and design knowledge on business IT alignment. In addition, explanatory provides how and why IT governance and business IT alignment are to be re-conceptualized for enabling agility. The knowledge reveals that governance follows common design decisions for enabling agility, despite the variety of bimodal IT types and large-scale agile IT organizations. As business and IT capabilities are increasingly converged within cross-functional teams for developing digital services, agility often implies reducing silos and the resulting friction between business and IT personnel. This newfound business IT alignment or rather fusion on the operational level within the team then leads to a rethinking of IT governance as becoming an integral part of the enterprise governance instead of separating IT and business concerns – at least within those areas, but increasingly beyond for rapid planning, management and re-evaluation of decisions. This is also facilitated by empowering the operational level to make both IT and business-related decisions autonomously in a decentralized fashion. In a bimodal IT organization with both a traditional and an agile mode, preventing inertia in speed is enabled by introducing short-cycled planning and management cycles to both modes or by decoupling them as much as possible.

The findings further reveal that agility includes a new common angle for IT governance in order to cope with external volatility: the value that the organization creates for the business ecosystem with the customer value and the resulting needs as focal points for planning and governing both business and IT. Since customer value creation increasingly relies on business partners, their partner value creation is also to be taken into account for enabling agility. Finally, understanding and continuously monitoring rivals' actions and changes within the market, such as regulatory adjustments, is essential, as both can weaken the delivery of products, services and/or business models in an indirect way. In order to support coping with the volatility, companies must not only create an awareness of customer value creation within their organization. Some move one step ahead and centre their strategies and plans on customer value or use the value streams of their customers for organizing their organizational structure with the internal services, processes and the underlying IT landscape.

As continuous change becomes the rule instead of the exception, the findings finally show that agility implies the continuous 'governing', 'aligning' and 'organizing' of internal business and IT capabilities – leading to adaptive strategy, structures, processes and IT architecture instead of traditional organization for stability. This also includes the continuous evaluation and adaptation of the organization in the event of changes, both with the individual service and across the entire service landscape. As a result, architectural thinking becomes an essential governance activity in all business and IT functions for continuously assessing the fit of internal business and IT capabilities, and services to the desired customer value.

Contribution: The thesis makes multiple theoretical and practical contributions. First, this research contributes to describing and understanding the link of shaping the IT function and agility by reflecting IT's governance and its alignment to the business IT alignment in particular. This theoretical angle both extends and links the existing conceptual organizational agility research and analyses on scaling agile methods and values, as the latter is yet limited to the setup of agile teams and inter-team coordination. Enriched with a variety of experiences from practice via grey literature and empirical insights, the thesis provides an initial overview on the means for shaping the IT function for agility, and the current approaches for realizing the means. A main contribution of this thesis is one of the first academic analyses on recent trends on agile IT functions, bimodal IT and large-scale agile IT organizations, and on unfolding its multiplicity of approaches. Furthermore, the implications for the IT organization and the business, reflecting IT governance and business IT alignment in particular, advances the existing body of knowledge on both theoretical concepts by explaining how to embed the IT function within the enterprise context in order to fulfil IT's new crucial role as 'business enabler'. This detailed description on how the IT function is outlined for agility can also serve to support other organizations on how to introduce and customize agility to their individual organizational contexts.

Second, the findings contribute in-depth knowledge on how to govern IT and align business and IT for enabling agility, advancing research on both theoretical concepts by stepping out of the predominant focus on traditional (IT) organizational settings. Based on a variety of literature and empirical sources, multiple instances of pre-theoretical design knowledge provide guidelines for the enabling and fostering of agile IT governance business IT alignment. Concerning IT governance, the research takes particular consideration on agility and the IT governance decision areas of portfolio and enterprise architecture management. This extends the existing knowledge by both providing the underlying requirements and principles of agility for each area and across and by linking single mechanisms to such an underlying governance system. Furthermore, the thesis also contributes pre-theoretical explanatory knowledge to both IT governance and business alignment research by revealing how both concepts are re-conceptualized in the light of agility. In particular, as continuity in changes is the regularity instead of an exception based on today's volatile environments, the insights broaden existing analyses and approaches by revealing a novel IT governance and alignment logic that emphasizes continuous organizing of both internal business and IT capabilities with strategies, structures, processes and systems for responsiveness to changes, instead of an organization based on stability. In sum, the knowledge provides a reference point for re-shaping existing or deriving new approaches and analyses on shaping the IT function for agility with IT governance and business IT alignment.

Limitations: This research is subject to limitations. For instance, whilst the empirical cross-industry analyses enable insights from a broad variety of companies, agility's complex nature requires in-depth knowledge on how to embed agility on the operational and strategic level and how to handle the horizontal and vertical interdependencies across the levels – preferably within all of the analysed enterprises. Yet, rich insights on the individual case companies can only be given to a limited extent, although the analyses involved a multitude of interview partners from different parts of the organization. Furthermore, direct insights on the business side remained limited throughout the analyses, as many interview partners have IT-oriented roles within their respective organization. Another limitation is the limited contribution of the findings towards innovation as one pillar of agility's sense and response. Whilst the thesis includes analyses on ease and speed by looking for answers on how to minimize internal friction as well as friction to the external environment – either within the specific agile IT units, across the IT organization or even the whole enterprise – with propositions on how to design those responses, the insights only address the call for innovation to a limited extent. Thus, how to enable a proactive mind-set in order to derive innovation for responding to changed external circumstances is still lacking concrete guidance. Finally, the insights are bound to a specific context. Although the thesis outlines the different shapes of the IT function in the light of organizational agility with bimodal IT and large-scale agile IT organizational settings, insights are missing on when to apply (n)one of the approaches. As the findings only analysed a short timeframe, they also do not show their evolution, potential interdependencies and/or causalities between the approaches and predictions on the aspired final shape in the long term.

Future Research: The limitation of this thesis can serve as a starting point for future research. First, the timely optimization of existing products, services and/or business models and the ability of continuous reinvention and innovation provides possibilities for inquiry. To be specific, how to embed the mind-set for (continuous) innovation within the company represents a main area for research. In this regard, the theoretical concept of ambidexterity – the balance of exploring new venues (radical or disruptive innovation) and exploiting the existing capabilities (incremental innovation) can serve as a potential theoretical basement. Second, the focus on (selected) IT governance domains implies new venues for research. As the thesis solely provides in-depth insights on how to design portfolio management and enterprise architecture management for agility, other domains such as IT principles, IT infrastructure and IT budgeting and prioritization are only addressed to a limited extent. This leaves room for analyses on the best possible concrete design of those decision areas – in-depth insights on how design the individual area and insights on how to combine them in the optimal way in order to achieve agility. Finally, longitudinal studies on the evolution of approaches on shaping the IT function for agility would be a promising area of research. In addition, quantitative analyses could provide broad insights on a variety of organizations.

Keywords: Organizational Agility, IT Agility, IT Governance, Business IT Alignment

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List of Abbreviations

BITA	Business IT Alignment
CDO	Chief Digital Officer
CIO	Chief Information Officer
DG	Design Goal
DP	Design Principle
DSR	Design Science Research
EA	Enterprise Architecture
EAM	Enterprise Architecture Management
IoT	Internet of Things
IS	Information Systems
IT	Information Technology
ITG	IT Governance
RG	Research Goal
RQ	Research Question
SMACIT	Social, Mobile, Analytics, Cloud, Internet of Things
VUCA	Volatility, Uncertainty, Complexity, Ambiguity

1 Introduction

1.1 Motivation

The digital age both spurs and challenges many organizations today. First of all, using the 'SMACIT' IT megatrends such as, e.g., cloud computing or internet of things (IoT), enables process digitization and automation for more efficiency in delivery and operations (Legner et al. 2017; Riasanow et al. 2019; Vial 2019) and fosters innovations by enhancing existing products and/or services with digital capabilities, opening new channels or even creating novel services and business models (Bharadwaj et al. 2013; Fitzgerald et al. 2013; Matt et al. 2015; Yoo et al. 2012). However, using the IT megatrends also leads to a variety of new and in some cases unexpected rivals to surface, who sometimes develop, modify and (re)innovate in a faster way (Berman 2012). In addition, customers can often easily select a suitable and sophisticated service (provider) from the vast array of opportunities in the market by which to satisfy their needs, which in turn leads to a shift of power towards the customers (Brenner et al. 2014; Denning 2010, 2016a). Consequently, the markets and their developments have become volatile, uncertain, complex and ambiguous (VUCA) (Bennett and Lemoine 2014).

The (perceived) pressure for continuously being able to cope with the VUCA environments deeply challenges corporate reality (Berghaus and Back 2017; Kotter 2012; Riasanow et al. 2019; Vial 2019). In order not to suffer the same fate as prominent examples of 'sunk' organizations such as, e.g., Kodak or Blockbuster, who misread the signs for required changes and could not move until it was being too late to prevent their vanishing from the markets (Hess et al. 2016; Riasanow et al. 2019), companies perceive that they need to always "*capitalize on opportunities and dodge threats with speed and assurance*" (Kotter 2012, p. 4) – this is the ability of (organizational) agility. This may include always fulfilling existing customers' needs and facilitating radically changing existing markets or entering new markets for extending the customer base (Sambamurthy et al. 2003; van Oosterhout et al. 2006). Innovation of products, services and/or business models, enabling speed with fast time to market, or both (Conboy 2009; Doz and Kosonen 2010), are key facilitators in this regards. For enabling each individual goal or both of them, companies strive for finding an organizational response that enables the firm's ability to be proactive in sensing needs for changes and responding to them with ease, speed and dexterity (Overby et al. 2006; Sambamurthy et al. 2003). In other words, companies look for ways of coping with change, speed and flexibility with their strategies and business models, organizational structures and business processes, as well as with the IT infrastructure and IT architecture (Lui and Piccoli 2007; Sharifi and Zhang 1999; Yusuf et al. 1999).

The move of companies towards agility, especially when aiming for digital business, also results in internal challenges – most notably concerning information technology (IT). With digital technologies moving to the core of business in order to make digital products, services and/or business models possible (Melarkode et al. 2004; Nissen and Rennenkampff 2017), IT's role is moving towards being a business enabler instead of merely supporting internal processes (Besson and Rowe 2012). In addition, the dynamic business, and particularly the rapidly evolving IT environment with an ever-growing number of new IT-enabled innovations, puts pressure on the organizations to develop their own IT-enabled products, services and business models, and to evaluate digital options and flexibly adapt to ever-changing business demands (Berghaus and Back 2017; Vial 2019). As a result, finding the optimal organizational response for enabling agility across the company fundamentally involves comprehending how to manage the IT effectively, in order to always secure the (changing) digital business (Chakravarty et al. 2013; Jia et al. 2016; Lu and Ramamurthy 2011). With the IT function traditionally being the custodian of managing the corporate IT, this results in the call for enabling agility with and within the IT department for being able to fulfil its role as business enabler (Tallon et al. 2019).

Yet, becoming agile is a tremendous challenge for many of today's corporate IT functions. First of all, they typically need to achieve operational excellence and support the business value (Weill and Ross 2004). Thus, IT functions predominantly still follow the business by having the main task of providing IT services at high levels of stability, efficiency, and compliance as well as handling increasingly complex IT infrastructures in an effective way (Guillemette and Paré 2012; Peppard 2018). The task is further complicated, as many IT functions are separated from the business with their own strategic directions and management as well as processes, structures and skills (Henderson and Venkatraman 1993). As a result, balancing delivering and sustaining (new) digital services (Urbach et al. 2019), optimizing existing IT-enabled products, services and business models for customer needs, whilst securing the underlying IT architecture for optimal service delivery, requires a new shape of the IT function. This means that organizations need to (1) decide on an aspired shape of the IT function and its integration into the overall organizational response, and (2) continuously evaluate the status quo and the aspired goal. To be specific, the underlying task is to outline how to design the IT function with its strategies, operational and management processes, structures and skills for being able to handle variations in changes from the market in order to always secure the existing and enable new ways of business (Lee et al. 2007; Lowry and Wilson 2016; Overby et al. 2006).

Achieving agility with and within the IT function with a corresponding shape includes thinking about flexibilizing and accelerating the service delivery for the business, such as in agile software development (Denning 2016c; Lee and Xia 2010; van Oosterhout et al. 2006). Yet, this also involves finding solutions on how to govern IT and the resulting optimal accountabilities, planning and management of IT skills, processes and architectures for fulfilling business objectives (Haes and van Grembergen 2004; Weill and Ross 2004) whilst coping with the business objectives' constant change. Yet, the complex dynamics of IT-enabled innovation, rapidly changing technologies and high levels of uncertainty, pose challenges to traditional IT governance (Tiwana and Kim 2015). On the one hand, the traditional notion of stability in IT functions' strategies and plans, portfolios and architectures through meticulous and extensive planning is challenged by the continuous change in business demands because of moving customer preferences (Dybå and Dingsøyr 2008). On the other hand, IT governance's traditional top down nature is challenging for enabling agile teams' high autonomy whilst they are still aligned to the overall corporate principles and plans (Dybå and Dingsøyr 2008; Moe et al. 2008; Moe et al. 2009). Thus, IT governance is critical for the success of the IT organization by ensuring the desirable behaviour of IT towards business (Haes and van Grembergen 2004; Weill and Ross 2004). Consequently, it is essential to know how to shape the planning and directing of IT for agility next to the IT delivery and operations in order to understand how to achieve the aspired goal of agility in the end.

As IT affects the corporate way on how to do business (Berman 2012) with penetrating the core business processes and services (Nissen and Rennenkampff 2017; Melarkode et al. 2004), the journey towards an agile organizational response and the resulting shape of the IT function for embracing the digital age is presumably not limited to changes to the IT function alone. IT's new strategic role as business enabler (Besson and Rowe 2012; Bharadwaj et al. 2013), the increasing popularity of structural arrangements across business and IT such as cross-functional teams (Legner et al. 2017; Urbach et al. 2019) and digital strategic and operational planning and adjustments (Denning 2017c; Lui and Piccoli 2007), indicate that companies may need solutions on how to integrate business and IT. As innovation is often driven by IT, exploiting business opportunities arising from digital options make this alignment even more pressing (Berghaus and Back 2017; Tallon et al. 2019; Vial 2019). However, this is in conflict with the traditional managerial thinking within many organizations, where IT managers have the necessary know-how regarding technology whilst business owners are acting as separated experts in their business field (Peppard 2018). With digital interlinking business and IT logic (Melarkode et al. 2004), the traditional unidirectional thinking of IT following business (Henderson and Venkatraman 1993) is thus to be re-evaluated in order to enable shared understanding and bidirectional learning for collectively delivering the right business opportunities (Peppard 2018). Furthermore, organizations ought to enable a close yet flexible alignment of business and IT on a larger scale for realizing and/or changing the products, services and/or business models in a rapid way, or for creating new ones (Liang et al. 2017). As result, the notion of business IT alignment becomes an area of concern when designing the IT function for embracing the volatility stemming from today's markets (Tallon et al. 2019), but its concrete shape is yet unclear. However, this is particularly of interest for IT governance as one key mechanism for ensuring the fit of business and IT as well as across the IT function with its accountability framework (Haes and van Grembergen 2004; Weill and Ross 2005).

1.2 Research Goals and Research Questions

As previously mentioned, the search for an organizational response for enabling agility includes an understanding of how to shape the IT function in order to fulfil IT's role as business enabler. Whilst a profound knowledge base on how agility affects the IT delivery and operations does exist, which helps with outlining the operational level of the IT function, the interrelation of agility and IT governance and the fit to the business and the resulting options for shaping the IT strategic level are largely unknown. Thus, the underlying research goal of this thesis is:

> ***…to improve the understanding of the relationship of organizational agility and the shape of the IT function with IT governance and the alignment to the business***

The goal is framed by two sub-goals with two types of aspired knowledge. On the one hand, the thesis follows an **analytical goal** in order to grasp the presumably changing conditions due to the digital age for the IT function. Whilst digitization is not new, per se, its effects on the core of the business – with calling for a timely and flexible assembling of services as well as continuous recalibration of the organization and the resulting of IT as business enabler – result in challenges that have never been seen (to such an extent) before. Thus, the thesis first includes *describing and explaining how striving for agility shapes the IT function, particularly concerning its governance and its alignment to the business side*. Thus, the thesis aspires to provide *descriptive Ω knowledge* (Gregor and Hevner 2013) with describing how agility shapes the IT function (Type I theory, Gregor 2006) and explain (Type II theory, Gregor 2006) the reasoning for the shaping, particularly concerning IT governance and business IT alignment.

On the other hand, the thesis follows a **design-oriented goal** by converting the derived understanding of how to shape today's IT function for agility into design and explanatory knowledge for *designing and explaining how IT governance and business IT alignment changes for enabling agility***.** This shall lead to providing *prescriptive Λ knowledge* by designing how to change IT governance (RQ2) and business IT alignment (RQ3) for achieving agility (Type V theory, Gregor 2006). Furthermore, it is envisioned to *explain* (Type II theory, Gregor 2006) the underlying principles and regularities (Gregor and Hevner 2013) of IT governance and business IT alignment for agility. Yet, as the thesis emergently uncovers knowledge on the phenomenon of shaping the IT function for agility in order to be able to fulfil IT's role as business enabler, the knowledge goals are not isolated and linear in nature. Instead, they go hand in hand, as the design-oriented goal organically uses, refines and extends the insights from describing and explaining in an iterative way for creating a more holistic knowledge on shaping the IT function for agility, also leading to new descriptions. Thus, findings may not exclusively contribute to one goal only, but inform both to some extent. To achieve both sub-goals for fulfilling the overall research goal, three research questions are to be answered (see Figure 1). Each question will provide one or multiple essential facets to one or both sub-goals.

The foundation for understanding how agility shapes the IT function is knowing about existing approaches and their characteristics in the first place. As shaping an IT function as part of an organizational response for enabling adaptivity and innovativeness is gaining momentum in recent times (VersionOne Inc. 2020), organizations are flooded with proposed practices on how to enable agility within the IT function. Yet, most practices and approaches from academia may only be partially relevant for solving the challenge due to their limited focus on agile IT delivery and operations by introducing or scaling agile and/or lean values and methods (Beck et al. 2001; Denning 2016b; Rolland et al. 2016) or by addressing coordination issues among teams (Dingsøyr et al. 2019a; Hekkala et al. 2017) instead of considering the IT function as a whole.

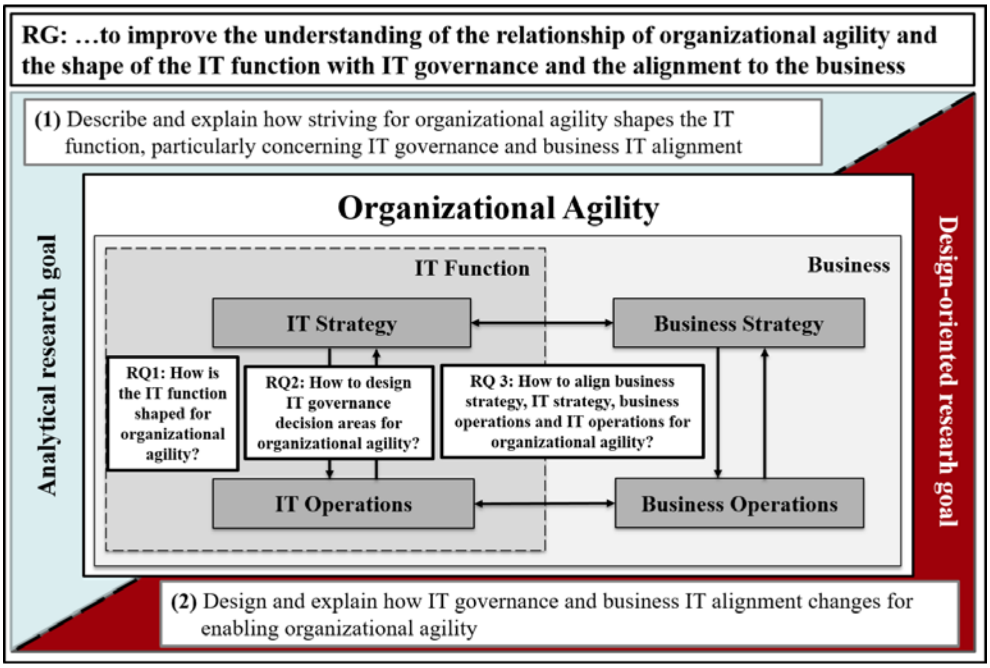

Figure 1: Research Goal and Questions.
Source: Own Representation.

Approaches for overcoming this lack of insight are rising, but are as yet limited to scaling agile frameworks as 'one size fits all' blueprints for scaling a specific agile method, particularly Scrum (Disciplined Agile Consortium 2020; Scaled Agile 2020). As the industries and organizational characteristics are, however, diverse in size, markets. etc., organizations that already aim to reap the benefits of agility across their IT function may rather customize their approach to the specific demands instead of introducing a 1:1 framework. Thus, gaining an understanding of agility and the IT function, independent from a blueprint and a preferred set of practices or agile methods for its operationalization, leads to analyses of practices across industries as well as input from consultancies that offer insights across industries. Therefore, this thesis concentrates on analyzing overall trends for enabling agility, which encompass agile structures and processes as well as practices and methods. As such, the analysis was initiated with an understanding of one very popular approach for introducing agility in recent times: a bimodal IT organization (Gartner 2020). This approach is characterized by separating the concerns of IT functions by centering efficiency and stability of the IT services within one modus operandi and facilitating agility through fast delivery of customer-oriented services within a second one (Haffke et al. 2017). In addition, the thesis also covers bimodal IT's 'counterpart' of balancing agility and efficiency within a coherent structure: the large-scale IT organization (Dingsøyr et al. 2014a; Dingsøyr and Moe 2014).

The holistic nature of both trends will be insightful for knowing paths for delivering the services in a rapid way and enabling flexible allocation of IT skills, processes and architectures with IT governance for timely responses. As such, the findings may also support shaping an initial understanding of IT governance for agility and outline patterns for structuring agile IT functions. With organizational agility being perceived as an enterprise-wide ability and, therefore, affecting both the business and IT organization, the insights on IT governance may also uncover initial approaches and journeys on how and to which extent a fit of business and IT is realized. Thus, the first research question analyses the following:

RQ 1: How is the IT function shaped for organizational agility?

The existing approaches reveal that agility is indeed an area of concern for the IT function as a whole, although the organizations take different avenues for its operationalization, from changing the way of delivering and operating the services up to further modifying the IT governance process and structures. Thus, it has crystallized that IT governance for allocating the optimal IT skills, processes and architectures to the business objectives acts as a key linking mechanism for enabling agility. Yet, companies still struggle with where to start with re-organizing within their IT function and how to sustain the change because of missing insights on how to design for agility. In particular, IT governance's very complex character with decisions on how to govern IT through an accountability framework with processes, structures, and relational mechanisms (Haes and van Grembergen 2004) and what is to be governed of IT for agility by shaping IT governance decision areas, such as IT strategies, IT portfolio or architecture management (Weill and Ross 2004), is yet in its nascency when it comes to agility and resulting required actions. Whilst the first is gaining momentum in IS research with the rise of team autonomy (Moe et al. 2019), knowledge on the latter is yet scarce and isolated to exemplary operationalization of single decision areas (Stettina and Hörz 2015; Uludağ et al. 2019a). Furthermore, solely focusing on specific practices or methods does cloud their relationship to agility as an aspired outcome. As a result, research question two addresses:

RQ 2: How to design IT governance decision areas for organizational agility?

The findings also confirm organizational agility as an enterprise-wide construct that influences both IT strategy and IT operational structures and the corresponding business side in which business strategy and business operational structures are influenced. For instance, agility within the IT governance decision area of portfolio management leads to a closer or even shared decision-making of business and IT, both on the strategic and operational level, for rapidly finding the optimal allocation of IT and business resources and a frictionless delivery for solving the business objectives in the optimal way. Furthermore, a close integration across the organization between the operational and the strategic level facilitates agility by being able to always see changes in customer preferences and thereby propose business opportunities and/or innovations for filling the gap. Similar insights also surfaced when analyzing a second IT governance decision area of enterprise architecture management in more depth. This area is also faced with enabling rapid and flexible decisions and reducing internal friction whilst managing the widespread autonomy of the operational level for preventing new friction with prioritizing local interests over global synergies. However, the concrete shape and extent of how to align business and IT strategies with their corresponding operational structures, and across all four elements is not yet known despite initial insights showing the influence of alignment on agility (Liang et al. 2017). As such, companies are yet missing a 'manual' on addressing such topics within their organizations. As a result, the third question targets:

RQ 3: How to align business strategy, IT strategy, business operations and IT operations for organizational agility?

1.3 Structure of This Thesis

This dissertation encompasses a wrapper and eight publications (see Table 1). The wrapper spans an arching overview about the whole research project, while the publications focus upon answering the individual research questions.

Table 1: Structure of the Thesis

<table>
<tr><td rowspan="2">Wrapper</td><td>1. Introduction</td><td>2. Theoretical Framing</td><td>3. Research Design</td><td>4. Publications</td></tr>
<tr><td>5. Theoretical Contribution</td><td>6. Practical Contribution</td><td>7. Limitations</td><td>8. Implications for Future Research</td></tr>
<tr><td rowspan="2">Publicat</td><td colspan="4">9. Bimodal IT: Business-IT Alignment in the Age of Digital Transformation</td></tr>
<tr><td colspan="4">10. Increasing the Agility of IT Delivery: Five Types of Bimodal IT Organization</td></tr>
</table>

	11. Bimodal Enterprise Architecture Management: The Emergence of a new EAM function for a BizDevOps-based Fast IT
	12. IT Governance in Scaling Agile Frameworks
	13. Agile Portfolio Management: Design Goals and Principles
	14. Everyone's Going to be an Architect: Design Principles for Architectural Thinking in Agile Organizations
	15. Reconceptualising Business-IT Alignment for Enabling Organisational Agility
Appendix	17. Appendix A: Steering IT For Speed and Dexterity – Towards Re-Shaping IT Governance for Organizational Agility

The first chapter presents the introductory motivation for the research in the thesis and outlines the overarching research goal and research context and the resulting research questions. The second chapter introduces the theoretical foundations of organizational agility, its relationship to the IT function and discusses business IT alignment and IT governance as analysed concepts in the light of organizational agility. Chapter 3 highlights the underlying research design and the applied research methods. The fourth chapter presents a tabular summary of the publications that constitute the research findings in this thesis in order to answer one or multiple research questions. Chapter 5 highlights the theoretical contributions, whereas chapter 6 shows the contributions of the research for practice. Chapter 7 outlines the limitations of this research. The following eighth chapter then presents a research outlook as well as implications for future research. Finally, chapter 9 to 15 and 17 comprise the full text all of the articles that have contributed to this research.

All publications included in this dissertation were reformatted to secure a uniform formatting style and consistency. The reference style were unified according to the MIS Quarterly style for all articles. Tables and Figures are renumbered sequentially. When necessary, orthographical and grammatical changes were made.

2 Theoretical Framing

This chapter provides an overview of the theoretical concepts used in the research. First, the understanding of organizational agility and the influence on the IT function is outlined. Second, the section defines the concept of IT governance by highlighting its nature and showing existing research on the influence of agility. Finally, this chapter shows this thesis' understanding of business IT alignment and its research background in relation to agility.

2.1 Organizational Agility

2.1.1 Basis Characteristics of Organizational Agility

Change and how to deal with it has always been an important issue in organizations. Yet, in today's VUCA markets, firms need to become agile by being able to handle extreme changes, e.g., those caused by consumer preference changes, economic shifts or technological advancements (Overby et al. 2006), and by being able to capitalize on emerging business opportunities (Prahalad 2009). Thus, agility is characterized as a firm's ability to cope with rapid, uncertain, unprecedented threats (Lu and Ramamurthy 2011; Sharifi and Zhang 1999; van Oosterhout et al. 2006) and thrive in an environment of continuous, unanticipated and unpredictable changing opportunities (Dove 2001; Goldman et al. 1995). The unpredictability can be three-fold (van Oosterhout et al. 2006). First, it can be unknown whether or when a specific event will happen. Second, the shape and extent of the effects may be uncertain. Third, the organization's response such as "*the speed and exact requirements to the organization and processes*" (van Oosterhout et al. 2006, p. 134) may be unpredictable.

Faced with rapid and often unanticipated change, agility is predominantly defined by two fundamental abilities:

- the ability to detect (Sambamurthy et al. 2003; Tallon and Pinsonneault 2011), anticipate (Lee et al. 2007) and/or sense (Nazir and Pinsonneault 2012; Overby et al. 2006) the change and
- the ability to seize (Chakravarty et al. 2013; Hovorka and Larsen 2006; Sambamurthy et al. 2003) and/or respond (Lowry and Wilson 2016; Overby et al. 2006; Sherehiy et al. 2007) to opportunities and threats appropriately.

Whilst sensing implies the intellectual ability to find appropriate things upon which to act (Dove 2001), response is characterized as the act itself, based on the gained insights within the sensing ability. As a consequence, sensing requires some form of knowledge creation and management (Dove 2001; Overby et al. 2006; Sambamurthy et al. 2003) first in order to identify opportunities. Thus, sensing is characterized by scanning, creating, learning, and interpreting the insights (Roberts and Grover 2012) across technologies and markets. Once an opportunity is identified, the appropriate moves need to be made with the organization. Depending on the individual scope (Dove 2001), the organization needs to find the suitable response (Overby et al. 2006), either with innovation of products, services and/or business models, enabling speed with fast time to market or both (Conboy 2009; Doz and Kosonen 2010). Yet, although the definitions may suggest a static view on sense and response, the two fundamental abilities are not a snapshot. Instead, as the circumstances may change at any time, agility is rather an ongoing ability to be optimized within an organization with continuous sensing and responding (Conboy 2009).

With continuous sense and response for embracing unpredictable changes, agility includes three level for adaptability (Yusuf et al. 1999). First, the **business ecosystem** (Doz and Kosonen 2010; Tsourveloudis and Valavanis 2002) needs continuous re-evaluation and the readiness by which to adapt through continuously monitoring customers' needs (Denning 2016c; Lu and Ramamurthy 2011) and involving customers in exploring and exploiting opportunities to leverage their voice in service delivery (Sambamurthy et al. 2003). Yet, as many services and/or business models are realizable with the help of third partners, 'partner agility' (Sambamurthy et al. 2003) is also to be pursued. This involves using the knowledge, assets and/or skills of suppliers and business partners, often within alliances and partnerships (Sambamurthy et al. 2003), for maximizing the gains of cooperation (Yusuf et al. 1999).

The second level of **enterprise agility** involves the overall response to business ecosystem changes with both the business offerings via products, services and/or business models and the underlying organization. This involves (re)evaluating the aspired market position and the resulting *adaptivity of the business offerings* (Sherehiy et al. 2007) by either proactively changing how to do business by "*revis[ing] [the] positioning and strategies and organiz[ing] new business approaches to gain early advantages in changing conditions*" (Chakravarty et al. 2013, p. 978) or "*be[ing] resilient and adaptive to environmental change in order to maintain* *competitive parity and competitive leadership*" (Lee et al. 2007, p. 4). Whilst an entrepreneurial spirit is more likely to be associated with exploration (March 1991) by "*anticipat[ing] environmental changes and conduct[ing] strategic experiments with new business approaches and models*" (Lee et al. 2007, p. 4) for organizational renewal (Lewis et al. 2014), adaptive agility is, by contrast, usually associated with exploiting things already known through refinement and extension of existing competencies, technologies, and knowledge (March 1991). For both, this may lead to adjusting the repertoire and range of business offerings, as well as to changes in the product volume, model and configuration (Sharifi and Zhang 1999), or to speeding up product transitions, sometimes again with the help of partners through forming (strategic) alliances (Sengupta and Masini 2008). As a result, continuously rethinking strategic moves (Denning 2017b; Doz and Kosonen 2010; Weber and Tarba 2014) and being willing to take actions (Long 2000) with decision-making are perceived as cornerstones of enabling agility with the business offerings. This then involves an overall collective commitment and shared dedication to the organization's goals by the leadership and employees across the organization (Long 2000; Sampath and Krishnamoorthy 2017), which requires collaborating with all stakeholders in a fast and open manner to effectively execute strategies (Doz and Kosonen 2007).

Next to speed in discovery and decisions on responses (Overby et al. 2006; Sambamurthy et al. 2003; van Oosterhout et al. 2006), agility on the enterprise level also includes the ability of *operational adjustment* (Lu and Ramamurthy 2011; Sambamurthy et al. 2003) of the organizational system (Denning 2017b; Yusuf et al. 1999) towards the changing strategic direction. This calls for a dynamic organizational and operational setup with corresponding flexible and rapidly responding internal business processes (Dove 2001; Goldman et al. 1995; Kettunen and Laanti 2008; Lui and Piccoli 2007) for assembling the requisite assets, knowledge, and relationships with speed and surprise (Goldman et al. 1995; Lee et al. 2015; Yusuf et al. 1999). Thus, agility is the ability to integrate the right mix of resources, such as technology and people (Lui and Piccoli 2007; Yusuf et al. 1999), by their rapid redeploying and reconfiguration (Sampath and Krishnamoorthy 2017; Weber and Tarba 2014). For their effective handling and (re)configuration, the underlying organizational culture (Dove 2001; van Oosterhout et al. 2006) and structure (Kettunen and Laanti 2008; Lui and Piccoli 2007; Sharifi and Zhang 1999) also require agility with re-configurability of the whole enterprise and for each individual constituting part (van Oosterhout et al. 2006).

Finally, agility on the **individual level** mainly involves the individual mind-set (van Oosterhout et al. 2006) for embracing change and being aware of delighting the customer with continuous learning and not only adopting a set of agile practices (Denning 2016a, 2016b). Furthermore, the development of the personnel towards a multi-skilled and flexible workforce (Kettunen and Laanti 2008) via, e.g., trainings or job rotation (Lui and Piccoli 2007) and the continuous access to information, knowledge and expertise (Tsourveloudis and Valavanis 2002; Yusuf et al. 1999) is crucial for individual adaptiveness to change. However, cooperation with third parties is another crucial part of the ability the accelerate the stock and velocity of the circulation of talents, particularly in the case of missing competencies (Yusuf et al. 1999).

2.1.2 Agility and the IT Function

IT increasingly becomes an integral part of organizational agility, as it facilitates both internal speed in decision-making and communication (Lu and Ramamurthy 2011) by streamlining work processes and building inter-organizational relationships (Tiwana and Konsynski 2010), whilst enabling the building of digital options (Sambamurthy et al. 2003). Thus, the dimensions of agility also apply to the IT function (Lee et al. 2015; Lu and Ramamurthy 2011; Sambamurthy et al. 2003; Tiwana and Konsynski 2010). Internally, this implies the mobilization of core IT capabilities, knowledge, and processes along an underlying culture of change (Denning 2016b; Liang et al. 2017), for always embracing changing strategic moves. In addition, the IT function needs the ability to adjust the technology architecture (van Oosterhout et al. 2006) so that the technological base, individual information systems and their landscapes are able to adapt to changed conditions, whilst being modular for reconfigurations (Tallon and Pinsonneault 2011; Tiwana and Konsynski 2010) and connective among systems for minimal friction (Lui and Piccoli 2007; Sharifi and Zhang 1999). IT personnel, thus, need technical, analytical and managerial IT skills to handle the flexibility of the IT architecture effectively (Chakravarty et al. 2013; Fink and Neumann 2007; Roberts and Grover 2012). In addition, they need a close relationship with the business (Fink and Neumann 2007; Lu and Ramamurthy 2011) and a strong strategic alignment (Lee et al. 2015; Tallon and Pinsonneault 2011) for always knowing what and how to adjust within the IT function. Yet, this is increasingly reciprocal (Lee et al. 2007; Lee et al. 2015) with the IT function's new role as business enabler, by "*proactively search[ing] for ways to embrace new IT innovations or exploit existing IT resources to address and create business opportunities*" (Lu and Ramamurthy 2011, p. 936).

Despite not being linked to the organizational agility concept, introducing agile values and principles within the software development with small and self-organizing teams (Moe et al. 2019; Vidgen and Wang 2006, 2009), targeting continuous design improvements and testing with rapid feedback and change based on customer feedback (Beck et al. 2001), is perceived as foundation for enabling speed in response towards changing needs. In particular, introducing autonomous or self-managed project and/or product teams is perceived as one main antecedent for realizing the agile manifesto (Beck et al. 2001), the fundament of enabling agile software development. A well-known phenomenon within organizational research (Trist and Bamforth 1951) is the fact that those teams are perceived as key by being faster for solving problems because of the decision-making authority being local. The accuracy of problem-solving is also higher with the shared ownership for a specific service or feature, as the team constellation enforce a stronger commitment to both the group and the product (Moe et al. 2019). As such, the responsibility for optimizing their service increases and the team has more freedom and stronger capabilities in order to be innovative and entrepreneurial (Patanakul et al. 2012; Tata and Prasad 2004). Yet, there is still a need for alignment and coordinated decision-making across teams (Moe et al. 2019). Thus, organizations see that agility on the team level also requires a corresponding agile mind-set, structures, and processes across the IT function to enable a fast and continuous delivery flow with as little friction as possible (Fuchs and Hess 2018; Lee and Xia 2010; Nerur et al. 2005).

As a result, many organizations have started to scale agile values across their software development or to other contexts such as new product development (Bharadwaj et al. 2013) in recent years. The meaning of scaling agile has a different meaning in different settings (Dikert et al. 2016; Rolland et al. 2016), most often following one or multiple of three underlying dimensions: size, team distribution, and specialization (Bosch and Bosch-Sijtsema 2010). Size primarily refers to the number of individuals and teams involved, which can range from many members in a single team, from less than 10 up to more than 100 people and/or teams (Dikert et al. 2016; Dingsøyr et al. 2014a; Dingsøyr and Moe 2014). In contrast, the distribution of teams refers to the proximity of members or whole teams that may be local, distributed and global (Bosch and Bosch-Sijtsema 2010). Whilst local teams are all sitting at the same site, distributed teams are spread throughout a single area or multiple areas and have a limited ability to frequently meet personally (Paasivaara and Lassenius 2016). In turn, global teams are located around the globe and have very few overlapping working hours during the day. Finally, teams can be scaled based on the degree of specialization (Bosch and Bosch-Sijtsema 2010). Whilst each team member, independent of the job title, is aware of literally everything that is going on, scaling either implies specializing into specific tasks (vertical scaling) or scaling the number of teams along the number of systems. Furthermore, scaling may also involve horizontal scaling by expanding capabilities within a single team. For instance, cross-functional teams include IT and business logic instead of solely development expertise by which to bridge operational level gaps (Melarkode et al. 2004). Yet, despite the manifold definitions of scaling agile within academia and the increasing popularity in real-world applications, research predominantly addresses the underlying principles for coordination within and among agile teams and their challenges (Bosch and Bosch-Sijtsema 2010; Dikert et al. 2016; Moe et al. 2009; Moe et al. 2019; Paasivaara and Lassenius 2014, 2016). Thus, approaches for realizing scaling across the IT function are limited in extent, mainly involving scaling agile frameworks as one fits all blueprints for large scale agile organizations (Disciplined Agile Consortium 2020; Scaled Agile 2020). Yet, as most primarily address scaling agile software development and increasingly include IT operations, extending scaling agile values towards IT management and governance is yet in its nascency.

2.2 IT Governance

2.2.1 IT Governance and its Decision Areas

As investments in IT may encompass a significant percentage of an organization's overall budget, one prominent avenue of IS research focuses on identifying how to make superior IT-related decisions in order to achieve the maximum of returns from IT investments (Weill and Ross 2004; Weill and Woodham 2002). In this regard, setting up an effective IT governance is seen as a cornerstone for success. Predominantly depicted as a sub-set of corporate governance (ISACA 2003, 2019; Webb et al. 2006), IT governance shall ensure that IT enables the business objectives (Haes and van Grembergen 2004) by "*specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT*" (Weill and Woodham 2002, p. 1). As a consequence, IT governance steers the responsible use of IT resources and the respective performance (Haes and van Grembergen 2004) and appropriate management of IT-related risks (ISACA 2003, 2019) for exploiting opportunities and maximizing benefits (ISACA 2019; Webb et al. 2006; Weill and Ross 2004) by defining processes, structures, and relational mechanisms (Haes and van Grembergen 2004) as the highest level of direction, leadership and control, and their execution via IT management practices (Weill and Ross 2004). The locus on IT decision-making may, however, vary (Brown 1997). In general, three primary modes are distinguished: centralized, decentralized, and federal governance (e.g., Sambamurthy and Zmud 1999; Weill and Ross 2004). In a centralized mode, the IT or business executives and management have the authority with which to make all IT-related decisions. This shifts to divisional IT, business line managers or individuals when operating in a decentralized mode. Finally, the federal mode distributed IT-related decision making between both corporate and divisional and/or line managers.

For operationalizing effective IT governance, clarification is needed on what to govern in relation to IT. Whilst various approaches on structuring IT governance's scope do exist (e.g., ISACA 2019; Rüter et al. 2010; Weill and Ross 2004), five main decision areas can be distinguished, in general (see Figure 2). First, the IT needs overarching **IT principles** in order to define the strategic role of IT with its funding and connection to business principles (Ross and Weill 2004), often in the form of a central IT strategy. Second, IT governance involves the whole decision-making process of **IT investment**. This includes the elicitation, prioritization and selection of where IT investments should be focused, and describes the procedures for IT project proposals, justification, approval and accountability (Weill and Ross 2004). Whilst sourcing and deciding on the financial aspect of these investment decisions is usually encapsulated under the umbrella of IT budgeting (Rüter et al. 2010), the prioritization of the corresponding initiatives in order to realize the IT investments is often the responsibility of portfolio management (ISACA 2019; Rüter et al. 2010). This further includes the decision area of the prioritization of **business application needs** for setting the individual functional requirements for purchased or internally developed IT applications (Weill and Ross 2004). Both areas then concretize the standards and determine how much and where to invest in IT (Weill and Ross 2004), sometimes with the support of IT service management as guardian and librarian of the existing IT service landscape (Rüter et al. 2010). In turn, the technological basis for the standardization of realized IT services and other technological choices is the responsibility of the **IT architecture** decision area, including disciplines such as enterprise or IT architecture management (Greefhorst and Proper 2011). Those also define the **infrastructure strategies** so that they fit to the business processes and activities (Weill and Ross 2004). Finally, decisions on IT sourcing are sometimes depicted as under the domain of IT governance (Rüter et al. 2010) or as integrated within the other domains, mainly that of IT budgeting (Weill and Ross 2004).

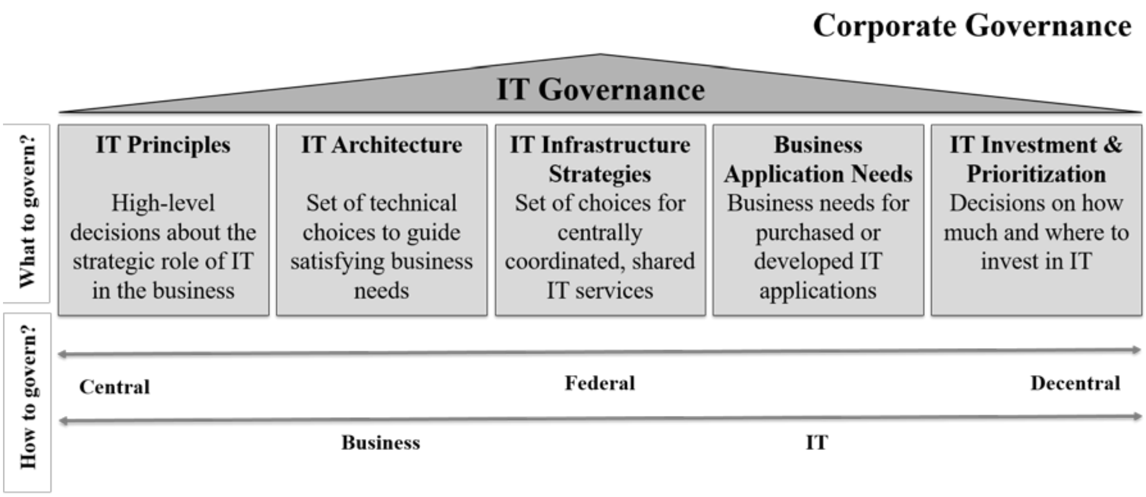

Figure 2: IT Governance Decision Areas and Locus of Decision-Making.
Source: Own Representation based on *(Weill and Ross 2004).*

2.2.2 Agility and IT Governance

Research on the relationship of organizational agility and IT governance is slowly becoming an area of interest for academia. With the crucial role of IT for corporate success in the digital age, how to steer the IT use and capabilities within the organization is heavily affected by agility (Denning 2017c; Tiwana and Kim 2015; Urbach et al. 2019). Some even proclaim that a combination of agile and governance capabilities must be guaranteed in order to cope with relentless change (Luna et al. 2014, 2015, 2019). As a consequence, agile governance targets finding approaches on how to incorporate the agile values of the agile manifesto (Beck et al. 2001) within the governance structures, processes and relational mechanisms.

When striving for agility, finding the locus of the IT governance within the organization is key, as the decision-making changes by decentralizing decision rights with autonomous agile teams for acceleration in service delivery (Moe et al. 2008; Moe et al. 2009; Moe et al. 2019). Whilst this poses challenges for traditional governance systems that focus on clear overall authority by corporate management (Luna et al. 2010; Sun and Wang 2013), a highly decentralized governance structure is one key in many organizations (Bogsnes 2009; Hope and Fraser 2003; Lee and Xia 2010). Nevertheless, as the teams still need to be in line with corporate strategic objectives, governance for agility is to pursue the call for aligned autonomy (Dybå and Dingsøyr 2008; Moe et al. 2009; Moe et al. 2019). For its realization, academia and real-world applications increasingly introduce approaches and frameworks, both across the IT governance decision areas and for a single area such as portfolio and enterprise architecture management.

They emphasize that teams are to be largely independent in planning their individual services, simultaneously in a functional, methodological and technological way (Moe et al. 2019). Thus, former governing functions such as enterprise architects shift towards consulting the teams in their decisions (Hanschke et al. 2015; Uludağ et al. 2017; Uludağ et al. 2019a). For having a shared overall direction, roadmaps are a popular tool for clarifying the aspired goals (Stettina and Hörz 2015). As IT is a crucial factor for business success, such roadmaps also increasingly incorporate both IT and digital services and/or business activity via a digital business strategy (Bharadwaj et al. 2013).

As agility also centers on speed and adaptivity to changes, IT governance also has to incorporate such values. Thus, organizations introduce a variety of agile mechanisms, such as , e.g., short, lean and flexible decision paths or communication structures for enabling rapid responses (Vejseli et al. 2018, 2019, 2020). Furthermore, flexibility is also enabled by loose coupling of the IT architecture, as this also facilitates decentralized decision-making with limited friction based on interoperability and cross-service interdependencies (Tiwana and Konsynski 2010). Yet, speed is also about continuously reevaluating the fit of the services to the customer demand and market landscape as well as across the organization (Hoffmann et al. 2017; Hope and Fraser 2003). Thus, continuous planning (Fitzgerald and Stol 2017; Lee and Xia 2010; Suomalainen et al. 2015b) with short re-evaluation of the overall direction and the resulting needed bundling of IT capabilities and competencies is proposed as a keystone to agile IT governance. Furthermore, since the teams represent the ‘ear to the customer’ in regard to the services, prior research found that their extensive knowledge is also a valuable source on potential innovation (Fitzgerald and Stol 2017). As a result, the teams’ ideas, based on identified new or changes in customer preferences, ought to be facilitated when planning across teams and in overall planning.

2.3 Business IT Alignment

2.3.1 Shape of Business IT Alignment

In order to achieve the corporate goals, IT governance targets the optimized synchronization between the dynamic business objectives, processes and the respective technological services provided by IT (Ullah and Lai 2013), predominantly referred to as business-IT alignment. A key issue for business and IT executives and managers for more than four decades (Gerow et al. 2014; Luftman et al. 2017) due to its criticality for gaining business success (Chan et al.

1997; Chan et al. 2006; Kearns and Lederer 2003), business-IT alignment is an extensively studied concept in IS research (Chan and Reich 2007; Coltman et al. 2015; Ullah and Lai 2013).

Although a variety of alignment models were proposed for solving the conflict of fit between business and IT (Broadbent and Weill 1993; Henderson and Venkatraman 1993; Luftman 2000; Sabherwal et al. 2001), most include four main concepts (see Figure 3) that are to be aligned (Bergeron et al. 2004; Ullah and Lai 2013). From the business side, **business strategy** as well as **business operations** need to be taken into account when striving for a fit with IT (e.g., Chan 2002; Sabherwal et al. 2001). The **IT strategy** and **IT operations** are the counterpart from the IT side (e.g., Broadbent and Weill 1993; Henderson and Venkatraman 1993). Some differentiate the operational level further, so that the business and IT structures, processes, skills and infrastructures need to be in line with each other (Broadbent and Weill 1993; Chan 2002; Henderson and Venkatraman 1993). Thus, whilst sometimes seen as a purely enterprise-wide concern on the company-wide strategic level when seeking alignment (Chan et al. 1997; Reich and Benbassat 1996; Sabherwal and Chan 2001), successfully fitting business and IT strategies (**strategic functional integration**) and transferring them into daily business operations implies that alignment between the strategic and the operational level (**strategic fit**) as well as along the operational level is inevitable (**operational functional integration**) (Bergeron et al. 2004; Henderson and Venkatraman 1993; Reynolds and Yetton 2015). Furthermore, the **cross-domain alignment** between business strategy and IT operational level and vice versa is also to be taken into account (Gerow et al. 2014). Yet, as the organization is continuously evolving, alignment is a dynamically evolving goal instead of a fixed state (Galliers 2004; Reynolds and Yetton 2015; Sabherwal et al. 2001).

Aligning the business and IT strategies, their corresponding operations and vice versa involves multiple dimensions (Chan and Reich 2007; Ullah and Lai 2013). First, the **strategic or intellectual alignment** predominantly involves the strategy and planning level by addressing the content of the strategy and its creation (Chan 2002; Reich and Benbasat 2000; Wu et al. 2015). As it represents "*the degree to which the IT mission, objectives and plans support and are supported by the business mission, objectives and plans*" (Reich and Benbassat 1996, p. 56), the main aim of strategic alignment is creating an understanding (Lederer and Mendelow 1989) and agreement (Kearns and Lederer 2000) of business and IT strategy and plans, such that the plans reflect each other (Kearns and Lederer 2003), optimally by IT and business executives participating within the planning process. In turn, finding the optimal degree of **structural fit** between business and IT organization is an overarching concern for both strategy and operations (Chan and Reich 2007; Ullah and Lai 2013). Structural alignment focuses on finding the optimal location of IT and business decision-making rights, which is closely related to (de)centralization of IT and IT personnel deployment (Bergeron et al. 2004; Brown and Magill 1994; Chan 2002), such that it is explicated by the organizational structure (Bergeron et al. 2001; Pyburn 1983; Ullah and Lai 2013).

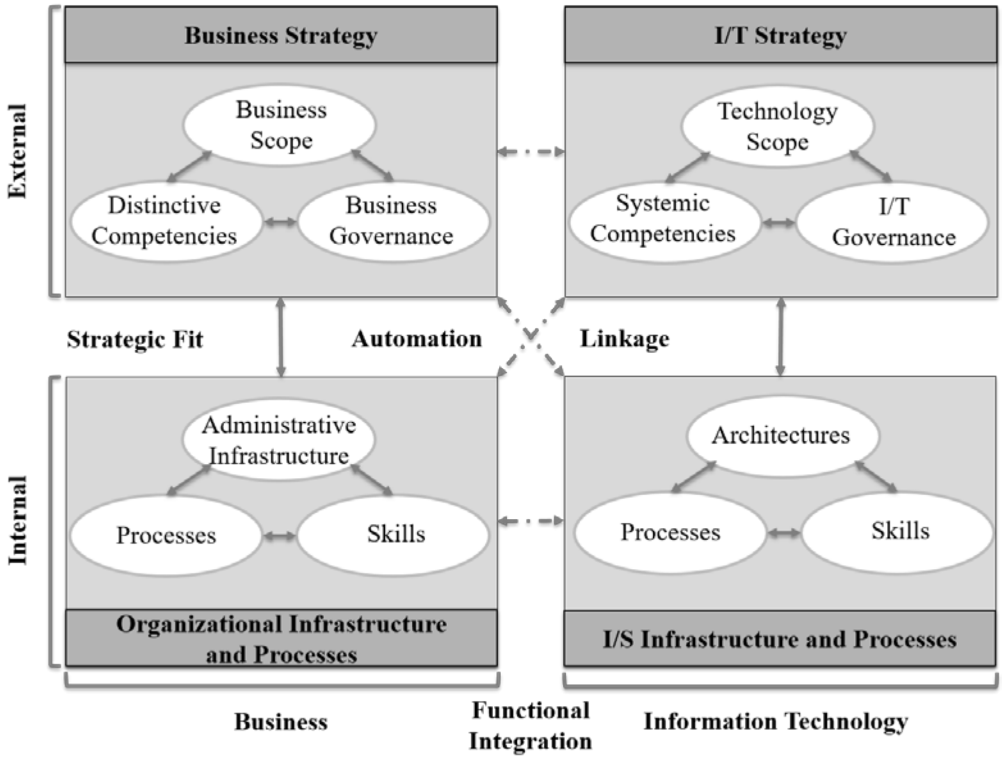

Figure 3: Concepts of Business IT Alignment.
Source: (Henderson and Venkatraman 1993).

Whilst strategic and structural alignment are rather explicated, the third dimension of **social alignment** focuses more on the mind-set by targeting the shared understanding and commitment of business and IT professionals, predominantly among the executives (Kearns and Lederer 2003; Reich and Benbasat 2000) for enabling trust (Broadbent and Weill 1993; Preston and Karahanna 2009; Reich and Benbasat 2000) and strong working business and IT partnerships (Feeny et al. 1992; Lederer and Mendelow 1989). This kind of alignment is enabled by sharing the domain knowledge (Johnson and Lederer 2010; Preston and Karahanna 2009) and having a clear and shared language (Preston and Karahanna 2009) and communication path (Luftman 2000, 2007), both formal and informal (Chan 2002). This also supports strategic alignment by addressing the shared commitment to follow the business and

IT missions, the objectives and the plans and, in turn, actively engage towards fulfilling each other's plans, objectives, and mission (Johnson and Lederer 2010; Reich and Benbasat 2000). Furthermore, social alignment is closely linked to the fourth dimension of the **cultural fit** (Chan 2002; Luftman and Brier 1999) that emphasize shared values, beliefs and behavioral norms (Ullah and Lai 2013) through a shared planning and communication style (Chan 2002; Pyburn 1983). As a result, a cultural fit is a crucial precondition for planning IT and business effectively, as the informal structure via the culture is the most enduring aspect of alignment (Chan 2002), as it sets the mind-set that encourages shared commitment and engagement across the organization (Pyburn 1983).

2.3.2 Business IT Alignment and Agility

The relationship between organizational agility and business IT alignment has been increasingly gaining momentum in recent times, predominantly regarding the question of whether both concepts facilitate or impede each other. The majority of insights proclaims that business IT alignment mainly enables agility (Tallon and Pinsonneault 2011; van Oosterhout et al. 2006), as aligning business and IT improves shared understanding, knowledge sharing and shared language for describing IT (Vejseli et al. 2020). Furthermore, embedded alignment "*allows firms to gather environmental knowledge, to share that knowledge across business units, and to react to change in a more informed, aggressive, directed, and agile manner*" (Tallon and Pinsonneault 2011, p. 468), so that innovation is accelerated as a result (Gupta et al. 2006; He and Wong 2004). In order to facilitate this ability, organizations primarily need to enforce a strong social alignment among business and IT staff, as it enhances emergent coordination between business and IT when sudden changes occur (Liang et al. 2017). Whilst this may involve IT leadership, who ought to actively participate in business strategy and planning with business executives as well as collaborate with them when setting the strategic objectives for IT (Melarkode et al. 2004; Yousif et al. 2016), the remaining IT function shall also proactively and regularly engage with the business (Melarkode et al. 2004). For instance, dedicated teams or individuals are to be installed throughout the business for this engagement (Denning 2017c; Tallon 2008; Yousif et al. 2016), e.g., with cross-boundary committees (Vejseli et al. 2020) or with IT and business personnel indulging in informal relationships and groupings (Fink and Neumann 2007), such that the IT function always sustains an up-to-date picture of business priorities and how it can contribute to them whilst proactively working towards identifying and driving new opportunities for value creation through IT (Melarkode et al. 2004; Tallon 2008).

In turn, alignment can also impede agility due to tunnel vision and relying on insights from the past instead of looking towards and proactively anticipating the future (He and Wong 2004; Tallon and Pinsonneault 2011). First of all, structural alignment concerning the IT architecture may lead to stagnation, strategic inflexibility, and competitive disadvantage (Gerow et al. 2014). As too much complexity in the IT architecture is expensive to maintain and has difficulties with small and incremental changes (Aral and Weill 2007; van Oosterhout et al. 2006), minimizing the benefits of agility via a time-consuming, costly, and formal alignment process in order to enable quick responses to changing market conditions (Overby et al. 2006; Sabherwal et al. 2001). Yet, a strong intellectual alignment that overly emphasizes formal alignment between business and IT strategies can have even more negative effects (Liang et al. 2017). Whilst the stable times of business may be facilitated by intellectual alignment, times of disruption may lead to inertia with limited agility and firm performance due to rather fixed organizational arrangements, such as resource allocation, structures, and routines manifested within the business and IT strategy (Liang et al. 2017). As a consequence, having long-term resource commitment to possibly outdated strategic objectives may slow the rate of innovation and responsiveness to change (Gupta et al. 2006; He and Wong 2004). Thus, sustainable IT business alignment in times of continuous change requires a degree of dynamic and nondeterministic processes that evolves over time (Chan and Reich 2007; Sabherwal et al. 2001), although this is difficult and not without any costs (Vessey and Ward 2013). As one way to enable a certain flexibility, social alignment is proposed with its informal character, as it puts no or limited structural restrictions on the organization and facilitates real-time information exchange, informal communication, and personal interaction between business and IT executives (Liang et al. 2017). Consequently, business and IT executives are perceived to coordinate with each other to solve unpredictable problems at the top level and empower their staff to engage in cross-functional coordination as well (Liang et al. 2017).

For enabling the positive effects of alignment in the light of agility, business IT co-evolution (Sabherwal et al. 2001) or two-way alignment becomes a key mechanism through which IT creates value (Coltman et al. 2015). The bidirectional evolvement and alignment imply that business and IT are elements within an organizational ecosystem and have complex non-linear relationships, effects and causalities on multiple levels from strategy to operations (Benbya and

McKelvey 2006; El Sawy et al. 2010). Similar to the operationalization of agility within the organization (please see section 2.1.1), the organization is to be seen as a network, wherein individual elements should be able to move as independently as possible, such that self-organization is high (Benbya and McKelvey 2006; Tanriverdi and Lim 2017). Yet, both business and IT need to form effective collaborative partnerships within the individual, operational, and strategic level and across the levels (Benbya and McKelvey 2006; El Sawy et al. 2010). Whilst this may include closely integrating business needs and development so that IT is more involved in strategic business decision-making instead of acting as consultants after decisions have been made (Fitzgerald and Stol 2017), operational two-way alignment may also lead to a structural change by setting up cross-functional agile teams, which research on scaling agile is proposing for enabling speed and adaptability (Legner et al. 2017; Urbach et al. 2019). Furthermore, establishing a single strategy for the organization (Smaczny 2001) may facilitate speed due to minimized coordination, rather than developing two separate strategies. Particularly for organizations that digitize their entire businesses and/or build digital options in order to capitalize on future opportunities, this concept of unity is proposed via a digital business strategy that formulates and executes the leveraging of digital resources (Bharadwaj et al. 2013; Matt et al. 2015). In this, all of the impacts are evaluated at the same time and the technology forms part of a fully integrated "*organic being*" (Smaczny 2001).

3 Research Design

This chapter addresses the research design of this thesis. In a first step, the overall research strategy with the methodical perspective of this dissertation is outlined. The remaining sub-sections describe the applied research methods in the thesis and how they contribute to the overarching research strategy.

3.1 Research Strategy – Phenomenon-based Research

Overall, the thesis follows a *phenomenon-based research approach* (von Krogh et al. 2012; Schwarz and Stensaker 2016), as a way for embracing today's VUCA markets with agility, such that the resulting (effective) shape of the IT function is a rather new and largely unexplored challenge for research. Phenomenon-based research is characterized by understanding the "*regularit[y] that [is] unexpected, that challenge[s] existing knowledge (including the extant theory), and that [is] relevant to scientific discourse*" (von Krogh et al. 2012, p. 278) first and theorizing at a later stage (Schwarz and Stensaker 2014). This angle is useful, as theories may serve as blinders (Holmström and Truex 2011), which may prevent a true understanding of the phenomenon. By reinforcing rather than challenging existing knowledge (Rolland et al. 2016), mere gap-spotting with theories may also result in underwhelming and limited significance of the findings (Alvesson and Sandberg 2011). In particular, as the current organizational challenge of outlining the IT function for agility is quite complex, by involving IT operations, governance and the fit to the business, it can be analyzed from many theoretical perspectives from IS, management and organizational science, but often without providing a holistic description of the current situation at hand. Thus, focusing on theories in the first place may "*prevent the reporting of rich details about interesting phenomena for which no theory yet exists*" (Hambrick 2007, p. 1346). Finally, applying theory is often not helpful to practitioners, as it does not help them to make sense of their world (Ross 2020). Thus, providing a deeper understanding of the issues and pursuing lasting changes is more appropriate (Ross 2020).

As there are very few and vague insights on how to shape the IT function for agility, particularly concerning IT governance and business IT alignment, the research is in the embryonic stage (von Krogh et al. 2012). In this stage, "*a phenomenon that is new to the scientific field needs first to be singled out against the backdrop of other known phenomena*" (von Krogh et al. 2012, p. 286). As the knowledge base is scarce for such a segregation at first, it is particularly important both to gain an initial understanding of the phenomenon and identify suitable theories for deeper analysis and distinction to similar phenomena. As a consequence, following the first analytical research goal (please also see section 1.2), the thesis initiated with the activities on **exploring** how to shape the IT function for agility as well as **distinguishing** it from other occurrences for "*giving the phenomenon an identity*" (von Krogh et al. 2012, p. 292) with its peculiarities and other distinctive characteristics (see Figure 4). Yet, maturing within the research on the phenomenon requires more in-depth knowledge on the nature of the phenomenon for being able "*to judge the extent to which it overlaps with or deviates from extant theories*" (von Krogh et al. 2012, p. 296) and on which (alternative) research designs enable an analysis in the best possible way. This is addressed by following the design-oriented research goal (see section 1.2), which mainly encompassed the activities of **designing and theorizing**.

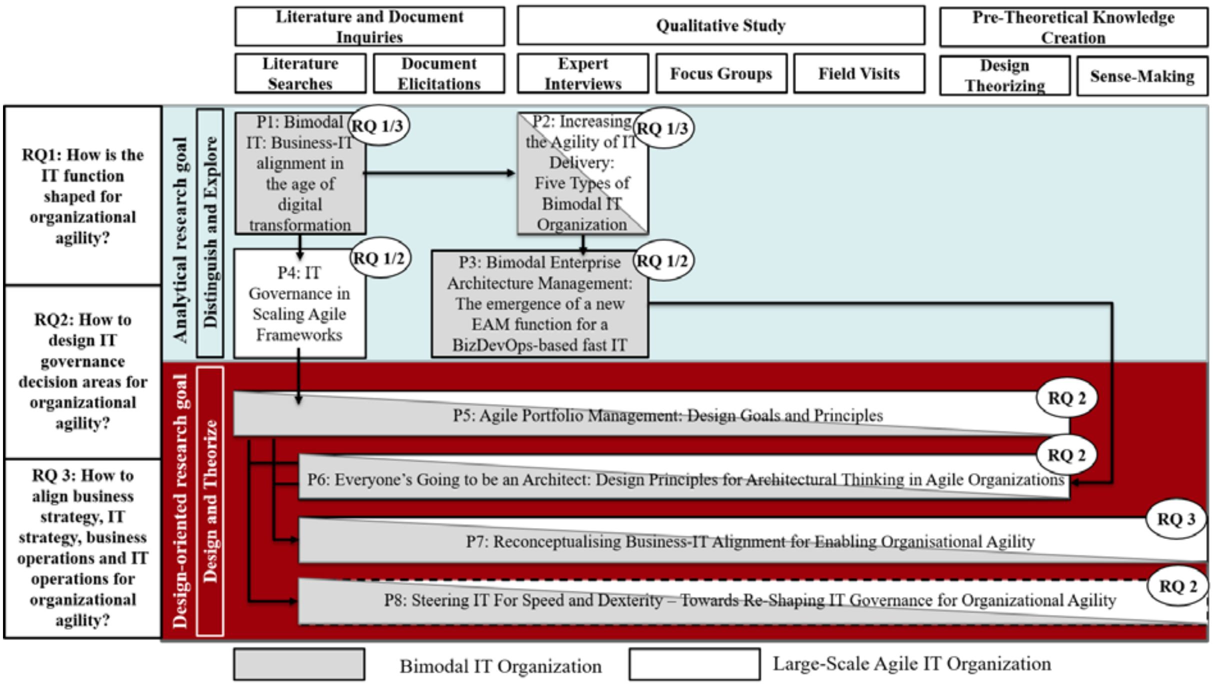

Figure 4: Research Strategy, Methods and Contributing Papers.
Source: Own Representation.

Similar to the analytical and design-oriented goals, the activities are, however, not linear in their nature, as moving towards the design-oriented goal also involves further exploration, e.g., on single concepts within the phenomenon, and their distinguishment from similar occurrences based on refining and extending the own understanding on shaping the IT function, particularly concerning IT governance and business alignment, for agility. Furthermore, designing and theorizing is not restricted to the design-oriented goal, as the initial analyses on the shape of the IT function also involve applying different research designs as well as "*referring to extant theories, even to highlight what the phenomenon is not*" (von Krogh et al. 2012, p. 296) – one strategy for theorizing. This is in line with IS research, which entails both the behavioural understanding of organizational problems and their contexts as well as their solutions, with rigor, e.g., by designing new artefacts and introducing them into the organizational context (Gregor 2006; Simon 1996).

The activities of **exploring and distinguishing** primarily enable describing the phenomenon by showing the means for shaping the IT function for enabling agility and by revealing the different approaches by organizations for realizing agility (Type I theory, Gregor 2006). Furthermore, they support explaining the reasoning for the shaping (Type II theory, Gregor 2006), particularly concerning IT governance and business IT alignment. Presuming that "*no currently available theory has sufficient scope to account for the phenomenon or the relevant cause-and-effect relationships associated with*" (von Krogh et al. 2012, p. 280) the shaping IT function for agility, this is realized by uncovering the phenomenon's characteristics with exploration, whilst distinguishing involves bracketing the peculiarities against the backdrop of adjacent occurrences and existing theoretical knowledge (von Krogh et al. 2012).

In order to create such an understanding, broad and diverse, yet relevant insights for purposeful information collection are key. In addition, information needs to be available in order to gather rich insights on the phenomenon. Thus, literature as well as analyzed organizational contexts for the empirical studies were selected based on their suitability for gaining insights on the shaping of the IT function for agility and/or for revealing specific details on IT governance and/or business IT alignment in those settings. For the latter, personal contacts of all involved researchers were further used for accessing potentially relevant companies. Followups were primarily acquired through snowball sampling (Gläser and Laudel 2010), as insights on the phenomenon were rather scarce but experts within the field have active discussion and exchange, either within or among the organizations. The same sample strategy has also been applied within the activities of designing and theorizing.

Yet, in contrast to von Krogh et al.'s (2012) assumption of distinction happening before exploration, both activities happened in a parallel fashion in this research. For instance, shaping the concept of bimodal IT as one approach for outlining the IT function for agility by analyzing existing literature and approaches in practice resulted in both understanding the concept and its elements and distinguishing the notion of business IT alignment and IT governance in such settings from traditional organizations with a central corporate IT department. The same applied when exploring IT governance by analyzing scaling agile frameworks as exemplary existing approaches for understanding the second popular approach for outlining the IT function for agility, the large-scale agile IT organization.

The activities **designing and theorizing** involve the search for suitable research designs, guided by the nature of the phenomenon of shaping the IT function for agility instead of following from the theory formulation process (von Krogh et al. 2012) for the optimal research angles. Furthermore, they also involve juxtaposing the "*new concepts, information, and interpretations*" (von Krogh et al. 2012, p. 296) from exploring and distinguishing with existing theories in order to extend, modify or neglect existing theoretical advancements in the light of the phenomenon or generate new theories or concepts. By conducting a multitude of research methods including focus groups, interviews and observations from different angles within IT governance and business IT alignment, research designs were derived that helped grasping the phenomenon whilst still preventing the "*theoretical straightjacket*" (Schwarz and Stensaker 2014). Nevertheless, the theoretical angle with IT governance and business IT alignment also enabled structured and focused analyses within this complex setting of agility with its multitude of facets and IT functions with its plethora of contexts.

In line with von Krogh et al. (2012), who advocate that "*researchers may choose not to attempt to build theory but may instead elect to report on the phenomenon*" (p. 296), the findings of the designing and theorizing primarily address designing how IT governance and business IT alignment have changed and the consequent alterations within the IT function, which resulted in two main findings. First, the thesis aims for uncovering changes for IT functions by agility, which led to two sets of pre-theoretical knowledge for explaining (Type II theory, Gregor 2006) with re-conceptualizing business IT alignment and the IT governance decision areas for agility. Yet, since the research is heavily inspired by practice, this also includes developing knowledge for being able to design IT functions for agility. Thus, the second findings include three sets of pre-theoretical knowledge for design (Type V theory, Gregor 2006) with design knowledge on the IT governance decision areas of portfolio management and architectural management as well as on business IT alignment for agility.

However, the findings show that the embryonic stage of understanding of IT functions, IT governance and business IT alignment regarding agility is not completed due to still missing in-depth analyses on, e.g., other IT governance decision areas or on dimensions of alignment. Furthermore, similar insights with alternative research designs and findings are yet in their nascency in IS research. Thus, the thesis did not pursue the fifth research strategy of phenomenon-based research by synthesizing the existing insights and establishing an overview, neutral from the individual design and theory (von Krogh et al. 2012).

3.2 Literature and Document Inquiries

One fundamental source of information for the thesis was an existing body of knowledge from theory and practice. In this regard, both publicly available literature as well as corporate documents were used. Both enabled an understanding of the individual parts on how to shape IT functions for agility as well as their interlinkages as well as identifying the existing research and practice landscape on the phenomenon.

3.2.1 Public Academic and Practice-Oriented Literature Search

For understanding the phenomenon at hand whilst being able to distinguish it from other phenomena and the existing body of knowledge, phenomenon-driven research requires "*extensive theoretical knowledge and an extraordinary overview of the existing knowledge*" (Schwarz and Stensaker 2014, p. 488) in order to show that there is a lack of existing theories that can adequately or better explain it. Thus, this thesis encompassed a series of six systematic literature searches (Vom Brocke et al. 2009) (see Table 2) in order to identify, evaluate and characterize the rising research topic of IT functions for agility (Kitchenham 2004). Following the two research goals, the reviews followed two main purposes. The first purpose is uncovering the observed trends by shaping the identified types of bimodal IT and large-scale agile IT organizations. In turn, the second purpose involved the goal of integrating and extending existing theories as well as developing new and alternative theories based on the gained insights (Schwarz and Stensaker 2014; Schwarz and Stensaker 2016). Therefore, those searches emphasized shaping specific areas of IT governance and/or business IT alignment in light of agility in order to clarify the existing research landscape of those theoretical concepts addressed within this thesis.

Table 2: Applied Literature Searches.

Article	Literature Search Focus	Search Terms	Research Knowledge
1	Delineation of the bimodal IT concept and identification of bimodal IT practices	Bimodal IT and its synonyms	- 177 articles from practice - 1 academic paper, technical focus on bimodal IT architecture
4	Identification of approaches on large-scale agile IT organizations	“framework” OR “approach” AND (“scaling agile” OR scaled agile”)	35 frameworks with varying foci - IT organizational governance - Inter-team coordination - Agile transformation management
5	Delineation of existing knowledge and approaches for portfolio management and agility	(agil* OR lean OR continuous) AND “portfolio management”	- Knowledge base from 8 frameworks from article 4 - 19 (semi-)scientific articles, mainly additional frameworks or reflection on individual portfolio practices
6	Identification of existing knowledge and approaches on architectural thinking and agility	(agil* OR lean OR continuous) AND “architecture”	- Knowledge base from 8 frameworks from article 4 - 2 (semi-)scientific articles on architectural thinking without link to agility - 11 (semi-)scientific articles on agile architecture manage-ment with dedicated architects
7	Identification of existing knowledge and approaches on business IT alignment and agility	(agil* OR lean OR continuous) AND (“business IT alignment” OR BITA)	- Knowledge base from 8 frameworks from article 4 - 23 (semi-)scientific articles on influence between BITA and agility, few approaches
8	Identification of existing knowledge and approaches on IT Governance and agility	(agil* OR lean OR continuous) AND “IT governance”	- Knowledge base from 8 frameworks from article 4 - 12 (semi-)scientific articles on influence between IT governance and agility, few approaches

The first step of each literature review included outlining the research strategy with search terms, relevant outlets, and criteria for selecting relevant literature (Kitchenham 2004; Vom Brocke et al. 2009). The strategy of each literature search was as non-restrictive as possible, based on the missing shaping of the overall phenomenon and its components. Therefore, the search terms (see Table 3) were defined in an iterative fashion. First, prominent IS journals and conferences were analysed in an unstructured way, which resulted in limited findings. Subsequently, the search for suitable terms was extended to large IS databases such as Google

Scholar and Web of Science. Furthermore, a search in the Google database was conducted, as most of the topics were practitioner-oriented with very limited academic insights during the time. Within the found literature, forward and backward searches (Vom Brocke et al. 2009; Webster and Watson 2002) were further conducted in order to uncover potentially relevant but as yet unknown additional sources of information. As relevance criteria for the found literature, all publications containing aspects, approaches or concepts for the respective analysed concept in each review were perceived as relevant for the following literature evaluation. Thus, grey literature such as white papers or technical reports were included in the literature base, since they provided input in the practice-oriented concepts for designing IT functions for agility.

3.2.2 Corporate Document Elicitation

Next to using a public body of knowledge, corporate documents were a second source of information – especially for shaping ideas for (selected) IT governance areas for organizational agility. Corporate documents allowed the reconstruction of the evolution of how to shape the IT function for agility by analyzing the documents that were created at some point in the past and the present (Marshall and Rossman 2006). This enabled an access that was otherwise not possible and thus sheds light on the internal view on the organizations, their actors and actions (Merriam 1998). However, as most of the documents of the analysed organizations were not grasping the specific (IT) organization as a whole, they were predominantly used to triangulate findings from the empirical qualitative studies (see section 3.3).

Table 3: Applied Corporate Documents.

Article	Corporate documents' Purpose	Corporate Document Used
3	- Outline case company context - Outline corporate approach and elements on bimodal enterprise architectural management	- Meta-models - Business and IT architecture management role models and process specifications - IT service catalogue - Documentation from DevOps tool chain (changes to code, responsibility,…)
6	- Outline companies' approaches and elements within agile portfolio management systems - Triangulation of insights from empirical study	- Portfolio management role models - Architectural documentation on portfolio management system - Portfolio process specifications - Marketing brochures on agile organizational IT response - Training material for new employees
7	- Outline companies' approaches and elements on	- Architecture management role models

	architectural thinking for agility - Triangulation of insights from empirical study	- Architecture management process specifications - Meta-models - Service designs

3.3 Qualitative Studies

A second essential research method used in the thesis involves three qualitative empirical studies for understanding the phenomenon and its constituting parts. Whilst the first method targeted understanding and exploring the practical operationalization of one trend towards shaping the IT function for agility – bimodal IT – due to the lack in academia, the latter encompassed identifying in-depth insights on areas of IT governance and business IT alignment when striving for agility. The first study was solely comprised of a set of expert interviews. The second also included expert interviews, but further encompassed focus group workshops and field visits. The concrete use of each research method in the thesis is described in the following.

3.3.1 Expert Interviews

Qualitative interviews are perceived as one essential tool for gathering rich data in qualitative research (Gläser and Laudel 2010; Myers and Newman 2007) by allowing comprehensive discussions (Langley and Abdallah 2011), especially in such an exploratory research on a novel phenomenon. As knowledge on such a new area of research is yet largely lacking in the public discourse and media outlets, insights 'from the field' are an even more valuable and scarce resource, inaccessible to anybody in the field. As shaping the IT function for agility is very complex in nature, requiring the experience of persons with a high level of domain-specific knowledge for enabling more thorough insights on the analysed concept at hand, the interviews within this thesis mainly represent expert interviews (Gläser and Laudel 2010; Meuser and Nagel 2009). The representatives are considered experts, as they are involved in or have directly influenced the respective concept of inquiry with their specialist roles in their case organization for a long time (Bogner et al. 2009, p. 19) or have gained their broad knowledge on the specific topic with engagements across multiple company contexts. However, the interviews covered a multitude of perspectives and background in order to prevent an elite bias (Myers and Newman 2007) (see Table 4). Snowballing interviewees based on recommendations of the interviewed partners (Meuser and Nagel 2009) further helped in gaining a critical mass and diversity in views on the organization, as those experts are usually well connected with other knowledgeable persons in the field. Furthermore, this technique may help overcoming the lack of trust (Myers and Newman 2007), so that interviewees may open up to a larger extent.

The interviews were semi-structured by using an interview guideline with open-ended questions for more in-depth and detailed insights and experiences of the experts (Gläser and Laudel 2010; Myers and Newman 2007). Independent from the specific theoretical angle, the interviewers first introduced the aspired outcome in each interview and then strived for getting to know the background of each interview partner with introductory questions on his or her position and the organizational context. The main part of the interview consisted of guided questions, inspired by the individual theoretical angle. In case of needed clarification, follow-up questions were formulated ad hoc. Open questions on yet missing aspects from the interviewees' perspective finally concluded the interview. All interview sessions were audio-recorded and transcribed.

Table 4: Applied Interviews.

Article	Interview Purpose	Participants	Number	Date
2	Shape of bimodal IT in own IT function	Staff units for CIO, head of departments	9	12/2015 – 04/2016
5,6,7,8	Outline of agility in own IT function	CIO and CDO	5	11/2017 – 03/2018
6	Agility, architectural thinking and own/seen IT functions	Architecture functions, consultants	16	03/2019 – 07/2019
7	Agility, business IT alignment and own/seen IT functions	Extension of interviews in article 6 towards governance functions	29 - 16 New Zealand - 13 Germany	03/2019 – 11/2019
8	Agility, IT governance and own/seen IT functions	Further extension of interviews towards governance functions	33 - 17 New Zealand - 16 Germany	03/2019 – 03/2020

3.3.2 Focus Group Sessions

Whilst the interviews and corporate documents allowed covering a broad spectrum of insights from a plethora of involved roles and functions within single companies, the thesis also strives to uncover in-depth insights on shaping the IT function for agility across organizations. Commonalities across the differing approaches when striving for agility with the IT function are of particular interest, as they provide one essential input for deriving design options in a second step. Therefore, three focus group workshops with CIOs/CDOs were conducted, as they are a prominent approach for gaining rich and large amounts of data on a variety of actors from a particular concrete situation (Krueger and Casey 2014; Stewart and Shamdasani 2014)). As this contrasts with other approaches such as surveys that usually encompass a multitude of topics for inquiry, focus groups are a common means for conducting exploratory or phenomenological research in order to shed light on one issue at hand (Merton et al. 1990; Stewart and Shamdasani 2014). Focus groups further enable more information than individual interviews, as the purposeful discussion among the group members also shows the interpersonal relationships, such as the group's reaction to information provided of one or several participants (Krueger and Casey 2014; Merton et al. 1990). As IS researchers are, however, not experts in sociology or psychology (Benbasat and Zmud 1999; Nili et al. 2017), the focus of the focus groups was mainly the content dimension by identifying approaches and good practices for agility in organizational (strategic), which "*excludes specialized psychological observations and analyses of the participants' internal states*" (Nili et al. 2017, p. 3).

As focus groups are especially useful for reflecting the social realities of a dedicated group with their specific language and experiences (Hughes and DuMont 1993; Merton et al. 1990), they are perceived as most productive with a certain state of homogeneity of the group, especially regarding prestige or status factors, such as, e.g., social class among participants (Krueger and Casey 2014; Nili et al. 2017). Therefore, the group sessions within the thesis were exclusively comprised of IT head peers having the title of CIO or CDO in the respective organization (see Table 5). The group was further homogenized by participating organizations needing to fulfil common criteria: (1) the organizations are (becoming) agile including at the strategic level, (2) participants hold a position with insights on the organizational system, and (3) there is a willingness for cooperation and open information sharing among the participants and with the researchers. As the moderator is equally important in the setting, homogeneity was strived for by having the same professor involved in the research project – as the academic equivalent of having a position of department head – filling this role.

Similar to the expert interviews, a focus group was used to accomplish the research objectives within and across the focus group workshops, by steering the group in a thematic way (Hughes and DuMont 1993). Thus, the guide provided a set of issues for the group to discuss within each focus group round. All rounds were then thematically clustered under a preselected umbrella topic such as, e.g., portfolio management. As the focus groups were more of an exploratory nature, the discussions, guided by the moderator, were still relatively broad and unstructured so that participants could raise additional concerns within the topic (Hughes and DuMont 1993; Krueger and Casey 2014). In order to enable a structured analysis of the discussion, all discussions were tracked by audio-recording and by using a focus group canvas. On this canvas, all involved researchers wrote down notes of addressed issues and resulting comments by the participants within the focus group discussion. As the canvas also should encourage an active discussion, the canvas was open for everyone to see.

Table 5: Applied Focus Group Sessions.

Article	Focus Group Purpose	Participants	Duration	Date
5,7,8	IT organizational approaches and concerns on portfolio management for agility	6 - 5 CIO - 1 CDO	02:36 h	03/2018
5,8	IT organizational approaches and concerns on structuring and planning for agility (product vs. project orientation)	7 - 5 CIO - 2 CDO	02:13 h	08/2018
7,8	IT organizational approaches and concerns on how to integrate and cooperate with the business side	4 - 3 CIO - 1 CDO	03:09 h	02/2019

3.3.3 Field Visits

For being more involved within case organizations by analyzing "*observation or participation in action*" (Walsham 2006, p. 321) independent from a specific perspective of a corporate role or function, multiple field visits were conducted (see Table 6). In contrast to the interviews, where researchers are removed from the organization(s) they are analyzing (Walsham 2006), field visits allow a more in-depth observation of a dedicated company. Next to analyzing a specific topic, they also have the advantage of examining the people in the specific setting based on being personally immersed in the interactions across the different functions (Wolcott 2005). In turn, this facilitates generating a richer understanding of the organizational 'rules', particularly the social action within the respective organization, which usually is hidden from the public eye (Walsham 2006). Therefore, taking field notes of the organizational context and the corresponding actions was an essential part of each field visit (Wolcott 2005).

The cases for the observations were purposively selected. Thus, the first field visit took place in mid-January to mid-February 2017 in one of the first movers on large-scale agile IT organizations at that time. The one month of observation served as a preliminary insight and input for designing and theorizing, as it lay the foundation for understanding the shape of the IT function of the case organization, but with the specific focus on the to-be-analyzed theoretical angles identified within the thesis: IT governance and business IT alignment. Thus, the visit intended to understand the organizational system on the one hand and derive implications for backlog management in a globally distributed setting, one of the main concerns of the corporation within their agile transformation at that time.

The organization also served as the first organizational context in the second time of the field, along the focus group sessions. This case and the following were purposefully selected by the focus group participants as the following workshop location due to their maturity in the design of IT functions for agility. The participant observation was then mainly realized through field visits with walkthroughs by the researcher within the specific case organization and informal interviews and discussions with actors. Therefore, all focus group workshops were combined with a field visit, which included a walk through the specific hosting case company and talks of and conversations with people engaged in the respective transformation.

Table 6: Applied Field Visits.

Article	Field visit Purpose	Duration	People Observed
5,6,7,8	- Observation of IT function - Task by company: Consulting on backlog management in distributed agile organization	4 weeks	- CIO and Chief Operating Officer IT (COO IT) - Management team COO IT - Consultants for global agile transformation - Business Process Lead - 2 Tribe Leads
5	Observation of current IT function - Walkthrough - Experience reports from management team COO IT - Informal discussions	1 day	- COO IT - Management team COO IT - DevOps Engineer - Agile Team Members
7	Observation of current IT function - Walkthrough - Experience reports from management team CIO - Informal discussions	1 day	- CIO - Management team CIO - EA Management - Business Development - Agile Team Members
7	Observation of current IT function - Walkthrough - Experience reports form finance unit and agile coaches - Informal discussions	1 day	- CIO - Business Development - Finance Business Unit Team Members - Agile Coaches

3.4 Theorizing with Pre-Theoretical Knowledge Creation

Particularly for designing and theorizing the phenomenon at hand, the research strived for producing actionable artefacts that outline and capture the ‘know how’ – imperative or prescriptive knowledge – in contrast to the descriptive ‘know what’ knowledge of the gained understanding within the exploration and distinction (Gregor et al. 2020). As a consequence, the thesis includes various artefacts from design science research (DSR), the aim of which is to provide knowledge that has scientific legitimacy and also provides utility in achieving goals (Gregor and Jones 2007) – creating an effective IT function for agility. Furthermore, this thesis also includes sense-making for moving towards a theory for explaining how and why such an effective IT function for agility has to be established.

3.4.1 Design Knowledge Creation

The primary purpose of phenomenon-driven research is not only to describe and report on the phenomenon, but it should also be to move a step further towards the distant goal of its explanation with new or alternative theories (Schwarz and Stensaker 2014). Consequently, academia needs to “*presents something innovative, counterintuitive, or even surprising relative to what we already know*” (Schwarz and Stensaker 2014, p. 488). For its achievement, design-oriented research is seen as a suitable paradigm by striving for such novelty via “*(1) the utilization and application of knowledge for the creation of novel or innovative artifacts that engender change or improvement in existing situations or problem spaces, and (2) the generation of new knowledge*” (Baskerville et al. 2015), p 544). The resulting design knowledge then incorporates generalizable knowledge that can be utilized within varying contexts across a common problem space (Baskerville et al. 2015) – in particular like finding the ‘right’ shape of the IT function for agility.

Design knowledge can be manifested either in the form of material artifacts, usually referred to as instantiations, more abstract artefacts such as constructs, models, frameworks, architectures, design principles and/or methods or even more abstract and mature artefacts such as mid-range or grand design theories (Cronholm and Göbel 2019; Gregor and Hevner 2013). Whilst the first set of artefacts is relevant and interesting for this research, this thesis strives for a more abstract view by creating knowledge as operational principles above the individual instantiation, whilst not including a well-developed design theory about embedded phenomena (Gregor and Hevner 2013). Thus, it focuses on creating pre-artefact and pre-design-theory design knowledge

(Baskerville et al. 2015; Weick 1995) through design theorizing (Gregor 2006) to capture prescriptive knowledge, inspire and guide individual decisions and actions (see Table 7). The derived design knowledge is within a pre-theoretical state, as it only covers some criteria of a design theory by Gregor (2006) and (Gregor and Jones 2007). For instance, the constructs of the knowledge and the principles of form and function are defined with knowledge descriptions at an abstract level via design goals and principles. Furthermore, the constructs are described in abstract terms without having recourse to the specific IT function by design features. In addition, testable propositions are derived based on relationships to design features or identified theory-induced challenges, which allow empirical generalization and testing in a second iteration. For the findings moving to the stage of a well-developed design theory, a more structured link of the design knowledge to justificatory knowledge as theoretical framing needs to be established in order to "*explain why the artifact works along with testable propositions*" (Gregor and Hevner 2013, p. 352). This also requires more evaluations of the design knowledge for the generalization of the theory in its whole as well as in its specific components.

Table 7: Applied Design Knowledge Creation.

Article	**Design Knowledge Purpose**	**Empirical Base**	**Findings**
5	Meta-requirements and baseline in form and function on portfolio management for agility	- Cross-industry study with 5 IT executives - Focus group session 1 - 13 research articles and 8 scaling agile framework	- 4 Design goals - 6 Design principles - Testable propositions - Instantiation with exemplary design features
6	Meta-requirements and baseline in form and function on architectural thinking for agility	- Cross-industry study with 16 interviews	- 6 Design principles - Rationale for each principle by agility - Exemplary design features on shaping architectural thinking
7	Meta-requirements and baseline in form and function on business IT alignment in light of agility	- Cross-industry study with 5 IT executives - Focus group session 1-3 - Cross-industry study with 29 interviews	- 4 Design goals - 5 Design principles - Set of design features for each principle

3.4.2 Sense-Making

Next to generating pre-theoretical design knowledge via design goals, design principles and design features, the thesis also strived to explain IT governance and business IT alignment in the light of organizational agility. Therefore, especially the later articles include pre-theoretical knowledge as a result of theorizing (Weick 1989, 1995) or sense-making (Drechsler and Hevner 2018; Magala 1997; Weick et al. 2005) of the empirical and literature findings for enabling explanation (Gregor 2006) in order to guide individual decisions and actions (see Table 8).

Sense-making as "*inventing a new meaning (interpretation) for something that has already occurred during the organizing process, but does not yet have a name […]*" (Magala 1997, p. 324) enables a clarification of organizational phenomena by having an "*ongoing retrospective development of plausible images that rationalize what people are doing*" (Weick et al. 2005, p. 409). By "*making of sense*" (Weick 1995, p. 4) through labelling and categorizing experiences from chaos (Weick et al. 2005), circumstances are turned "*into a situation that is comprehended explicitly in words and that serves as a springboard into action*" (Taylor and van Every 2000, p. 58). As a result of giving the experiences a clear structure, sense-making enables finding common ground among the actors, which, in turn, can guide further action and interpretation (Weick et al. 2005).

In contrast to profound theories, the derived explanations rather consist of approximations in lieu of strong theories (Weick 1995). This is caused by "*the process of theorizing consist[ing] of activities like abstracting, generalizing, relating, selecting, explaining, synthesizing, and idealizing*" (Weick 1995, p. 5) the final results from the data, but not requiring or facilitating that all facts must be noticed due to the linearity of the used theoretical concepts in the analyses. In order to be able to transform those insights into a full theory, knowledge of the context the resulting work in is required. As a result, interrelations between the organizational context and the derived results, and even more, the reasoning for each derivation, are to be uncovered and explicated. However, as those interrelations may be of a complex nature, the consequent focus on a single theoretical angle within this thesis has been too limiting. Thus, whilst the use of IT governance and business IT alignment as underlying theoretical concepts within the analyses serve as a good foundation for their specification, clarification and definition (Weick 1995) as well as for providing generalizable insights (Gregor 2006) in the light of agility, it enabled limited explanations on the causality of the findings (Gregor 2006). In other words, "*a nonlinear vision loses accuracy when it is converted into propositions*" (Weick 1995, p. 2).

Table 8: Applied Sense-Making.

Article	Sense-Making Purpose	Empirical Base	Findings
7	Reconceptualization of business IT alignment for agility	- Cross-industry study with 5 IT executives - Focus group session 1-3 - Cross-industry study with 29 interviews	- 4 BITA-related challenges in the light of agility - Re-conceptualised BITA model along 4 novel alignment dimensions
8	Reconceptualization of IT governance domains from Weill and Ross (2006) for agility	- Cross-industry study with 5 IT executives - Focus group session 1-3 - Cross-industry study with 33 interviews	- 4 principles on IT governance for agility - Re-conceptualised IT governance definition with graphical portrayal

3.5 Qualitative Analysis Inspired by Grounded Theory

The material from the literature and the qualitative inquiries throughout the thesis were analysed in a structured way. The analyses were inspired by the coding stages from grounded theory (Strauss and Corbin 1991) in order to prevent missing out on important aspects based on a narrow theoretical perspective. Thus, the analyses within the thesis followed the process of open, axial and selective coding, but not strictly in every detail. Therefore, some mechanisms of grounded theory, such as a predominantly inductive reasoning with primarily constructing codes and categories from the data instead of deducting from theoretical propositions (Charmaz 2006) were not applied. This is caused by the complexity at hand and the resulting challenges for a cumulative thesis whilst providing coherent yet independent research articles. Thus, since each article contributes a part to the knowledge on the wide research area of agile IT functions, IT governance and/or business IT alignment, the respective analysis focused on one or a small number of selected topics instead of covering the width of the theoretical concepts via inductive reasoning. As result, examining all the existences and potential complex as well as multiple interrelations of the various elements within agile IT functions, IT governance and/or business IT alignment was not applicable for this single doctoral thesis.

As a consequence, the analyses predominantly followed an abductive approach for analyses in order to let the data speak for itself, instead of restraining the inquiry by solely preselecting codes from a specific theoretical perspective. Whilst researchers on phenomenon-driven research are right in their assumption that "*selecting one theoretical frame over others restricts the researcher from more eclectically drawing on a multitude of more appropriate theoretical insights or in developing alternative theoretical insights grounded in the empirical material*" (Schwarz and Stensaker 2014, p. 489), a theoretical frame, however, provides guidelines for a common ground in order to structure complexities within the phenomenon to a manageable size. Since shaping the IT function for agility is of such a high complexity, involving a plethora of actors from the operational, tactical and strategic level, such a focus was helpful for providing manageable insights for publications as well as for outlining and limiting the scope of the dissertation. Thus, theories were also used to structure the empirical insights in order to position the study and the phenomenon, or to build new theory based on the existing framing if applicable (Schwarz and Stenskaer 2014).

The process starts with assigning codes based on the abstracts of the manifestation of theoretical concepts of organizational agility and different areas of the influencing theoretical concepts of business IT alignment, IT governance in general or specific decision areas such as portfolio management and enterprise architecture management, whilst conducting an open coding of the empirical insights. In turn, for concepts not covered by the a-priori codes, open codes by using descriptive labels with words from the material where possible have been assigned. Thus, assigning codes line by line, e.g., to concepts in the transcripts that are not included in the respective theoretical models, was a main component to all analyses. Via constant comparison among the codes, they have been consolidated within the code areas by the codes' common character. This process of constant comparison was then repeated across the code areas until the final theory-inductive aggregated code area emerged. During the whole process, the findings were discussed among the involved researchers and iteratively refined.

The analysis of the literature was conducted in a similar manner. By following the concept of a qualitative document analysis (Bowen 2009), the literature was analysed along the theoretical commonalities. Thus, the underlying theoretical concepts of bimodal IT and agility as well as IT governance and/or business IT alignment served as structure. For example, the two modes of bimodal IT were used for structuring the identified articles from practice in the literature search (see section 3.2). However, as the modes did not include specifications regarding their operationalization, the dimensions of architecture, processes and structures have been derived through inductively comparing the papers' content. The concept-centric approach (Webster and Watson 2002) was also followed when presenting the findings in order to grasp the breadth and heterogeneity of the different underlying components of each concept of inquiry. In addition, this enables discovering recognizable patterns and subdividing topics into units of analysis (Webster and Watson 2002). As a consequence, concept-oriented analyses allow better and more rigorous arranging, discussing, and synthesizing of prior research (Vom Brocke et al. 2009).

4 Publications

Eight publications address and answer the research questions of this thesis: all of them have been published by well-reputed conferences or are currently under review in such a conference. This section briefly introduces all included publications (cf. Table 9 – Table 16).

Chapter 9: Bimodal IT: Business-IT Alignment in the Age of Digital Transformation (P1)

Table 9: First Publication of the Cumulative Thesis.

Citation	Horlach, B., Drews, P. and Schirmer, I. 2016. "Bimodal IT: Business-IT alignment in the age of digital transformation," in *Proceedings of the Multikonferenz Wirtschaftsinformatik (MKWI)*, Ilmenau, Germany, pp. 1417-1428.
Ranking	WKWI: C VHB-JOURQUAL 3: D CORE Ranking: -
Type	Completed Research Paper
Track	Strategisches IT-Management
Addressed Research Question	RQ 1: How is the IT function shaped for organizational agility? RQ 3: How to align business strategy, IT strategy, business operations and IT operations for organizational agility?
Aim	This paper aims at outlining the concept of a bimodal IT organization. Furthermore, the paper strives to identify the theoretical background from an IS research perspective for managing bimodal IT setups as well as and derive implications for future research.
Methodology	Systematic Literature Review
Contribution	The paper contributes to practice, as it outlines a bimodal IT organization with its constituting parts of IT architecture, processes and skills. In addition, it reflects on the critical discussion on the usefulness of establishing two separate IT modes. Concerning academia, this article introduces the concept of a bimodal IT organization to IS research by highlighting its systemic effect on the IT function. It further links the concept to the theoretical debate on IT governance by showing governance as linking mechanism. The same applies to the theoretical concept of business IT alignment, which require new ideas for aligning the IT modes with each other and to the business.
Co-authors & contribution	The paper is co-authored with Paul Drews and Ingrid Schirmer. Paul Drews recommended to link the bimodal IT concept to the theoretical model of business IT alignment. Both gave substantial feedback on the presentation and discussion of the results as well as providing ideas for supporting illustrations of the concept.

Chapter 10: Increasing the Agility of IT Delivery: Five Types of Bimodal IT Organization (P2)

Table 10: Second Publication of the Cumulative Thesis.

Citation	Horlach, B., Drews, P., Schirmer, I. and Böhmann, T. 2017. "Increasing the Agility of IT Delivery: Five Types of Bimodal IT Organization," in *Proceedings of the 50th Hawaii International Conference on System Sciences (HICSS)*, Waikoloa Village, USA, pp. 5420-5429.
Ranking	WKWI: B VHB-JOURQUAL 3: C CORE Ranking: A
Type	Completed Research Paper
Track	Practice-based IS Research (Minitrack) /Organizational Systems and Technology (Track)
Addressed Research Question	RQ 1: How is the IT function shaped for organizational agility? RQ 3: How to align business strategy, IT strategy, business operations and IT operations for organizational agility?
Aim	The focus of this paper is to extend the knowledge on the first paper with empirical evidence on how companies realize a bimodal IT organization. In addition, it strives to reveal more in-depth insights on the effect of a bimodal IT organization on IT governance and business IT alignment as linking mechanisms among the modes and towards the business.
Methodology	Cross-Industry Expert Interviews
Contribution	The paper contributes one of the first empirical insights on the nature of bimodal IT within IS research. The paper further uncovers that the selection of a type mainly relies on the existence and/or need of internal digital skills. By providing a collection of mechanisms for realizing a bimodal IT organization, the paper final provides an initial about the landscape on applied methods.
Co-authors & contribution	The paper is co-authored by with Paul Drews, Ingrid Schirmer, and Tilo Böhmann. All remaining authors gave substantial feedback on the presentation, visualization as well as the discussion of the results.

Chapter 11: Bimodal Enterprise Architecture Management: The Emergence of a new EAM Function for a BizDevOps-based Fast IT(P3)

Table 11: Third Publication of the Cumulative Thesis.

Citation	Drews, P., Schirmer, I., Horlach, B. and Tekaat, C. 2017. “Bimodal Enterprise Architecture Management: The emergence of a new EAM function for a BizDevOps-based fast IT,” in *Proceedings of the IEEE 21st International Enterprise Distributed Object Computing Workshop (EDOCW)*, Québec City, Canada, pp. 57-64.
Ranking	WKWI: B VHB-JOURQUAL 3: - CORE Ranking: B
Type	Completed Research Paper
Track	-
Addressed Research Question	RQ 1: How is the IT function shaped for organizational agility? RQ 2: How to design IT governance decision areas for organizational agility?
Aim	This paper aims to understand how a bimodal IT organization affects the function of enterprise architecture management (EAM). This includes the identification on the locus of architectural decision-making and governance as well as the responsibilities within and across the modes. This aims at extending the link of the research areas of EAM and agility within IS research with the novel angle of a bimodal IT organization.
Methodology	Cross-Industry Expert Interviews, Corporate Document Elicitation
Contribution	This paper contributes to IS research by showing that a bimodal IT organization leads to an additional dimension of bimodality by having a bimodal EAM. The article further provides insights on how to shape bimodal EAM by outlining and comparing the role description of enterprise architects in traditional and agile IT organizations, showing the effects on the process and models of EAM and by deriving guidelines on how to introduce such a setting.
Co-authors & contribution	The paper is co-authored by with Paul Drews, Ingrid Schirmer, and Carsten Tekaat. Paul Drews and Ingrid Schirmer developed the paper’s idea and design, and wrote its results. I contributed the theoretical foundations and continuously revised the paper. Together with Carsten Tekaat, I further provided empirical background information on the shared research project that the results stem from.

Chapter 12: IT Governance in Scaling Agile Frameworks (P4)

Table 12: Fourth Publication of the Cumulative Thesis.

Citation	Horlach, B., Böhmann, T., Schirmer, I. and Drews, P. 2018. "IT Governance in Scaling Agile Frameworks," in *Proceedings of the Multikonferenz Wirtschaftsinformatik (MKWI)*, Lüneburg, Germany, pp. 1789-1800.
Ranking	WKWI: C VHB-JOURQUAL 3: D CORE Ranking: -
Type	Completed Research Paper
Track	Strategisches IT-Management
Addressed Research Question	RQ 1: How is the IT function shaped for organizational agility? RQ 2: How to design IT governance decision areas for organizational agility?
Aim	This paper strives for creating an understanding on how IT governance is reflected within large-scale agile IT organizations by analysing corresponding scaling agile frameworks that encompass both the team, cross-team and (sometimes) organizational level. Scaling agile frameworks are a prominent way to introduce the agile values and mind-set within IT organizations, as they provide a blueprint for how to setup large-scale agile IT organizations.
Methodology	Systematic Literature Review
Contribution	The paper contributes a link of agility, IT governance and business IT alignment research by providing a systematization of scaling agile frameworks regarding alignment as well as 'control' dimensions along the five domains of IT governance following Weill and Ross (2004). The paper also provides a collection of mechanisms for enabling agility in relation to IT governance.
Co-authors & contribution	The paper was co-authored with Tilo Böhmann, Ingrid Schirmer and Paul Drews. Tilo Böhmann contributed to the idea of the paper by proposing to structure the findings along the theoretical framing of the IT governance domains following Weill and Ross (2004). All remaining authors provided feedback on the introduction, discussion, and conclusion of the paper.

Chapter 13: Agile Portfolio Management: Design Goals and Principles (P5)

Table 13: Fifth Publication of the Cumulative Thesis.

Citation	Horlach, B., Schirmer, I. and Drews, P. 2019. "Agile Portfolio Management: Design Goals and Principles," in *Proceedings of the 27th European Conference on Information Systems (ECIS)*, Uppsala-Stockholm, Sweden, pp. 1503-1520.
Ranking	WKWI: A VHB-JOURQUAL 3: B CORE Ranking: A
Type	Completed Research Paper
Track	Rethinking IS Strategy and Governance in the Digital Age
Addressed Research Question	RQ 2: How to design IT governance decision areas for organizational agility?
Aim	The goal of this paper is to outline how to establish an effective portfolio management when striving for organizational agility. In order to not restrict the findings to a specific organizational context, the insights aim to represent meta-requirements and principles of form and function in form of design goals and principles.
Methodology	Design Science Knowledge Creation based on Focus Group Sessions, Field Visits, and Literature Review
Contribution	The main contribution of this paper are the prescriptive design goals and principles of portfolio management when striving for organizational agility. Together with the collection of exemplary mechanisms, the exemplary presentation on how the design goals and principles have been applied by a case organization and the testable proposition as the 'checklist' on the contribution of principles to agility, the paper presents an actionable design knowledge on how to integrate agility within a portfolio management system. By reflecting the proactive nature of agility, it further extends the existing knowledge in this research area.
Co-authors & contribution	The paper was co-authored with Ingrid Schirmer and Paul Drews. Both contributed to the paper by revising the introduction, the design and description of the design goals and principles as well as the conclusion.

Chapter 14: Everyone's Going to be an Architect: Design Principles for Architectural Thinking in Agile Organizations (P6)

Table 14: Sixth Publication of the Cumulative Thesis.

Citation	Horlach, B., Drechsler, A., Schirmer, I. and Drews, P. 2020. "Everyone's Going to be an Architect: Design Principles for Architectural Thinking in Agile Organizations," in *Proceedings of the 53th Hawaii International Conference on System Sciences (HICSS)*, Wailea, USA, pp. 5420-5429.
Ranking	WKWI: B VHB-JOURQUAL 3: C CORE Ranking: A
Type	Completed Research Paper
Track	Agile and Lean: Organizations, Products and Development (Minitrack)/ Software Technology (Track)
Addressed Research Question	RQ 2: How to design IT governance decision areas for organizational agility?
Aim	This paper aims to understand and outline how architectural decisions are made in organizations that move towards agility. This knowledge creation shall answer the question on whether and how architectural thinking may support the tension of local optima within autonomous agile teams and the corporate global optimum.
Methodology	Design Science Knowledge Creation based on Cross-Industry Expert Interviews, Field Visits, Literature Review and Corporate Document Elicitation
Contribution	This paper contributes to the debate on EAM and agility by creating an understanding on how everyone develops an architectural mind-set within in agile organizations based on six prescriptive design principles of agile architectural thinking. For acting on the general design principles, the article further provides a collection of mechanisms for enabling agile architecture management.
Co-authors & contribution	The paper was co-authored with Andreas Drechsler, Ingrid Schirmer and Paul Drews. All remaining authors contributed to the design of the paper by revising the introduction, the design principles' design and description as well as the conclusion.

Chapter 15: Reconceptualising Business-IT Alignment for Enabling Organisational Agility (P7)

Table 15: Seventh Publication of the Cumulative Thesis.

Citation	Horlach, B., Drews, P., Drechsler, A., Schirmer, I. and Böhmann, T. 2020. "Reconceptualising Business-IT Alignment for Enabling Organisational Agility," in *Proceedings of the 28th European Conference on Information Systems (ECIS)*, A Virtual Conference.
Ranking	WKWI: A VHB-JOURQUAL 3: B CORE Ranking: A
Type	Completed Research Paper
Track	Rethinking IS Strategy and Governance in the Digital Age
Addressed Research Question	RQ 3: How to align business strategy, IT strategy, business operations and IT operations for organizational agility?
Aim	This paper aims to answer the question on how business IT alignment is shaped by organizations striving for organizational agility. While IS research identified a positive effect of agility on business IT alignment, the concrete effect has not been yet provided. As result, this paper aims at providing knowledge on how to design organizations for organizational agility and the reasoning behind the design.
Methodology	Design Science Knowledge Creation and Sense-Making based on Cross-Industry Expert Interviews, Field Visits, Focus Group Sessions, Literature Review and Corporate Document Elicitation
Contribution	This paper contributes to the understanding on how organizational agility affects the theoretical concept of business IT alignment in three ways. First, the article uncovers the gap of alignment and agility by revealing concrete challenges that companies striving for agility (may) face regarding alignment. Second, design goals and design principles provide a knowledge base for acting upon the challenges and realize alignment in organization when striving for agility. Finally, the findings show the reasoning behind the design knowledge by re-conceptualizing business IT alignment, using the SAM model of Henderson and Venkatraman (1993).
Co-authors & contribution	The paper was co-authored by Bettina Horlach, Paul Drews, Andreas Drechsler, Ingrid Schirmer and Tilo Böhmann. All remaining authors contributed to the paper by revising the introduction, the artefact's design description and the conclusion.

Chapter 17: Appendix A: Steering IT For Speed and Dexterity – Towards Re-Shaping IT Governance forOrganisational Agility (P8)

Table 16: Eighth Publication of the Cumulative Thesis.

Citation	Horlach, B., Drews, P., Drechsler, A., Schirmer, I. and Böhmann, T. 2021. “Steering IT for Speed and Dexterity - Towards Re-Shaping IT Governance for Organizational Agility,” Under Review for *Proceedings of the 29th European Conference on Information Systems (ECIS)* 2021
Ranking	-
Type	Completed Research Paper
Track	-
Addressed Research Question	RQ 2: How to design IT governance decision areas for organizational agility?
Aim	This paper strives for uncovering how the IT governance decision areas of Weill and Ross (2004) and the resulting responsibility structures are affected by striving for organizational agility, independent from the shape of each individual area. Although IS research provides such insights on singular decision areas in recent times, they do not act in isolation. Thus, this calls for an overarching analysis on the underlying effects on what to govern in IT functions for agility and how to govern it as a result.
Methodology	Sense-Making based on Cross-Industry Expert Interviews, Focus Group Sessions, Field Visits and Literature Review
Contribution	This paper contributes to the understanding how organizational agility affects the theoretical concept of IT governance with two main contributions. First, the findings uncover the underlying principles how and why the five IT governance decision areas of Weill and Ross (2004) change when striving for agility. Second, the principles reveal the-re-conceptualization of IT governance for agility towards ‘Ecosystem co-evolution governing’with a definition of the concept and a corresponding graphical representation for its visualization.
Co-authors & contribution	The paper was co-authored by Bettina Horlach, Paul Drews, Andreas Drechsler, Ingrid Schirmer and Tilo Böhmann. All remaining authors contributed to the paper by revising the introduction, the results and the conclusion.

5 Theoretical Contribution

As "*developing theory is what we are meant to do as academic researchers and it sets us apart from practitioners and consultants*" (Gregor 2006, p. 613), this thesis predominantly strives for being scientifically useful (Ågerfalk 2014) by providing novel insights and originality to the theoretical discourse on the phenomenon of shaping the IT function for agility in order to fulfil IT's role as business enabler, and on how (selected) IT governance decision areas and business IT alignment change in this regard. In general, usefulness can be achieved by describing the phenomenon and explaining their regularities (the 'what') with *Ω knowledge* and/or by providing prescriptive artifacts and design theories for outlining 'how' to design the phenomenon with *Λ knowledge* (Gregor and Hevner 2013). This chapter shows how such types of contribution to scientific knowledge are achieved with the findings. First, the overall theoretical contribution is summarized. Second, the individual contributions are highlighted along the lines of the theoretical concepts that are changed by agility

5.1 Overall Theoretical Contribution

In general, the thesis makes two major contributions, following the two research goals of the thesis (see Figure 5). First, it provides how and why IT function changes due to agility for addressing the analytical goal. Thus, it provides *descriptive Ω knowledge* (Gregor and Hevner 2013) by uncovering and outlining the character about the phenomenon of shaping the IT function for agility (Type I theory, Gregor 2006) (RQ1). This descriptive knowledge is also *explanatory* to some degree (Type II theory, Gregor 2006), as it shows potential regularities of the phenomenon (Gregor and Hevner 2013) as reasoning for their shape, particularly by reflecting the findings through the lens of IT governance and business IT alignment. Second, the thesis provides *pre-theoretical design Λ knowledge* by design theorizing (Drechsler and Hevner 2018) first design principles on how to change IT governance (RQ2) and business IT alignment (RQ3) for achieving agility (Type V theory, Gregor 2006). In addition, the design-oriented research goal is addressed with *pre-theoretical explanatory Ω knowledge*, which shows why IT governance and business IT alignment do change (Type II theory, Gregor 2006). Yet, since the knowledge goals go hand in hand, the contributed knowledge may not exclusively address one goal only, but rather intertwine multiple to some extent – particularly concerning the design knowledge and its fundament of describing the phenomenon first.

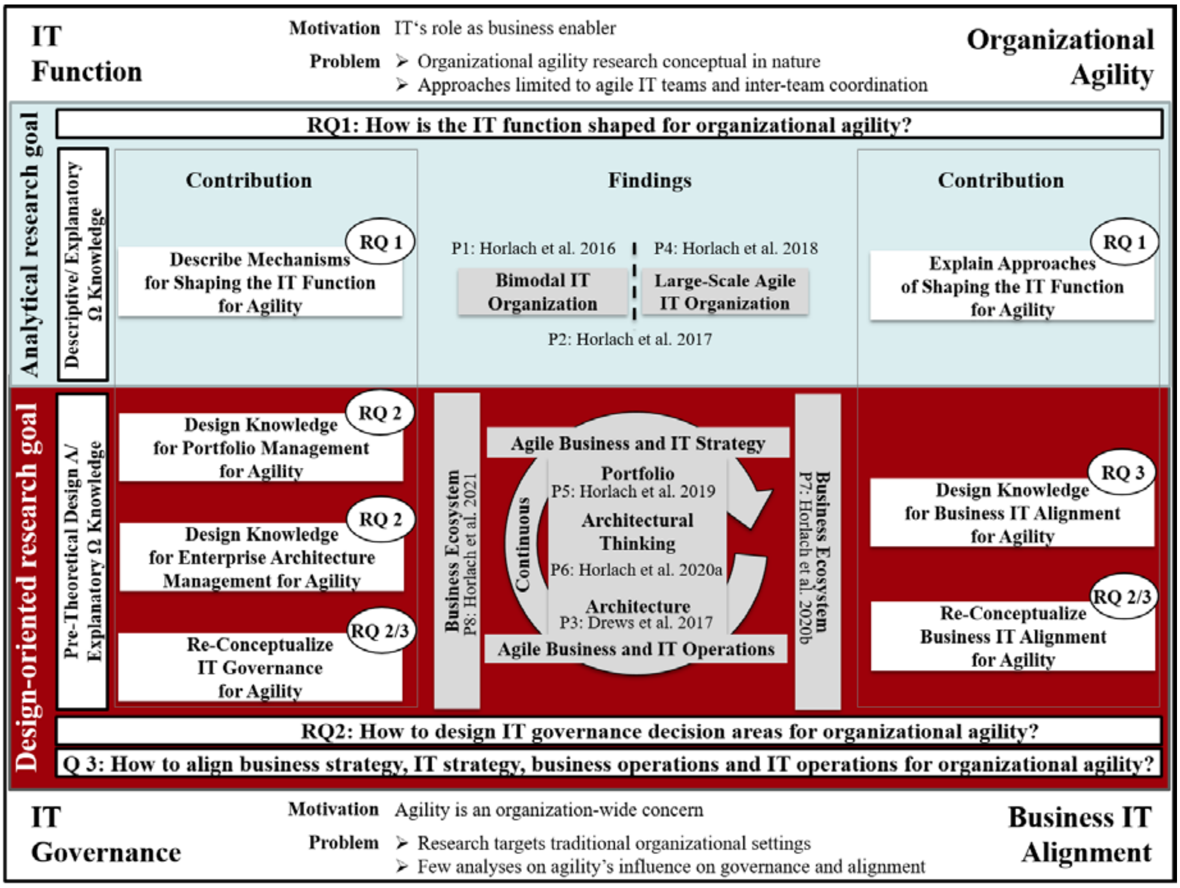

Figure 5: Overall Theoretical Contribution.
Source: Own Representation.

Regarding **descriptive knowledge for shaping the IT function for agility,** the thesis makes two contributions for research: (1) *describing the mechanisms within the IT function that are affected by the transformation towards achieving increased agility* and (2) *describing how organizations approach agility within their respective IT function*. The first extends existing knowledge on introducing agility within the IT function, especially concerning (scaling of) agile values and principles on the one hand and the conceptual discourse of required IT capabilities for organizational agility on the other hand, by showing that agility as organization-wide concern moves beyond the IT function and needs evaluation of the alignment of business and IT in particular. As a result, the whole IT function with its strategy and governance, IT architecture, processes and the organization, is under scrutiny in order to enable ease, speed and dexterity (Horlach et al. 2016). By moving the focus beyond the IT function and towards the enabling role of alignment of business and IT, the mechanisms of shaping the IT function also extend the academic discourse on how to achieve agility on the organizational level. To be specific, by revealing that shaping the IT function for agility relies on the alignment of the IT function and the corporate objectives, IT governance is a linking mechanism for enabling the fast delivery of products, services or business models for the business whilst calling for fast responsiveness and flexibility (Horlach et al. 2016, 2017, 2018).

Describing how organizations approach agility within their respective IT function also contributes to the existing academic discourse on organizational agility and the IT function's role in it. On the one hand, providing the first academic analyses on the trend of bimodal IT organizations (Horlach et al. 2016, 2017; Drews et al. 2017) and being a pioneer in collecting and structuring scaling agile frameworks for analysing the second trend of large-scale agile IT organizations (Horlach et al. 2018) extends the IS research knowledge by introducing both trends to the academic debate on organizational agility, IT capabilities and scaling agile values and methods. On the other hand, including the notion of IT governance and business IT alignment within these analyses also contributes to closing gaps on existing research on organizational agility and scaling agile values and methods by linking the organizational level with the IT operational level and by explaining on how agility is embedded within the IT function beyond scaling a singular agile method and the reasoning behind (Horlach et al. 2016, 2017, 2018; Drews et al. 2017).

Consequently, the contributions are perceived as useful for IS research, as they opened up the discourse on delving deeper into the phenomenon of shaping IT functions for agility. With more than 100 citations of the publications, particularly concerning the character and outline of bimodal IT organizations (Horlach et al. 2016), the contributions spurred IS research to understand agility on the level of IT functions in much greater depth. To be concrete, the insights accompanied or served as the foundation for a series of adjacent analyses on finding the 'optimal' shape of the IT function for agility and the underlying critical success factors (Fuchs and Hess 2018; Gerster et al. 2020; Haffke et al. 2017; Holotiuk et al. 2018; Leonhardt et al. 2017).

Furthermore, the thesis contributes to the IT governance and business IT alignment research by providing both **pre-theoretical design knowledge** on how to *realize selected agile IT governance decision areas (RQ2) and how to achieve agile alignment of business strategy, IT strategy, business operations and IT operations* (RQ3), and **explanatory knowledge** on the *reasoning behind the changes due to moving towards agility*. To be specific, the design knowledge extends the existing knowledge base on agile IT governance decision areas of portfolio and enterprise architecture management (EAM) by introducing generalized design implications to the predominantly descriptive debate on EAM for agility (Horlach et al. 2020a) and by broadening the existing perspective of descriptive and design knowledge on agile portfolio management towards proactive thinking (Horlach et al. 2019). In addition, the design goals and principles contribute by informing the rationale behind the design elements and activities, independent from an individual shape of the IT function. Moreover, the design knowledge within the thesis also enables opening up the debate across the IT governance decision areas by outlining a potential path how IT governance will change as a whole when striving to enhance agility (Horlach et al. 2021). The same applies to the discourse on agile business IT alignment with highlighting the overall change to business and IT strategy, business and IT operations and their cross-linkages (Horlach et al. 2020b). As a result, the design goals, principles and features aid both researchers and practitioners with an understanding of what design activities can help them adopting agility within their IT department, through IT governance decision areas and business IT alignment. Furthermore, the design goals, principles and features extend existing design knowledge and frameworks that either target individual practices or non-generalizable blueprints for an agile organizational setup without showing alternative approaches.

Finally, the contributions to the explanatory knowledge base provide insights on research on shaping IT functions, IT governance and business IT alignment for agility. By showing that it is beneficial for the whole organization to engage with the surrounding ecosystem for sensing changes and continuous organizing – including reshaping IT function and beyond, governing IT and business and aligning across the organization – the knowledge illustrates the shortcomings of designing an IT function for agility solely from the IT function perspective and the importance of engagement across the whole enterprise. On the one hand, this contributes to the ongoing discussion on how to acknowledge the power and impatience of today’s customers (Denning 2016c) and the resulting continuity in change due to their volatility (Conboy 2009), by providing tangible insights for its realization. On the other hand, the explanations, combined with the design knowledge, contribute to the discussion on how to enable this thinking across the organization by extending their view towards the strategic and the enterprise level instead of being limited to solely focusing on analysing the IT function. To be concrete, the focus on the common outside-in yet flexible focus on the ecosystem with the mind-set, strategies and structures extends the current academic debate on assuring continuous commitment of everyone

– business and IT – within the organization towards understanding the customer, but simultaneously including openness for change within corporate solutions towards fulfilling their needs (Bharadwaj et al. 2013). As a consequence, the thesis provides an initial understanding that agility means stepping out of the traditional boundaries of IT governance and business IT alignment and moving towards a converged outside-in view and commitment through strategies and plans and increasingly corresponding structures.

5.2 Contributions to Shaping IT Functions for Agility

5.2.1 Describe the Mechanisms for Shaping the IT Function for Agility

As IT plays an important role in enabling the sensing and responding capabilities of firms, IT is one of agility's enabling factor (e.g., Chakravarty et al. 2013; Lu and Ramamurthy 2011; Lui and Piccoli 2007). For either directly enabling fast moves with an adaptive IT architecture (Tiwana and Konsynski 2010; van Oosterhout et al. 2006) or indirectly with improving a firm's process and knowledge reach and richness (Overby et al. 2006; Sambamurthy et al. 2003), agility implies a high speed of IT adoption (Hovorka and Larsen 2006), the timely access to, and use of IT, rapidly IT development, implementation, modification, and maintenance (Conboy 2009; Lowry and Wilson 2016), and the ability to take advantage of IT capabilities for business (Lowry and Wilson 2016; Lu and Ramamurthy 2011). Since research on organizational agility is of a rather conceptual nature, most analyses on its interrelation to IT capabilities largely do not answer the question on how to shape the organization for realizing the call for agility and the IT function as IT's traditional custodian in particular. The research stream on introducing and scaling agile principles for software development also provides limited insights in this regard (Dingsøyr 2010; Vidgen and Wang 2006) due to the lack of a 'theoretical glue' binding some agile practices and methods to agility as strong underlying logic and rationale (Conboy 2009). Thus, the practices primarily target scaling agile methods as 'doing agile' instead of giving guidance on how to 'be agile' by looking at agility as the aspired outcome (Denning 2016a). In addition, analyses on scaling agile principles primarily address isolated mechanisms such as communities of practice for the optimal coordination and setup of an agile team and the inter-team coordination (Paasivaara and Lassenius 2014, 2016), other IT operational domains such as IT operations or frameworks for more comprehensive agile software development 'systems' (Dingsøyr and Moe 2014; Kettunen and Laanti 2008; Rolland et al. 2016) without taking into account how to manage these domains.

To overcome the limitation of agility and the IT function within academia, Horlach et al. (2016) provide the first academic link of the views by analyzing the mechanisms for enabling a bimodal IT organization that, unlike prior approaches on structuring the IT function for speed and flexibility within software development and DevOps (Dikert et al. 2016), also takes into account the surrounding managerial context. In addition, the description of a bimodal IT organization not only reveals individual mechanisms, but highlights that skills, processes, organizational structures and IT architecture as well as the leadership model with IT governance and business IT alignment change for agility. This overcomes the singular view on agility by uniting the scattered and partial solutions such as a flexible IT architecture (van Oosterhout et al. 2006) or ease in internal knowledge processes (Sambamurthy et al. 2003). In particular, describing the changes to IT leadership, IT governance and business IT alignment as linking mechanisms within the IT function and to the business, contributes to being able to balance aligning the IT resources and capabilities with each other and to the company's objectives whilst allowing timely access to, and use of IT and fast adoption of IT. By explicitly applying the theoretical lenses of IT governance and business IT alignment, the findings step out of the traditional IT-centric IS research concerning shaping parts of the IT function for agility and move towards the organization as a unit of analysis for analyzing how to 'be agile' (Denning 2016a). In other words, the results open up the academic discourse on how to shape the IT function for the aspired outcome of agility by serving as some kind of 'common denominator' for the insights from the other research streams.

Thus, the thesis' findings point towards agile teams being a good starting point for introducing the agile mindset and speed within the IT function, but is to be accompanied by the adjacent management and governing organization. Whilst some scaling agile frameworks include such a systemic perspective, the thesis is one of the first academic contributions that provides this holistic view with a focus on how to design IT governance for agility. As such, the findings extend the call for combining agility and IT governance capabilities (Luna et al. 2015, 2019) by outlining the theoretical conceptualization with concrete insights instead of merely arguing for such a link. This also supports embedding insights on applied practices (Vejseli et al. 2018, 2019, 2020) within a 'governance system' that includes both an overarching view across the IT governance decision areas and more in-depth knowledge on how to design them. Finally, the findings contribute to the agility literature, which is mainly focused on the organization as the unit of analysis with few exceptions around process agility (Tallon et al. 2019), by concretizing the underlying organizational concepts and their relations. Those insights may lead to future conceptual analyses by reflecting potential candidates such as, e.g., short and cadenced portfolio cycles or a common strategic and/or architectural vision that may facilitate and/or inhibit agility.

5.2.2 Explain Approaches for Shaping the IT Function for Agility

With agility increasingly moving into organizations for realizing fast adoption of IT and timely development and use of IT capabilities in particular (Hovorka and Larsen 2006; Lowry and Wilson 2016), understanding how to realize an agile IT function is an area of concern for research on organizational agility, its IT capabilities and introducing and scaling agile values and methods – especially in the latter research stream. Emphasis has been given to describing how autonomous agile teams are formed for decentralized decision-making (Dingsøyr and Moe 2014; Moe et al. 2009; Moe et al. 2019), scaled with single agile methods and practices (Dingsøyr et al. 2014b; Paasivaara and Lassenius 2014, 2016), leaving the governance of the shape of IT functions for agility out of scope. Alternatively, analyses on scaling agile values describes the steps in the overall transformation towards an agile IT function (Conboy and Carroll 2019; Dingsøyr et al. 2019b; Fuchs and Hess 2018), e.g., with the aid of scaling agile frameworks, and the underlying challenges (Dikert et al. 2016; Hekkala et al. 2017; Rolland et al. 2016), yet also shy away from describing the target state for shaping the respective agile IT function. This target is predominantly reflected in the scaling agile frameworks, which are valuable input in this regard as blueprints of the a large-scale agile IT organization (Disciplined Agile Consortium 2020; Scaled Agile 2020; XSCALE Alliance 2020), at least for inter-team coordination for accelerated and autonomous agile software development and IT operations.

The analyses of Horlach et al. (2017, 2018) revealed that realizing a fast adoption of IT and timely development and use of IT capabilities for enabling fast and adaptive reactions to changing customer needs is only one side of the coin of agility within the IT function. In addition, IT functions still ought to fulfill their traditional role of enabling stability and predictability as well as scalability, risk aversion and cost savings to secure business operations with IT at any time. This broadens the conceptual understanding of the agility of IT function by putting guardrails – and limitations at the same time – on how to respond to the call for timely use and provision of IT capabilities and rapid IT adoption (Hovorka and Larsen 2006; Lowry and Wilson 2016). To be concrete, uncovering the underlying requirements for shaping the IT function for agility contributes that agile handling of the IT capabilities is the continuous balancing of flexibility and speed of IT delivery vs. operational excellence of IT systems. This balancing also may include the notion of innovation, either integrated in the call for flexibility or as a third separate concern (Horlach et al. 2016), since enabling speed in the delivery may not always require thinking ‘out of the box’ and derive radically new products and services.

Next to explaining that agility actually implies a balance of stable operations vs. flexibility within IT functions, instead of solely pursuing speed, Horlach et al. (2017, 2018) further contribute to the academic debate on shaping the IT function by describing that striving for realizing the balance leads to different shapes of the IT function, despite the call of scaling agile frameworks that solely put emphasis on a one-size-fits-all large-scale agile blueprint for the IT function. Generally, this involves following one of two trends: a bimodal IT and a large-scale agile IT organization (Horlach et al. 2016; 2017). A bimodal IT organization strives to solve the balance by separating the concerns of stability and speed in delivery due to their different aspired outcome and corresponding organizational requirements. Some again perceive that speed in delivery and innovation propose different requirements, so that they are to be split up further within the agile modus by distinguishing exploration of disruptive (customer-oriented and/or digital) innovations vs. exploiting existing products and services and their timely delivery, called trimodal IT. Depending on the organization, this differentiation may be permanent or temporary for each individual context depending on its specific requirements for the IT function, leading to a multimodal IT organization. In turn, large-scale agile IT organizations handle both agility and stability within their whole IT department – sometimes even towards the business side. Thus, instead of coordinating different concerns and modes of work, they involve one way of working and governing throughout the (IT) organization.

Finally, the approaches on shaping the IT function for agility describe that the trends of bimodal IT and large-scale agile IT organization include multiple types and explain the reasoning behind the plurality (Horlach et al. 2017, 2018). Whilst some solely integrate agile methods within the software development, others establish an agile mode within a single project or by setting up an agile unit. Some move towards agility throughout the IT organization and/or the digital business units next to the remaining business (see Figure 6). The difference on the individual approach is mainly due to the current scarcity of resources and capabilities for realizing digital customer-oriented services in a rapid way and with the required extent of radical and disruptive innovation. Thus, the choice for a specific approach is inextricably linked to the sourcing strategy (Horlach et al. 2017). Furthermore, the organization’s future plans for the company and the concrete market environment serve as influencing factors. This conceptualization with types of approaches as well as criteria for selecting a strategy on how to enable agility with and within the IT function has clarified the proposed approaches by consultancies by showing that the choice of a specific response requires in-depth knowledge on the aspired goal with the IT function, meaning the degree of proximity to the customer, extent of required innovativeness or kind of speed shape its concrete outline.

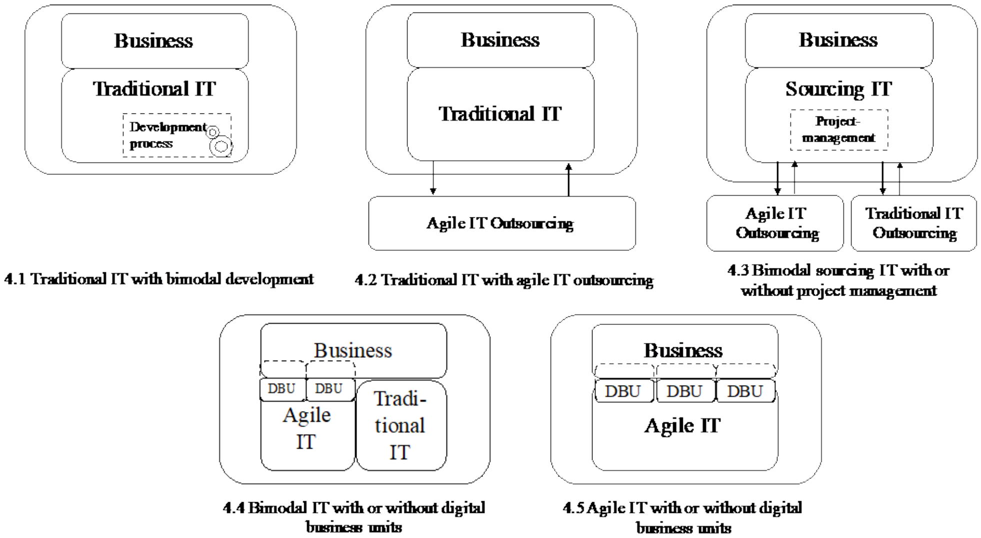

Figure 6: Overview on Identified Bimodal IT Types.
Source: Horlach et al. (2017).

In sum, Horlach et al. (2016, 2017, 2018) show that shaping IT functions for agility involves multiple design decisions based on the individual situation. With revealing initial selection criteria such as sourcing for overcoming skill shortages and the choice of a favored way of working by either separating or bundling responsibilities within the IT function, the findings span a foundation for more in-depth analysis on contingency factors. In this regard, the focus on speed vs. innovation vs. efficiency is an insightful baseline for selecting how to outline the individual IT department.

5.3 Contributions to IT Governance

5.3.1 Design Knowledge for Portfolio Management for Agility

As IT governance is integral for shaping the IT function for agility as linking mechanism across the organization, the demand for agility especially imposes changes for portfolio management as bottleneck for planning and managing the IT resources and capabilities (Luna et al. 2010, 2019). Research on planning agile organizations has picked up the role of portfolio management, particularly by proposing iterative agile portfolio tasks such as rolling wave (Daniel et al. 2014), event-based (Bogsnes 2009) or continuous portfolio planning (Suomalainen et al. 2015b) for timely delivery and evaluation, via its detailed plans for early periods and vague outlines for later ones (Rickards and Ritsert 2012) in short cycles (Krebs 2009) for the timely selection and prioritization of work, budget allocation and improvement (Bogsnes 2009; Hope and Fraser 2003). Emphasis is put on the portfolio process being carried out by a central portfolio management team that cascades down items (Hoffmann et al. 2017) and the teams pulling their work based on those directions (Disciplined Agile Consortium 2020; Laanti and Kangas 2015; Scaled Agile 2020).

Horlach et al. (2019) extend the academic debate in multiple ways with its pre-theoretical design knowledge on achieving agility by a portfolio management system with roles, processes and structures (see Figure 7). Next to confirming the need for short and iterative cycles (Krebs 2009; Suomalainen et al. 2015b), the design goals and principles recognize that the nowadays predominant structure of autonomous teams (Moe et al. 2019; Rolland et al. 2016; Tata and Prasad 2004) does not stop at the portfolio. Opposing other outlines of agile portfolio management (Hoffmann et al. 2017; Stettina and Hörz 2015), informed decentralizing decision-making with individual elements moving as independently as possible (Benbya and McKelvey 2006; Tanriverdi and Lim 2017) is an integral part of a portfolio management system. In line with scaling agile frameworks (Horlach et al. 2018), this leads to a high degree of freedom by teams being able to decide on the concrete work. Yet, the design knowledge also shows agility rather leads to ‘aligned autonomy’, but not towards the concrete work (‘what’ work is to be done) and methods (‘how’ is the work to be done). Instead, teams are guided by the aspired business outcome, which reflects ‘why’ the work has to be done (Horlach et al. 2019).

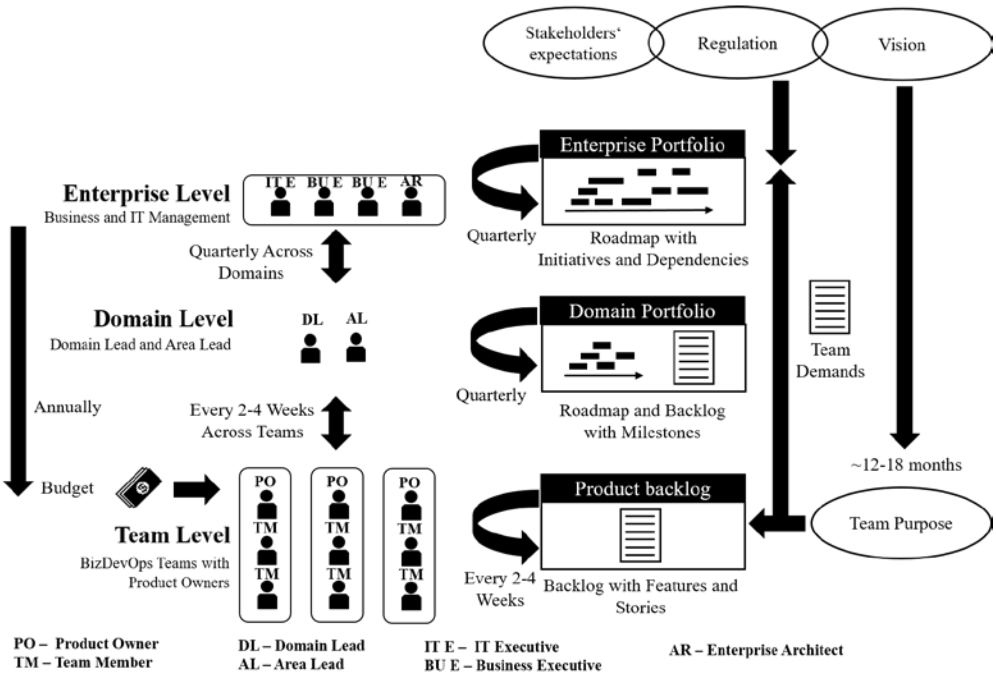

Figure 7: Exemplary Agile Portfolio Management System.
Source: Horlach et al. (2019).

In addition, as team members need to affect managerial decisions genuinely in order to benefit from self-management (Tata and Prasad 2004), a cycling back to top management further enables adaptivity by the company by adjusting (parts of) the overall direction in a rapid way based on customer insights by the teams. This leads to a second contribution of the design knowledge by actively linking the notion of innovation into the portfolio management system. To be concrete, purposefully encouraging teams for continuously re-evaluating their services, their customer needs and potential ideas and listening to their ideas within the planning cycles leads to new sources for (IT-enabled) innovation management on the one hand, and moreover extends the yet isolated debate on portfolio management for agility to the notion of the proactive stance as a main pillar for IT-enabled agility (Lu and Ramamurthy 2011; Sambamurthy et al. 2003).

Finally, Horlach et al. (2019) link the predominant IS-focused portfolio management research to organizational agility as an enterprise-wide concern by extending the notion of portfolio for agile software development (Stettina and Hörz 2015) towards a central enterprise portfolio management for enabling agility. First of all, implementing a converged vision and resulting overarching strategic goals contributes to a good practice for aligned autonomy with representing business and IT-oriented guardrails for teams’ decision-making (Moe et al. 2019;

Tata and Prasad 2004). The vision further aligns both business-related and technical overarching goals, providing a tangible good practice to the theoretical concept of the digital business strategy (Bharadwaj et al. 2013; Hess et al. 2016; Matt et al. 2015). In addition, merging business and IT-oriented portfolio planning opens up the debate on the relationships of portfolio to other IT governance decision areas such as IT principles and enterprise architecture management (EAM) for agility. Concerning EAM, a close connection is revealed, as architecture becomes more engrained in portfolio decisions with enterprise architects becoming portfolio advisers for evaluating the technological feasibility of solutions.

5.3.2 Design Knowledge for Enterprise Architecture Management for Agility

Next to portfolio management as an IT governance decision area for linking the strategic level with IT (and business) operations by steering the delivery and planning of IT resources and capabilities in a functional way, the call for an adaptive IT architecture (Chakravarty et al. 2013; Tiwana and Konsynski 2010; van Oosterhout et al. 2006) affects governance and decision-making on the enterprise architecture. Despite the autonomy of teams, agility implies that this is perceived as only being realistic if everyone has a clear blueprint of the IT architecture and its link to business functionalities (Canat et al. 2018; Fallmyr and Bygstad 2014), provided by enterprise architecture management (EAM) (Canat et al. 2018; Scaled Agile 2020; Uludağ et al. 2017; Uludağ et al. 2019a). Yet, EAM moves from predefining standards and controlling architectural changes in a top-down, centralized way with dedicated architects towards the consulting of teams' decision-making (Hanschke et al. 2015; Hauder et al. 2014; Uludağ et al. 2019b), solving intra- and/or cross-team issues with harmonizing governance requirements across teams and guiding them through the still present overall business and technical roadmaps (Martini et al. 2014; Uludağ et al. 2017; Uludağ et al. 2019a). This decentralized architectural decision-making increasingly leads to distributing architectural roles and responsibilities to 'non-architects' (Martini et al. 2014; Uludağ et al. 2019a), but with overall coordination across teams to the overall architectural guidelines (Uludağ et al. 2019b) for shared commitment to the common direction (Paasivaara and Lassenius 2014). Consequently, research sees the need for establishing an architectural thinking and awareness for non-architects instead of merely managing the architecture (Aier et al. 2015; Winter 2014).

The thesis makes two contributions on research towards agility and EAM. First, both Horlach et al. (2018) and Drews et al. (2017) confirm the propositions of prior research for decentralizing architectural decisions, at least within the agile mode of the IT organization, as a solution to the challenge by the autonomous team model (Dikert et al. 2016). In this regard, the description of a bimodal EAM (Drews et al. 2017) and EAM in scaling agile frameworks (Horlach et al. 2018) also extend the knowledge base on how to realize EAM for agility by revealing effects on the EA models, development process and tools and corresponding good practices. Finally, the notion of aligned autonomy for a shared commitment to a common direction, particularly regarding business concerns, infuses the discussion on how to guide the autonomous teams whilst still enabling flexibility.

The second main contribution to the academic spectrum of agility and EAM is broadening the awareness of architectural thinking and its integration in agile organizations with pre-theoretical design knowledge (see Table 17). In general, the principles address a set of aspects – both regarding the architecture content and the organizational setup – that may help to establish architectural thinking beyond traditional architecture functions or roles. Regarding the organizational setup, the design principles confirm the need for aligned autonomy (DP 4&6) in an architectural way for stepping out of local decision-making contexts and thinking about the ‘big picture’, predominantly infused by group-based approaches such as those in prior research (Paasivaara and Lassenius 2014).

Table 17: Design Principles of Architectural Thinking for Agility.
Source: Horlach et al. (2020a).

Design Principle	Rationale by Organizational Agility	Main Implications for Shaping AT
DP1: Architect around the business ecosystem	- Understand customer value & its creation - Identify business partners’ role in value creation - Continuously evaluate ecosystem for gaps	- Provide (linked) information about the ecosystem (e.g., customer value streams, customer & partner journeys)
DP2: Continuously map in- and external views	- Outline company’s role in value creation - Ongoing mapping & gap analysis of external demands with company’s value propositions and long-term strategic goals - Continuous mapping & gap analysis of external needs with operational internal delivery (e.g. service features)	- Provide (linked) information on enterprise vision, strategy, business model(s), external needs & problems - Integrate architecture in portfolio decision-making to analyze the link of (business) processes, capabilities & internal delivery with external needs
DP3: Create value-oriented architecture support	- Continuous alignment of internal service delivery to customer & business value - Ongoing monitoring that services fit to the expected value	- Support portfolio management in tailoring ‘ideal’ delivery organization - Put alignment mechanisms in place across the organization, e.g., shared purpose and metrics.
DP4: Empower local stakeholders to make	- Empower decision-making as much as possible within set frame (aligned autonomy)	- Decentralize architectural decisions as local as possible (e.g., skills in teams)

architectural decisions timely	- Enable fast, but informed decision-making	- Ensure fast support across company by, e.g., shared architecture service function
DP5: Provide long-term guidance for continuous architecting	- Foster continuous improvement & innovation (service, business model, process) - Enable adjustments to portfolio in case of novel/ complex locally derived innovations that require overarching decisions	- Establish collaboratively built and easily adjustable architectural vision - Consolidate and integrate models and data from time to time, e.g., via chapters - Support exchange among 'architects'
DP6: Make architecture discussable and visible	- Identify dependencies and collaboration partners early as possible, e.g., to resolve issues - Prevent unnecessary rework based on misunderstandings	- Enable non-architects to understand architectural models - Make architecture decisions & rationales transparent & easy to find

Regarding the architecture content, the principles the design principles open up the debate on the different parts of the architecture for agility. For instance, they reveal that aligned autonomy is achieved by a shared architecture vision (DP 5) that is linked to the portfolio – business and IT (DP 2&3). This extends the IT-dominated EAM literature by indicating a future point of convergence between strategic portfolio and strategic EAM in the organizational agility context due to the common overall vision, which moves the responsibilities of portfolio managers towards architecture (Horlach et al. 2020a). Finally, architectural consequences are required to be judged from a technical and a business-related, from a long-term and short-term and from an internal and external view – with creating value for the customer as the focal point of decision-making (DP 1&2). As a result, Horlach et al. (2020a) uncover that the agile teams as well as the overarching planning and coordinating roles, mainly architecture and portfolio managers, need to be aware of the customer needs, the organization's overall response to them and their own participating role and consequent level of freedom within this system. This overarching link between external environment and internal organization sets a novel link to theoretical concepts such as business ecosystem architectures (Drews and Schirmer 2014), which are traditionally without the notion of agility.

5.3.3 Re-Conceptualize IT Governance for Agility

The design knowledge of portfolio and enterprise architecture management uncovers that agility does not stop at the single decision area, but that the concept of IT governance itself is to be rethought. Overall, emphasis is put in prior research on IT governance being the means for still ensuring a controlled way (Tiwana and Kim 2015) of swiftly shifting and redirecting strategies, capabilities, knowledge, and processes (Denning 2016c; Liang et al. 2017) with controls, processes and structures (Qumer 2007; Vejseli et al. 2018) that emphasize speed and flexibility in IT use and steering (Jöhnk et al. 2019; Vejseli et al. 2019, 2020). Increasingly, combinations of agile and IT governance capabilities (Luna et al. 2014, 2019), a set of governance mechanisms (Jöhnk et al. 2019; Kiselev et al. 2020) or blueprints of accountability frameworks within agile organizations (Disciplined Agile Consortium 2020; Scaled Agile 2020) are proposed for solving the balance for control and agility. Yet, most of them either do not reflect IT governance in the light of organizational agility or do not show how to realize the combination of IT governance for enabling IT embracing the continuity in changes (Overby et al. 2006; Tallon and Pinsonneault 2011; van Oosterhout et al. 2006). In addition, research targets individual IT governance decision areas (Stettina and Hörz 2015; Uludağ et al. 2019a) or tasks for planning and monitoring (Hope and Fraser 2003; Suomalainen et al. 2015b), so that little is known about the conceptualization of an IT governance system that spans the decision areas.

To contribute to the field of IT governance and organizational agility, Horlach et al. (2021) derived four principles that give guidance for organizations in their agile journey on how to re-shape their IT governance approach and showed corresponding sets of practices for their realization (see Table 18). Those confirm that IT governance is to be re-conceptualized in general and moving towards an 'Ecosystem Co-Evolution Governing' in particular (see Figure 8), which leads to various changes to the IT governance decision areas and across the areas. Similar to the design knowledge on portfolio and enterprise architecture management, the principle of ecosystem centricity in governance decision-making first and foremost changes centering the whole IT governance system – from the strategic level down to the individual and both business and IT levels – from IT towards providing value to the ecosystem, mainly customers and partners. Whilst previous research on agility acknowledges the power of customers and partners (Sambamurthy et al. 2003), IT governance research rather reflected the mechanisms' suitability for internal flexibility (Jöhnk et al. 2019; Vejseli et al. 2019, 2020). Unifying IT and business concerns with a common aspired outcome instead of aligning internal separate business and IT goals, manifested in a customer-oriented vision, further enriches traditional IT governance research with revealing the change from IT principles (Weill and Ross 2004), towards being merged with business goal setting in an enterprise vision. This is further emphasized in the principle of digital business governance, which further confirms the findings of Horlach et al. (2019) and Horlach et al. (2020) regarding the merging of functional and technological planning towards a unified business and IT decision-making – the move towards a digital business strategy (Bharadwaj et al. 2013; Hess et al. 2016; Matt et al. 2015).

Table 18: Principles for Re-Conceptualizing IT Governance for Agility.
Source: Horlach et al. (2021).

Principles for Re-shaping IT Governance	Design of IT Governance System	Applied Practices	Relation to Research on Organizational Agility
Governance around the ecosystem - End-to-end ecosystem value contribution - Balance of internal aspired position and external changes - Ecosystem architecting	- Ecosystem concerns, particularly customer value contribution, as overall strategic angle - Focus on solving aspired part of value creation by team - Different origins of budgets, but assigned to ecosystem concern and teams' purpose - Architecture around ecosystem concerns	- Customer-oriented vision (I-3, I-31) - Roadmapping along business priorities (FG-1, I-33) - Purpose setting (FG-5, I-1) - Architecture as competency (I-15, I-23)	- Enable flexibility in strategic moves (Overby et al. 2006) - Adaptivity of portfolio process (Hoffmann et al. 2017) - Reevaluate business needs in short cycles (Hoffmann et al. 2017, Horlach et al. 2019)
Digital business governance - Embedding of digital capabilities within business strategies for new strategic moves - Social and increasingly structural business IT fusion in value contribution	- Ecosystem concerns shared strategic angle - Business and IT needs fused within strategic goals - Platforms new central digital operational backbone for digital service realization - Operationalization of IT principles for single strategic move within team	- Strategic goals (I-22, I-27) - Combined IT and business architectural view (I-7, I-25) - Team funding (FG-2, I-1) - Cross functionality (FG-6, I-9) - BizDevOps Team (FG-1, I-12) - Shared functions (I-8, I-30)	- Reflection of IT as business enabler (Melarkode 2004) - Embedding of digital concerns (Bharadwaj et al. 2013) - Flexible and adaptable budget allocation (Horlach et al. 2019) - IT infrastructure enabling swift shifts (van Oosterhout et al. 2006)
Reciprocity in governance - Top-down guidelines and autonomous concrete design - Consideration of teams' discoveries in overall planning	- Demand management encapsulated in team - Teams commit to architectural vision as guardrails - Architects and groups across organization for coordinated, 'standardized' understanding - Decentral IT infrastructure choices as much as possible	- Product vision (I-18, I-22) - Cloud strategy (FG-4, I-20) - Community of Practice (I-17, I-29) - Architecture as a service (I-11, I-25)	- Ensure team autonomy (Moe et al. 2019) - Flexibility in IT architecture with loose coupling (Chakravarthy et al. 2013) - Handling of duality of heavy- and lightweight IT (Bygstad 2017)
Continuous Governance (Governing) - Fluid business and IT resource allocation and prioritization - Continuous Learning with governing duality of thematic flexibility along guidelines and continuous capability reconfiguration	- Governance means directing organizational changes - Continuous discovery of ecosystem needs by teams and flow back into overall strategic direction - Constant thematic changes leads to changing required capabilities - Resource allocation independent from budget	- Continuous responsibility by team (FG-3, I-19) - Consistent flow of value (I-14, I-16) - Internal value stream (I-2, I-13) - Capability mapping (I-7, I-28)	- Flexible and adaptable resource allocation (Horlach et al. 2019) - Reconfiguration of internal processes, structures and capabilities (e.g., Denning 2017) - Secure organization as network of accountable teams, not centralized functions (Bogsnes 2009)

The merge of strategies, together with the third principle of reciprocity in governance, extends the academic debate on other IT governance decision areas. First of all, the autonomy of teams as one popular principle of enabling agility within the (IT) function (Moe et al. 2008; Moe et al. 2019) changes traditional IT governance decision-making authority towards being encapsulated as much as possible within the teams. Whilst top-down decisions mainly involve defining and selecting the value contribution to the ecosystem through vision and strategic goals, the teams are responsible for understanding and governing their ‘ecosystem architecture’ of their own path, merging the traditional IT governance decision areas of business application needs, the IT architecture and the IT infrastructure strategies (Weill and Ross 2004) – at least on the team level. In addition, the IT governance decision area of IT investment and prioritization is moving towards being encapsulated by assigning budgets – both business and IT – to a single team. Once again confirming the convergence of functional and technological planning, the process embeds governance practices such as budgeting (Bogsnes 2009), portfolio (Hoffmann et al. 2017) or architecture (Uludağ et al. 2019a) into the aligned autonomy concept. In particular, the notion of architecting on the team level and beyond contributes to understanding how to enable reciprocity, continuously governing the balance between autonomy for fast moves and alignment for the ‘right’ moves (Ross et al. 2019), which widens the focus beyond the IT architecture as one of the traditional IT governance decision areas (Weill and Ross 2004).

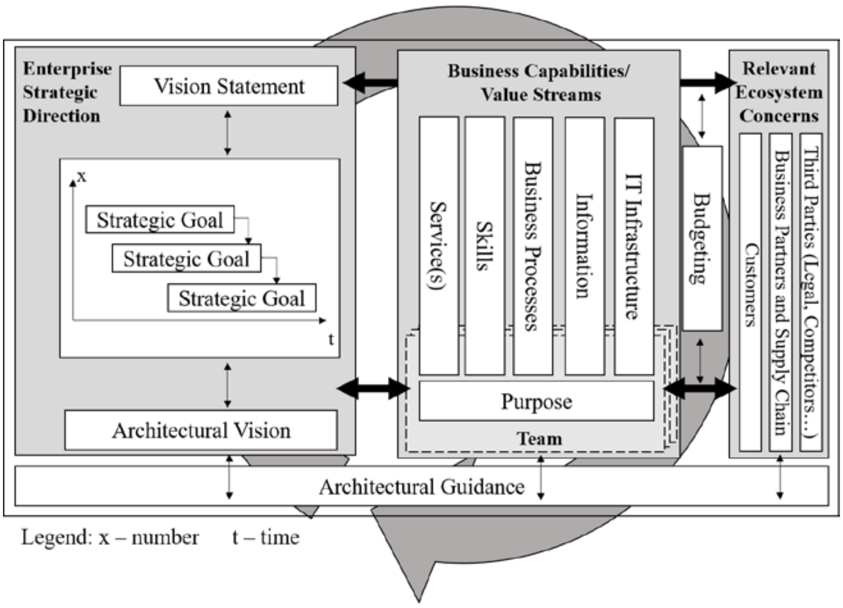

Figure 8: Re-Conceptualization of IT Governance for Agility.
Source: Horlach et al. (2021).

Finally, the principles contribute to swiftly shifting and redirecting strategies, capabilities, knowledge, and processes (Denning 2016c; Liang et al. 2017) with emphasizing continuous governing, concerning both capabilities and content, and the resulting continuous (re)fitting and (re)organizing between the ecosystem and the organization, within its different lines of business and IT and local and global interests. This extends the traditional agile governance by focusing more on changing the content and less on the organization (Disciplined Agile Consortium 2020; Scaled Agile 2020). In addition, it changes the notion of a stable strategy with a flexible portfolio and operational planning (Hoffmann et al. 2017) towards the continuous surveillance and adaptation of the whole governance system. Finally, it contributes to the notion of continuity when striving for agility (Conboy 2009; Suomalainen et al. 2015b) by emphasizing a meta-analysis across the first three principles in short interconnected multi-level feedback cycles and extending the planning to continuously surveilling actions as well as analyzing the gap among the internal value propositions – both within and across teams and on the overall strategic level – and to the customer value creation. The meta-analysis then shall enable making large-scale decisions on how to (re)organize resources and content.

In sum, the principles on re-conceptualizing IT governance for agility enrich the academic debate on how to enable an agile IT governance systems in manifold ways. First of all, they clarify the character of required agile and IT governance capabilities (Luna et al. 2014, 2019). Second, they contribute guidelines, which ought to facilitate setting up an agile IT governance system with selecting corresponding agile processes, structures and relational mechanisms (Vejseli et al. 2018, 2019, 2020). Finally, they link the intended outcome to a set of good practices, which in turn explains why and how to establish an IT governance system for agility.

5.4 Contributions to Business IT Alignment

5.4.1 Design Knowledge for Business IT Alignment for Agility

With agility being an organization-wide concern, analyses increasingly address the effect on aligning the IT function and the business (BITA) when striving for agility (Tallon et al. 2019), predominantly emphasizing a positive correlation (Liang et al. 2017; Tallon and Pinsonneault 2011; van Oosterhout et al. 2006). In particular, a high degree of social alignment facilitates agility, whilst a high degree of intellectual alignment may lead to inertia and myopia due to focusing on internal concerns instead of the external perspective concerning the fit between changing environments and the internal strategy and delivery (Liang et al. 2017; Tallon 2008;

Tallon and Pinsonneault 2011). Thus, IT is to be embedded in key business processes and roles (Denning 2017a, 2017c; van Oosterhout et al. 2006) for collaborative decision-making (He and Wong 2004) whilst alignment and decision-making ought to be dynamic at the same time in order to recognize changes and to be able to react rapidly (Doz and Kosonen 2010; Sushil 2015; Tiwana and Kim 2015; Vessey and Ward 2013). Yet, the degree of fit and integration among business strategy, IT strategy, business infrastructure, and IT infrastructure (Henderson and Venkatraman 1993) is still predominantly a concern in research on traditional plan-driven organizations. Whilst frameworks on large scale agile transformations (Disciplined Agile Consortium 2020; Scaled Agile 2020) increase in number and try to include an organization-wide perspective, most limit scaling the agile context to the IT function.

Next to confirming the importance for social alignment for enabling agility (Liang et al. 2017), Horlach et al. (2020b) contribute to the increasing discourse on agility and alignment by explicating how to realize agile BITA's outline with pre-theoretical design knowledge (see Table 19). In this regard, a main contribution is showing that agility leads to BITA moving from aligning two separate entities towards being designed as business IT convergence – both on the operational and the strategic level (DP 2&3). First, the convergence towards an enterprise strategy closes the missing link on agility's implications on business and IT strategy (Henderson and Venkatraman 1993). Second, it explicates adjacent concepts such as digital business strategy (Bharadwaj et al. 2013; Hess et al. 2016; Matt et al. 2015) by revealing the consequent view on the ecosystem (DG 1&2) as one fundament for enabling such a merged mind-set. In this regard, the design features are another contribution by revealing good practices for embedding this view at the strategy level. The features also foster embedding IT in key business processes and roles (Denning 2017a, 2017c; van Oosterhout et al. 2006) for achieving corporate engagement across the enterprise (DG 4) with introducing cross-functionality regarding planning and increasingly regarding structures and processes, leading to further extensions of traditional business and IT operations. Finally, merging the view on business and IT objectives explicates the high degree of social alignment whilst being flexible with aligned autonomy, by providing the awareness of balancing business and IT objectives on the local operational level, within the overall 'big picture' and with each other (C 2&3). This links the whole organization, both business and IT, towards an aspired outcome whilst still enforcing high autonomy and self-organizations of individual teams (DP 4).

The conscious focus on the relevant business environment(s) (C1), the requirements of the specific market for the internal delivery and organization (DG 1) and the alignment of the internal and external perspective (DG 2) is a second major contribution to the predominantly internal-focused alignment research. First of all, showing the need for continuous engagement with the ecosystem and providing answers for embedding this need throughout the organization provides the link to organizational agility research, particularly addressing customer and partner agility in order to be up to date with the appropriate products, services and/or business models (Denning 2016c; Sambamurthy et al. 2003) and the integration of the customer needs with suitable strategies, structures, processes, and cultures (Lee et al. 2015; Overby et al. 2006). Second, the design knowledge extends the conceptualization of customer and partner agility (Sambamurthy et al. 2003) by revealing that the consequent orientation on the needs requires their integration of this understanding within the organization – both on the strategic and operational level and both in business and IT (DP 2&3). This extends the notion of business and IT strategy by systematically embedding customers' and partners' needs within both the organizational strategy and the resulting operational planning and management mechanisms instead of just using customer insights isolated within a single service.

Table 19: Design Knowledge for Business IT Alignment for Agility.
Source: Horlach et al. (2020b).

Challenge	Design Goal	Design Principle	Design Feature (examples)
C1: Establish an effective focus on the relevant business environment(s)	**DG1: Understand the ecosystem response alignment gap:** Identification of threats in the business ecosystem and subsequent required multi-dimensional response of the organisation (addresses C1, C4)	**DP1: Understand and explicate the ecosystem:** Clarification and visualisation of customer value, needs, and touchpoints to the organisation to prepare for fit with customer and partner needs (addresses DG1, DG2)	- Customer value stream (I12, I20) - Partner value stream (FG5, I28) - Customer journey (I3, I29) - Persona (FG1, I27)
C2: Balance local autonomy concerning the used IT with the organisation-wide optimum	**DG2: Foster alignment between external and internal value propositions:** Persistent focus on customer and partner needs instead of focus on internal affairs (addresses C1)	**DP2: Employ customer vision-oriented strategic direction:** Definition of outcome-based goals based on identified current and potential future customer needs to ensure fit with them (addresses DG1, DG2, DG3)	- Enterprise vision (I14, I25) - Strategic goals (FG5, I18) - Roadmapping (I2, I29) - Product vision (I13, I17)
C3: Balance local autonomy concerning services and their functionalities with the	**DG3: Enable continuous (re)alignment:** Ongoing fit between external customer and partner needs and internal organisational services, structures and processes to fulfil these needs	**DP3: Align delivery 'structure' around customer value flow:** Optimal combination of business and IT capabilities for frictionless delivery of the 'right' customer services as fast as possible	- Cross functional team (I2, I8) - Product team (FG6, I12) - Internal value stream (FG5, I7) - Capability mapping (I10, I27) - Objectives and key results (OKR) (I1, I17) - Purpose setting (I11, I25)

organisation-wide optimum	(addresses C2, C3, C4)	(addresses DG2, DG4)	
C4: Cope with the fluidity of the organisational structure	**DG4: Empower corporate engagement:** Continuous converged proactive involvement of business and IT staff (addresses C2, C3)	**DP4: Enable autonomous, yet informed decision-making:** Information points for coordinating concerns regarding services and capabilities within and between levels (addresses DG3, DG4)	- Strategic product owner (I18, I22) - Open planning room (FG1, I2) - Open tool access (I10, I28) - Community of practice (I6, I12) - Architectural vision (I5, I20) - Shared services functions (I1, I20)
		DP5: Set up a meta-reorganisation capability: Continuous information exchange and adaptation procedures across organisation (addresses DG2, DG3)	- Skill to kill (FG1, I23) - Short cadences (FG2, I26) - Decentral team planning (I3, I20) - Central meta-planning (portfolio) management (FG3, I6)

Finally, the design knowledge contributes to alignment research by designing a crucial dimension of agility that strongly influences the fit between business and IT: the ability for (re)integration and (re)configuration (Sambamurthy et al. 2003). Whilst this partly applies to traditional alignment, mainly on the operational level through resource allocation to projects such as those suggested by many before, directional changes are now inextricably linked to a continuous transformation of the organization itself (DP 5). In other words, agility actively seeks a continuous transformation instead of seeing changes as the exception rather than the norm (C 4). This extends the existing knowledge on contributing factors to the transformations' realization such as a continuous resource (re)allocation and tailoring (e.g. people, skills and IT architecture) (Chakravarty et al. 2013) (DG 3). On top of that, the design knowledge proposes an overall solution by organizing around the customer value creation with a customer-centric vision and goals and a corresponding business capability or value stream-based organizational structure. Whilst those are known concepts to management and information systems, their usefulness for agility is yet largely unexplored and not linked to alignment. Therefore, the design knowledge is not only one of the first to present the need for a continuous re-alignment capability (DP 5), but also links mechanisms as design features for its realization.

5.4.2 Re-Conceptualize Business IT Alignment for Agility

Business IT alignment does change to a large extent when striving for agility. In particular, the use of IT for digital options (Sambamurthy et al. 2003) for rich knowledge sharing or for directly enabling products, services and/or business models (van Oosterhout et al. 2006) calls for a business IT co-evolution (Sabherwal et al. 2001) or two-way alignment (Coltman et al.

2015) instead of the traditional thinking on IT following business (Henderson and Venkatraman 1993). Emphasis is put on forming effective collaborative business and IT partnerships both within the individual, operational, and strategic level and across the levels (Benbya and McKelvey 2006; El Sawy et al. 2010), as they have complex non-linear relationships, effects and causalities on multiple levels from strategy to operations. This involves actively involving IT in strategic business decision-making (Fitzgerald and Stol 2017), whilst some propose moving towards a single strategy for the organization (Smaczny 2001) and/or closing the gap on the operational level with structural convergence (Legner et al. 2017; Urbach et al. 2019). Yet, business IT co-evolution also increasingly embraces flexibility– closely related to the operationalization of agility. This implies linking individual elements within the network of an organization whilst being able to move as independently as possible for self-organization (Benbya and McKelvey 2006; Tanriverdi and Lim 2017). Yet, the rather conceptual nature of prior research on business IT co-evolution, particularly regarding their link to agility, prevents showing how to realize business and IT on the eye level.

Horlach et al. (2020b) circumvent these limitations with the proposed pre-theoretical design knowledge for outlining agile BITA, but also by explaining how the theoretical concept of BITA is re-conceptualized (see Figure 9). In particular, the re-conceptualized model contributes to both the research on business IT alignment and its co-evolution by clarifying the implications of agility on the organization as a whole and the underlying reasons and means for change. To be specific, the notion of enterprise vision alignment explicates both the call for aligning business and IT along a single strategy for the organization (Smaczny 2001) and the resulting active involvement of IT in strategic business decision-making, particularly in agile organizational settings (Fitzgerald and Stol 2017), re-shaping the elements of business and IT strategy in alignment (Henderson and Venkatraman 1993). Furthermore, alignment along the lines of vision serves as the internal strategic foundation for enabling a coevolution-based self-organized emergent behavior and structure for coping with today’s turbulent markets (Benbya and McKelvey 2006) by moving to outcome-based objectives, leaving freedom and adaptivity for finding the ‘right’ output with products and services. The proposed new alignment dimension of ecosystem alignment further extends the research knowledge by defining the outcome with centering it on continuously securing the internal objectives to the external fit with the business ecosystem, mainly the value creation of customers and partners, instead of solely aligning business and IT concerns. Whilst this extends again the notion of traditional business and IT alignment, the value perspective links business IT alignment to other IS research disciplines such as, e.g., service design (Kalbach 2016), which provide an extensive knowledge base on what value creation implies and how to achieve value creation within and across services. In addition, the shared strategic objectives for business and IT based on the common aspired outcome enforces a shared understanding, leading to insights on how to enable a high degree of social alignment (Benbya and McKelvey 2006; El Sawy et al. 2010).

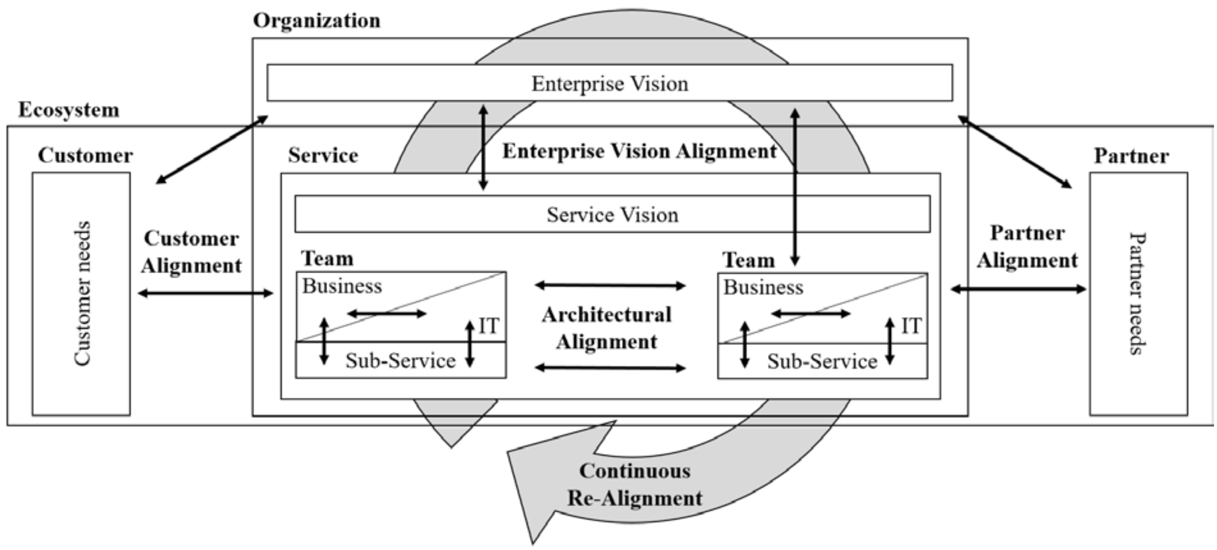

Figure 9: Re-Conceptualization of Business IT Alignment for Agility.
Source: Horlach et al. (2020b).

On the other hand, the proposed alignment dimensions of continuous re-alignment and architectural alignment are major contributions for enabling internal (structural) agility with self-organization of individual elements (Benbya and McKelvey 2006; Tanriverdi and Lim 2017). Next to the adjustment or shift of the work content and resulting products, and services, those two dimensions particularly show how to enable aligned autonomy whilst being adaptive in the longer term with the continuous re-configurability of IT and business capabilities. Aligning across the enterprise architecture, the fit of capabilities, structures and processes for delivering the services and their business and IT components with the services and vice versa, extends the traditional cross-domain alignment on the enterprise level (Henderson and Venkatraman 1993) by moving towards integrating the different visions of customer services and their fit to internal corporate services that they might use. This also changes the operational cross-domain alignment within each customer service, as it occurs between the sub-services and between the responsible autonomous teams and units instead of between business and IT units. As internal stabilization through business processes and IT architecture is only ensured along the different purposes, architectural alignment closes the gap on how to achieve the optimal internal capabilities through a continuous resource (re)allocation and tailoring (e.g. people, skills and IT architecture) (Sharifi and Zhang 1999; van Oosterhout et al. 2006; Weber and Tarba 2014) in order to provide the best possible service – operational agility (Lu and Ramamurthy 2011; Sambamurthy et al. 2003) of the organizational system (Denning 2017b; Yusuf et al. 1999) towards the changing strategic direction.

6 Practical Contribution

In addition to contributing to the scientific body of knowledge on agility, IT governance and business IT alignment, this thesis also provides utility for practice (Corley and Gioia 2011). In general, the body of knowledge within this thesis helps practitioners in identifying and selecting their shaping of the IT function when aiming for the embracing of agility. The developed insights from exploring as well as the derived design and explanatory knowledge further give actionable insights to practitioners on how to outline and shape their ventures.

6.1 Demystification of Shaping the IT Function for Agility

Given the rise, success and dramatic influence and even shifts in markets of many organizations by digital 'goliaths' such as Google, Amazon or Facebook, their own journeys towards being agile with speed and innovation for thriving in the digital age spurred many enterprises. Yet, as the variety of approaches towards this ability grew in numbers in recent years, the insecurity on how to proceed, as well as the scepticism towards their suitability also increased. This is further accelerated with the frameworks being presented as their own solution as the optimal blueprint for any organization. In contrast, this thesis contributes an objective understanding and differentiation of the approaches towards shaping the IT function for agility. The dissection of the components of the different approaches enables practitioners to understand both the complexity of the underlying involved organizational elements and their interrelations when striving for agility, as well as the resulting scope of transformation towards the desired state. For instance, the multi-faceted nature of bimodal IT and the corresponding types demystifies Gartner's concept (Gartner 2020) and shows how those two modes may be realized – both individually and in combination. In addition, showing the relation of the desired outcome and the desired speed of the outcome as two fundamental contingency factors of shaping the IT function for agility, and the resulting influencing dimensions of, e.g., sourcing, further provides rigorous insights to help practitioners in their quest to make sense of the variety of approaches. The same applies with approaches scaling towards agility of the whole IT function or even beyond, as the comparison of the plethora of scaling frameworks reveals their distinct characteristics and mechanisms.

6.2 Decision Support for Choice of Shaping the IT Function for Agility

Second, the results of the systematic exploration and theorizing of shaping the IT function for agility also provide an entry point for the choice on the approach to one's own transformation. The structured exploration of approaches in theory and practice give a comprehensive and detailed description of the various concepts and their instantiations, their differentiation and the organizational implications for each concept and potential mechanisms. By formulating design goals, design principles and their context of application, the applied mechanisms are further connected to the most critical design characteristics for enabling agility. Thereby, this knowledge supports practitioners in defining their individual approach with highlighting the fundamental principles of enabling agility within the IT structures and processes as well as in communication and information models. As the findings do not reveal favorite approaches, companies can assess the suitability of the variations to their specific needs from a perspective tailored to their specific context. This context-specific perspective also enables a profound reflection on the suitability of a specific scaling agile framework for the organization's own transformation, in case the organization wishes for more predefined support for planning the change within the IT function.

6.3 Guidelines and Explanations for Designing IT Governance for Agility

Next to contributing to the exploration of agile IT organizational setups as a whole, the thesis also provides rigorously derived insights for practitioners on dedicated decision areas when redesigning an IT organization in an effective way. For instance, the findings provide guidance on designing an agile IT governance setting with insights on all IT governance decision areas and in-depth knowledge on portfolio management and enterprise architecture management as crucial pillars. Furthermore, the underlying principles across the decision areas and the resulting re-conceptualization of IT governance enable insights on the extent of the effect of agility on the governance system as a whole, and also show directions on how to change accordingly. The knowledge of applicable strategies and tactics allows organizations to expend their journey towards being able to sense business opportunities and respond with ease and speed, whilst still being able to guide the IT function for following the business objectives. In particular, striving for always fulfilling the value for the customer (and partners) by moving to ecosystem governing and by showing the good practices for its realization enables organizations to embrace customers' power and the resulting market volatility in a continuous way.

6.4 Guidelines and Explanations for Designing Business IT Alignment for Agility

The findings also reveal practical insights on business IT alignment, which is still on the IT and business executives' agenda – even more so in the digital age. Similar to IT governance, the thesis contributes to this discussion by revealing a variety of business IT alignment mechanisms and practices that have been tried and tested amongst a series of organizations. Whilst some have implemented within single companies, the findings show that others, such as, e.g., communities of practice, have been proven for various organizations as being reliable when crossing the borders amongst a multitude of teams and functions – both business and IT. Yet, this thesis also takes one step further for practitioners by integrating the mechanisms into a set of guidelines on how to realize business IT alignment when striving for agility. As those guidelines represent the baseline for providing a fit within and across the operational and strategic level on the IT and the business side, they are relevant for both executives and operational roles. Whilst the guidelines explain the baseline to be followed when striving for agility, they also reveal one's own role for being effective. As they do not favour a specific avenue on how to enable a new business IT alignment by more closely integrating business and IT, they are not restricted to a dedicated organizational contexts such as the scaling agile frameworks. As a consequence, they resemble an objective baseline that a variety of organizations can use for outlining their own organizational transformation.

7 Limitations

The thesis shows insights on shaping the IT function for enabling organizational agility in order to cope with the digital age. Although the included publications cover five years of (1) developing, enriching and extending the understanding of how IT organizations approach the perceived need for agility, as well as (2) providing insights on how those are shaped in order to achieve a truly agile organization, both the individual publications and the synopsis are limited from both a methodological perspective and the research findings.

7.1 Limitations of Research Design

Concerning the research design, the abductive reasoning applied within the thesis represents one main source of limitation. Despite theory providing a common ground for structuring complexities within the phenomenon to a manageable size, they also "*restrict the researcher from more eclectically drawing on a multitude of more appropriate theoretical insights or in developing alternative theoretical insights grounded in the empirical material*" (Schwarz and Stensaker 2014, p. 489). As a result, the observations and resulting findings may be incomplete and biased based on the applied theoretical views within the organizational contexts, which in turn may have led to an incorrect reasoning (Simon 1996). While applying multiple methods on a variety of organizations with alternating organizational contexts may lead to extensive insights on the complex nature of shaping the IT function for agility, the reflection on those contexts with multiple theoretical lenses may still not prevent the research from overlooking concepts.

The abductive reasoning further reveals that the research is prone to author's bias. While abductive reasoning combines the advantages of both inductive and deductive reasoning by being able to 'let the data speak' for uncovering novel theoretical insights whilst still being guided through a theoretical framing for clear boundaries, the data needs to be interpreted and aggregated for deriving the concepts. As "*reality is not an objective entity; rather, there are multiple interpretations of reality*" (Merriam 1998, p. 22), the interpretation and aggregation by the author is subject to the author's knowledge, skills and his or her own interpretation of the world. Thus, the insights might be derived in a way that fits into the author's mind-set. Whilst using theories may mitigate this shortcoming by providing a unified language and concepts for analysis, the insights are not completely objective in their nature.

Third, the qualitative nature of the research methods applied within the thesis is also not without limitations. The empirical and literature analyses involved a multitude of different organizational contexts with, e.g., differences in organizational size, industry, or shaping of the IT function. Furthermore, various interview partners from the strategical and operational areas across the organizations, both with IT and/or business background were purposefully selected. Yet, whilst qualitative cross-industry empirical studies as well as extensive literature and document reviews enable insights from a broad variety of organizational contexts and backgrounds, the complex nature of agility with its integral embedding in the operational and the strategic areas of the organization and across requires in-depth knowledge on both the horizontal and vertical interdependencies – preferably within all of the analysed enterprises. Thus, despite taking measures for mitigating this limitation, rigor of the results regarding the individual case companies can only be achieved to a limited extent.

Finally, the research is limited to the underlying objects of analysis. Although initially striving for effects of organizational agility on the IT function, the first insights on the character of bimodal IT already reveal the crucial role of the business side within such settings. Whilst the following analyses use this knowledge on the importance of insights from business by involving a multitude of roles within the organizations, direct contact to business members remains limited despite the author’s efforts. In addition, intended business-focused roles such as, e.g., product owners, are nowadays predominantly set up with IT personnel due to the longer experience of IT in regard to striving for agility and the corresponding methods and practices. Such incomplete availability of empirical insights results in biased selectivity (Yin 2014), as the data reflect the opinions of the remaining interview partners instead of giving a truly holistic perspective of agility within the organizational context. Using triangulation via scaling agile frameworks for enriching the insights shall mitigate the selectivity, but these frameworks are also limited in their applicability to business functions because of their IT background of scaling up agile software development.

7.2 Limitations of Research Findings

Regarding the research findings, one main limitation is the nature of agility at hand. Whilst organizational agility is generally understood as the ability to sense business opportunities based on changed external movements and by being able to respond to them with ease, speed and dexterity (e.g., Sambamurthy et al. 2003), research has identified multiple facets of agility (see section 2.1). Yet, the findings do not address all facets in depth. The most noticeable gap within the findings is the notion of innovation (Denning 2017a; Doz and Kosonen 2010). Whilst the thesis includes analyses on ease and speed by analyzing how to minimize internal friction and to the external environment – either within the specific digital or agile IT unit(s), across the IT organization or even the whole enterprise – with propositions on how to design those setups, the insights only address the call for dexterity to a minimum. For instance, whilst the design principles of agile portfolio management include the awareness that innovations should be a part of enterprise planning in order to be on the radar of IT and business executives in a continuous way, limited answers are given on how to implement such a process. As a consequence, the aspect of how to enable a proactive mind-set for innovation across the organization in order to derive, implement and optimize innovation for responding to changed external circumstances in a rapid way is lacking concrete guidance.

Similar to the restriction concerning agility, the findings are also limited to incomplete knowledge on the phenomenon and the addressed theoretical concepts of IT governance and business IT alignment. Regarding the phenomenon, the insights are incomplete due to the complex nature of governing and aligning fast and traditional IT functions. For instance, whilst the findings reveal that bimodal IT organizations need an IT governance that aligns both IT modes with each other and each to the business side, they are challenged due to their focus on agility as outcome. As such, how to align a traditional working internal-focused mode with an agile customer-oriented one, especially not with a structural separation of teams, is still not fully answered. A similar limitation applies to large-scale agile IT organizations or enterprises. The findings acknowledge that more traditional IT functions and business areas may exist in those organizations. Yet, presumably due to the predominance of interview partners from the agile areas, the analyses revealed very limited insights regarding their concrete integration. Consequently, the propositions in this regard are rather vague.

Regarding the theoretical concepts, not all IT governance decision areas and business IT alignment dimensions were the primary focus within the analyses. For instance, whilst IT investment decisions are an area of concern when planning and managing the portfolio, the primary angle within this thesis was the selection and prioritization of issues and the resulting allocation of resources, in this case predominantly human resources and skills. As a result, the findings reveal insights on how IT investment decisions are made and budgets are allocated, but do not reveal in-depth knowledge on the whole investment cycle. This also includes budgets for innovation that may be decided and allocated in a separated or integrated innovation portfolio management process, or overall technological budgets that also may be separated from the main portfolio management process. The same superficiality also applies to some business IT alignment dimensions, primarily regarding the social and cultural fit of business and IT. Although the findings provide mechanisms for supporting social alignment by cross-functional teams and a common vision, the effectiveness of those mechanisms are not answered within the thesis. Furthermore, whilst the proposed mechanisms may support a cultural alignment, the applicability has yet to be analysed. Overall, the application of an agile culture and mind-set is perceived as prerequisite for enabling agility, but it needs operationalization in the long term.

The third limitation of the research findings is their conceptual nature. Whilst design goals and principles cover the underlying general requirements and principles of form and function of agile organizations and their interrelations, they need the existence and link to design features and practices as constructs (Gregor and Jones 2007) for enabling concrete actionable guidance on how to implement and/or reconfigure such an IT organizational setting. The same applies to the bimodal IT typology that does not include guidance on how to introduce a specific type. While the scaling agile frameworks provide a blueprint of agile organizations that may uncover good practices as a set of (minimal) design features for achieving an agile organization, they also offer only limited insights on design features due to their one size fits all nature. In turn, when striving for a design theory on agility and business IT alignment and/or IT governance, testable propositions as being "*truth statements about the design theory*" (Gregor and Jones 2007, p. 3222) are required for linking the existing design knowledge with the design features.

Furthermore, the applicability of the research findings is limited to a specific context. Although the thesis outlines the different shapes of organizational agility with bimodal IT and large-scale agile IT organizational settings, as well as general design and explanatory knowledge on how to shape agility within the IT function, when to apply (n)one of the approaches is scarcely outlined. Furthermore, the insights do not reveal patterns on how the choice of a specific approach changes over time so that, e.g., a bimodal IT organization may (not) solely be an intermediary state for becoming a large-scale agile IT organization in the end. This is caused by the insights not involving the organizational context to a large extent and the resulting contingency factors. In terms of a design theory, this requires the existence of principles of implementation (the causa efficiens) as the "*description of processes for implementing the* *theory […] in specific contexts*" (Gregor and Jones 2007, p. 322) and their link to design features.

Finally, the missing contextual factors also result in a fourth limitation of the research findings: limited predictability on how agile (IT) organizations will be designed along the further evolution and maturity of the corporate digital transformation and the further development of the business environments and ecosystems. As the findings provide a snapshot of possibilities within a certain timeframe, they do not show insights on how the approaches will be shaped in the long term and how to move along. In terms of the design knowledge, insights on the artefact mutability are lacking, which reflect the "*changes in state of the artefact anticipated in the theory, that is, what degree of artefact change is encompassed by the theory*" (Gregor and Jones 2007, p. 322).

8 Implications for Future Research

Following the limitations of the research methodology and findings, this thesis involves multiple potential avenues for further research analyses. Whilst such avenues cover how to concretize shaping the IT function for agility, they also show potential areas of strengthening IT governance and agility and how business IT alignment should incorporate the notion of agility.

8.1 Organizational Agility and the IT Function

With this thesis, the author started to investigate the new and under-researched phenomenon of shaping the IT function for enabling agility. Whilst it contains initial insights on the principles of how to introduce and scale the IT function as well as how it changes the business side for agility, a major avenue for future research activities would be further data analyses and theorizing about the phenomenon. For instance, additional insights on the nature of the different shapes of the IT function and their evolution may uncover predictive explanations of how companies should position themselves with the IT function for the future. Such explanations would support the decision on whether to choose to transform towards a bimodal IT, a large-scale agile IT organization or a customized approach. In addition, having a clear understanding of how and when to choose a specific approach as well as the circumstances that lead to a required change of approach within an organization may further demystify the required transformation process that the company ought to undertake. Longitudinal cross-industry studies on the evolvement of the shaping of the IT function as well as longitudinal in-depth case studies for tracing the individual transformation process would be a promising area of research. In addition, quantitative analyses could provide further broad insights on a variety of organizations.

Furthermore, the multi-faceted nature of organizational agility by implying both the ability to rapidly respond to changed market circumstances as well as to proactively change the market with continuously reinventing products, services and/or business models (see section 2.1) poses future possibilities for inquiries. First and foremost, further research may explore whether, how and when radical or disruption (digital) innovation (Nambisan et al. 2017; Yoo et al. 2012) acts as a facilitator for organizational agility in order to have a further grounding for when to choose a specific shape of the IT function. In addition, those insights may also uncover the contingency factors on when to pursue market-improving or market-creating innovations. In this regard, the theoretical concept of organizational ambidexterity (O'Reilly and Tushman 2004; Raisch et al. 2009) that targets the duality of exploration of new potentials, mainly via deriving new products and services, whilst exploiting the existing capabilities may serve as a potential theoretical basement. This may help in analysing the interdependencies between both areas of agility, as their optimal combinations are a further area of concern. Then, future research may also uncover how to embed the mind-set for (continuous) innovation within the IT function as well as within the remaining enterprise. Whilst insights on digital innovation for agility are gaining momentum in recent years (e.g., Barthel et al. 2020; Raabe et al. 2020), how to transform structures, processes and governance and how to sustain this mind-set within the company remains a question to be solved for future research activities.

8.2 IT Governance

The focus on (selected) IT governance decision areas within this thesis also implies new avenues for future research. The thesis covers in-depth insights on how to design the IT governance decision areas of portfolio management and enterprise architecture management for agility with design and explanatory knowledge. Yet, their interplay is only highlighted in an indirect way so that understanding how design choices within one area affect the effectiveness of another requires future research attention. Thus, further analyses may reveal how to enable an effective agile IT governance system by reflecting the interrelations. This may also involve knowledge on the remaining domains of IT principles, IT infrastructure and IT budgeting and prioritization (Weill and Ross 2004). As the focus within the thesis was on portfolio and enterprise architecture management, the other ones were only covered to some extent. This leaves room for in-depth analyses on the concrete design and corresponding good practices concerning those domains in order to achieve a truly agile organization.

Next to knowledge on IT governance decision areas, an effective IT governance system also includes insights on the optimal locus of decision-making (e.g., Sambamurthy and Zmud 1999). Whilst this thesis uncovers existing practices within the scaling frameworks and provides initial recommendations for setting up decision rights for enabling rapid responsiveness, more in-depth analyses may reveal good or best practices in this regard. For instance, the evolution of the relationship between predominant central business-oriented IT governance decision-making within IT principles and portfolio management whilst decentralizing technology-related governance decisions on IT infrastructure and architecture is a potential avenue for seeing the optimal degree of centralization. By further examining the different areas within the IT function and the business side concerning their decision-making structures, it may also be revealed whether this combination of central and decentral decision-making should be implemented organization-wide or whether each area needs an individual approach towards governing IT. Finally, exploring this interrelation may shed light on how to include the self-organized teams and enable aligned autonomy as a result.

8.3 Business IT Alignment

The thesis covers insights on how business IT alignment as a theoretical concept is shaped by striving for organizational agility. Yet, the derived design and explanatory knowledge leaves room for improvement and extension of insights in this area. As business IT alignment is a complex concept with multiple dimensions to consider (see section 2.3), profound insights on the character of each dimension and their interdependencies when being faced with the need for organizational agility is a long-term research endeavour. Thus, whilst the research findings acknowledge that social and cultural alignment is the backbone for flexible and adaptive behaviour by emphasizing communication and shared understanding across the organization, how to effectively engrain and sustain this fit is a question to be solved in the future. Those insights then may also serve as a foundation for seeing how to improve the proposed structural and strategic alignment guidelines and practices in order to prevent them from being opportunistic in nature. As a consequence, understanding the principles across the alignment dimensions and their effect on agility, and vice versa, may then potentially lead to good practices on how to establish an agile business IT alignment system.

As most corporate (digital) transformations are still ongoing, the move of the IT function towards being a business enabler is also still in progress. Whilst many companies actively strive to establish a closer connection of the IT function and the business side, e.g., by introducing the IT function that often includes some form of business IT integration or collaboration, further analyses may uncover more profound insights on applied measures and their effectiveness for agility. For instance, whilst digital business strategies are an area of concern for business IT co-evolution or two-way alignment with providing a common language and objectives for both business and IT (Coltman et al. 2015), their effect on agility is yet to be analysed in more depth. Furthermore, how to shape such a converged business and IT mind-set, strategies, processes and structures is also yet in its nascency. Thus, further inquiries may enhance and extend the gained insights within this thesis on business IT convergence and provide concrete actionable findings on a corresponding IT function and its practices.

9 Bimodal IT: Business-IT Alignment in the Age of Digital Transformation

Horlach, B., Drews, P. and Schirmer, I. 2016. "Bimodal IT: Business-IT alignment in the age of digital transformation," in *Proceedings of the Multikonferenz Wirtschaftsinformatik (MKWI)*, Ilmenau, Germany, pp. 1417-1428.

Abstract

Today, companies face a challenge, which has been coined as "digitalization" or "digital transformation". As a reaction to this challenge, many companies see the need of establishing a new "digital IT" unit or of shifting responsibility for IT systems to the business units. These changes should allow the business to be better informed, more flexible and faster in adapting its IT as well as its IT-enabled services and products to market opportunities and customer needs. The coexistence of digital IT and traditional IT has been coined as "bimodal IT" or "two-speed IT". By employing a literature review and a qualitative document analysis, this article clarifies the concept of bimodal IT and identifies implications for the business-IT alignment in organizations. We further describe and contrast the characteristics of "traditional IT" and "digital IT". In addition, we summarize various approaches for implementing bimodal IT on the architecture, process and organizational level. Finally, we address critical observations raised in respect of the bimodal IT concept.

9.1 Introduction

With the growing digitalization of ”virtually everything” driven by and based on the success of the IT megatrends social, mobile, analytics and cloud computing as the “nexus of forces” (Diallo et al. 2014), enterprises need to pursue digital innovation to improve or change their business models. If they fail to react faster than their competitors, they risk to lose their competitive advantage. As technology change accelerates and new digital solutions emerge, many companies feel the pressure to perform a digital transformation. This pressure increases due to changing preferences and expectations of customers and users.

Many ‘traditional’ organizations struggle with the implications of the digital transformation as it may lead to a loss of control over the customer relationship, increased competition and implies the threat of commoditization and standardization (Ernst & Young 2011). Due to complex and rigid IT infrastructures and inflexible hierarchical organizational silos in business and IT, companies are often not able to achieve the agility and flexibility needed for conducting the digital transformation. Business units increasingly control IT budgets (CFO Innovation Asia 2014a) in order to better solve business challenges with the help of IT. Consequently, well-established concepts like business-IT alignment (e.g. Henderson and Venkatraman 1993; Luftman 2000) need to be rethought for this changing business environment.

In some cases, the digital transformation in traditional organizations leads to two different modes of speed (“two-speed IT”). For performing digital innovation, a fast customer-facing and business-oriented IT organization is established in order to react to rapidly changing customer needs. In addition, companies run the ‘classical IT’ with the established IT infrastructure and organization. This part of the IT organization is working in longer cycles and works at lower speed, as it has to run large core systems, which cannot be changed or modified easily. Apart from the different speed modes, both parts operate with different organizational structures and methods. Hence, many companies implement a “bimodal IT” organization with different governance mechanisms, processes and organizational structures to respond to this duopoly of speed. In this paper, we will use the term “bimodal IT” (instead of “two-speed IT”) as it does not only refer to the speed but also includes different architectures, processes and organization in both parts.

If companies establish a fast or bimodal IT as a part of their digital transformation, they need to align this new IT with the existing IT and with the business. Therefore, our research question is: How is business-IT alignment affected by a bimodal IT organization? This question will be addressed in this article by conducting a literature review according to vom Brocke et al. (2009) and Brink (2013). Subsequently, the resulting sources were used as the material for employing a qualitative document analysis (Bowen 2009). In a first step, the different meanings of bimodal IT will be discussed to illustrate the characteristics of the concept. In a second step, the approaches to implement bimodal IT, will be identified and examined regarding alignment mechanisms employed on the technical and organizational level. Finally, perceived drawbacks of bimodal IT will be discussed.

9.2 Research Approach

For summarizing relevant literature, we conducted a two-step literature review: First, we conducted an unstructured literature search in selected English and German data bases such as ABI Inform, IEEE, SpringerLink, WISO, Google Scholar and Google. Based on the results, we identified nine search terms in English and German related to bimodal IT (see Table 20). Subsequently, a structured literature review in twelve high quality information systems and business-related data bases as mentioned by Knackstedt and Winkelmann (2006) has been conducted since bimodal IT affects both research fields. Additionally, Google has been searched to identify academic literature and suitable archival data like white papers, news articles etc. (see Table 20). A full text search strategy has been employed and no date filter has been set in order to identify all relevant publications.

For the document analysis, the first 200 search hits per search term for each data base have been reviewed to find out whether the concept of “bimodal IT” was addressed – at least by defining the term or any of its synonyms in the full text. The quantity of two hundred has been selected because higher numbers of results contained multiple duplicates and literature from other scientific areas such as, e.g., physics and chemistry which also deal with “bimodal” and ”two-speed” in their respective fields. 178 documents fulfilled the criteria of our search. While some of these could be identified in academic data bases such as ABI Inform and WISO, the vast majority of 122 documents was found by searching Google. The documents were subsequently analyzed based on their distinct view on the topic (technological vs. organizational) and their personal stance (neutral, optimistic or skeptical). Thereafter, each document was analyzed to highlight characteristics of the concept as well as approaches addressing the implementation of bimodal IT. Skeptical articles were further reviewed regarding possible drawbacks of bimodal IT and consequent alternative approaches.

Table 20: Search Results.

Data base / Search term	*ABI Inform*	*ACM Digital Library*	*AIS Electronic Library*	*Elsevier Sciencedirect*	*Emerald Insight*	*Google Scholar*	*IEEE*	*JSTOR*	*Springer Link*	*Web of Science*	*Wiley Online Library*	*WISO*	*Google*
Bimodal IT	73	3	1	222	316	1150	0	57	122	32	117	3	64200
Bimodale IT	0	0	0	0	0	1	0	0	0	1	0	4	776
Bi mode IT	0	0	0	3	0	5	0	0	0	0	0	0	9
Dual (-) speed IT	0	0	0	0	26	1	0	0	0	0	0	0	5270
IT der zwei Geschwindigkeiten	0	0	0	0	0	1	0	0	0	0	0	7	375
IT of two modes	0	0	0	0	0	0	0	0	0	1	0	0	0
IT of two speeds	1	0	1	0	0	5	0	0	3	0	0	0	5
Two (-) mode IT	3	0	0	567	64	22	0	0	232	1	120	0	57500
Two (-) speed IT	29	0	1	21	218	12	0	0	6	0	12	3	37800

The concept of “bimodal IT” is a recent topic in theory and practice. Since the advisory firm Gartner made the concept public to a broad IT-affine audience in its CIO agenda for 2014 (Aron and McDonald 2013) in late December 2013, bimodal IT became more often discussed in the IT community with 49 publications in 2014 and 119 in 2015 respectively. Only nine out of 178 publications addressed this topic prior to December 2013.

As bimodal IT is intensively discussed in practice, nearly the entire literature we identified in the review process can be categorized as archival data (see Table 21). Most of the publications such as blog entries, glossaries, news articles and white papers take a neutral stance in respect of bimodal IT. By drawing on practical cases, scenarios and metaphors, these publications mainly explain the concept and its elements. They also explain how bimodal IT is implemented and its implications on the technical and organizational level. Corporate-owned archival data such as presentations, interviews and corporate dossiers add to this information by providing advice for the implementation of bimodal IT. Companies use this literature for promoting their products and services as a solution to the challenges of bimodal IT. As these publications mostly focus on highlighting bimodal IT in the context the company is operating in, they permit a deeper insight into the concept. Finally, commentaries (as a special form of blog entries) highlight challenges and advantages of bimodal IT by discussing the concept itself and by giving feedback.

Only one publication has an academic background. It was published on the European Conference on Information Systems in 2015 (Bygstad 2015). This paper describes a study of how and to what extend “heavyweight” (e.g. databases) and “lightweight” IT (e.g. mobile app and bring-your-own-device) is used in organizations in the health sector, in which way they enable scaling by adding users to the services and how they facilitate innovation. An integration of light- and heavyweight IT is also discussed. While this publication addresses the use of agile and traditional IT in some form of coupling, a definition of the concept of bimodal IT and analysis of its implementation is not part of the article. Instead, the author dissociates himself from this concept (Bygstad 2015).

Table 21: Type of Publication in the Set of Relevant Results.

Type of publication		**Number of publications**
Academic paper	Case studies	1
Archival data	Blog entry	43
	Commentary	25
	Corporate Dossier	17
	Glossary	2
	Interview	3
	News article	59
	Presentation	10
	White paper	14

9.3 Bimodal IT as a New Challenge for Business-IT Alignment

In this section, we summarize our results of the document analysis we conducted on the empirical material mentioned in section 2. First, we present the basic characteristics of bimodal IT and the two different modes it comprises. Second, we discuss the need of changing business-IT alignment and governance as a result of the two modes. Third, we describe different ways of implementing bimodal IT on different levels (architecture, methods, organization). Fourth, we address critical observations raised against the concept of bimodal IT.

9.3.1 Bimodal IT: The Concept and Its Characteristics

With 106 direct and indirect references, the concept of “bimodal IT” is inextricably linked to the analyst firm Gartner. Publications from consulting firms like McKinsey (18 references) and

Boston Consulting Group (4 references) follow with far less references. According to Gartner, the concept is defined as “the practice of managing two separate, coherent modes of IT delivery, one focused on stability and the other on agility. Mode 1 is traditional and sequential, emphasizing safety and accuracy. Mode 2 is exploratory and nonlinear, emphasizing agility and speed” (Gartner 2015a).

Mode 1, which is also named the “core IT”, “industrial IT” or “traditional IT”, is used to ensure reliably running IT by delivering efficient IT services with high levels of operational excellence (Gartner 2015b). This mode focuses on enabling predictability, scalability, risk aversion and cost savings (Henthorn-Iwane 2015) while driving industrialization of services (Bils 2014). Its operation is based on backend ‘‘systems of records’’, which are built to provide long term stability and compliance (Bayley and Shacklady 2015). These systems are changed and improved in longer cycles and are usually managed with long-term waterfall project mechanisms (ibid.). In contrast, mode 2 is mainly based on agility and speed. It is also called “digital IT” or “agile IT”. In this new mode, the IT acts like a start-up inside the enterprise in order to follow short term market trends for which adequate digital services are developed in short cycles (Telecom Asia 2014). These client-facing “systems of engagement” are focused on fast innovation based on the proposed requirements by business units, external partners and customers (Kirschner and Kenney 2014). Value creation for business units, customers and partners is therefore the top priority for services operating in this mode (Gartner 2015b). It aims at facilitating personalized business moments for customers and at triggering customer branding (ibid). Because disruption by changing market requirements can occur at any time, mode 2 operations have to be non-sequential and non-linear based on lean, iterative and agile principles (Bils 2014). The characteristics of both modes are summarized in Table 22. In the following, we will refer to mode 1 as “traditional IT” and to mode 2 as “digital IT”.

Table 22: Characteristics of Traditional and Digital IT.

Traditional IT (mode 1, industrial / core IT)		**Digital IT (mode 2, agile IT)**
Stability	*Goal*	Agility & speed
IT-centric	*Culture*	Business-centric
Remote from customer	*Customer proximity*	Close to customer
Performance and security improvement	*Trigger*	Short term market trends
Performance of services	*Value*	Business moments, customer branding

Security & reliability	*Focus of services*	Innovation
Waterfall development	*Approach*	Iterative, agile development
Systems of records	*Applications*	Systems of engagement
Slow	*Speed of service delivery*	Fast

9.3.2 Bimodal IT: Alignment and Governance

Bimodal IT is described as a concept that allows narrowing the gap between what IT provides and what the enterprise needs. Therefore, it affects the core of strategic business-IT alignment as described by Henderson and Venkatraman (1993). Further, bimodal IT necessarily implies an operational alignment between the two modes as the according IS infrastructures, processes, structures, skills, methods and IT architectures have to be integrated.

Literature most often refers to IT governance and leadership as the key for aligning the traditional and digital IS infrastructures with the business counterpart and the strategic level of business and IT. Clear leadership and responsibilities on all levels are fundamental to the success of bimodal IT (Wall Street Journal 2014). At the operational level, the introduction of interdisciplinary, cross-functional teams consisting of business and IT specialists (Q_Perior 2014) with clear operational lead is a potential solution.

The publications propose various approaches for strategically leading and managing the bimodal IT. Some address the need for a single CIO, who is accountable for both traditional and digital IT to prevent delay and complex coordination difficulties (Wall Street Journal 2014, Andersson and Tuddenham 2014). Other companies, such as travel company Thomas Cook and coffee retailer Starbucks (Francois et al. 2014), favor a chief digital officer (CDO) leading the digital IT (The Economist 2013) who is separate from the CIO heading the traditional IT. For both types of leadership, transparency, resilience, openness to new developments and the ability to adapt and learn from failure are essential for dealing with the digital business (Diallo et al. 2014). Thus, CDOs and CIOs nowadays enhance collaboration with business units, mainly with marketing (Francois et al. 2014). Some CIOs even report to the Chief Marketing Officer (CMO) for stronger alignment (Kirschner and Kenney 2014). Others create even more specialized roles such as business relationship manager or chief marketing technologist who act as the link between the IT organization and the business units (Kirschner and Kenney 2014). As a result, a bimodal IT governance needs to be established, which focuses on compliance and security as well as on agility and flexibility (Bayley and Shacklady 2015). This requires multiple methods like e.g. creating a separate governance structure for digital IT (LeanIT 2015) or a special governance for cloud solutions in both modes (The Open Group Blog 2015). Further, the "governance clockspeed" (CEB 2015) can be accelerated by introducing lean decision processes (Q_Perior 2014), reducing the number of decision makers and using judgment instead of analysis for simple decisions (CEB 2015).

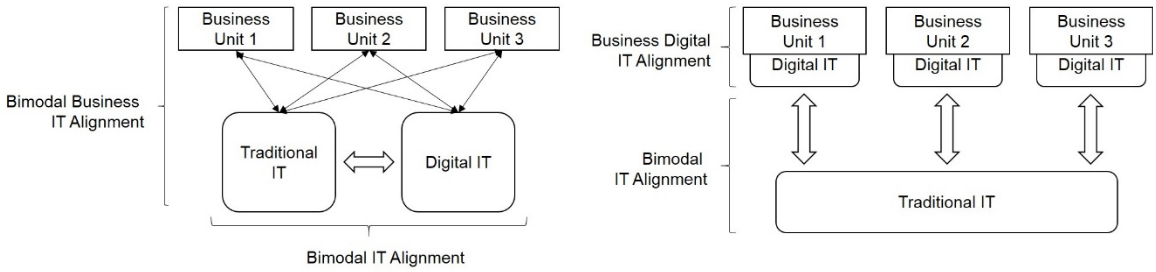

Figure 10: Two Modes of Alignment between Digital IT, Traditional IT and Business.

Consequentially, bimodal IT enforces an extension of the traditional business-IT alignment mechanisms as described by Henderson and Venkatraman (1993) regarding two major changes. First, the two IT modes – traditional and digital – need to be aligned with each other (see Figure 10 left, bimodal IT alignment). The most obvious reason for this is that the agile and customer-facing systems often need to access data, which is stored in the systems that are managed by the traditional IT. Hence, the traditional IT has to change its systems and architecture in a way that the digital IT is not slowed down or hindered. Second, the business units need to align their strategic and operational activities with the digital and the traditional IT in a faster and more agile manner. By decentralizing parts of the IT, a significant part of the digital IT might become a part of formerly non-IT business units. It needs to be aligned with the respective business unit (see Figure 10 right, business digital IT alignment). New governance and alignment mechanisms need to be developed and established to achieve a good business-IT alignment under these changed conditions. The alignment should also be achieved in the mindset of IT leaders and IT personnel to adopt a business and customer perspective instead of a merely technical oriented view (Rae 2015).

9.3.3 Bimodal IT: Approaches for Implementation

Bimodal IT not only changes the business-IT alignment on a macro level, it also implies concrete implementation steps in the IT organization and IS infrastructure. In the following sections, we summarize the implementation approaches on different levels (architecture, processes and organization) as described in the sources we analyzed.

Bimodal IT: Architecture

On the architectural level, bimodal IT takes advantage of emerging tools and platforms for agile customer-facing frontend systems while also running the traditional stable, mission-critical backend systems. This results in a duopoly of business-critical scale-up applications running on one stronger computer and scale-out applications distributed on several regular computers for reacting to changed or new business or technological conditions in the short term (Pfützner 2015). The required flexibility is enabled by virtualizing data and resources in a composable modular infrastructure for traditional IT and digital IT (Greiner 2015), partially with the aid of infrastructure respectively platform as a service cloud-based solutions. Companies often use private clouds for traditional IT in order to shield operations from risks and to ensure security (Delp 2015) while simultaneously accelerating waterfall development (QualiSystems 2015). Additionally, the risks emanating from the use of shadow IT can be reduced by providing users with a flexible productive infrastructure environment for development and testing separate from the traditional infrastructure (Henthorn-Iwane 2015). Digital IT also uses external public or hybrid clouds (Pfützner 2015) to enable the distribution of workload, decrease deployment time of services by enabling live testing (Marko 2015) and fostering the independence of providers and office hours for agility (Delp 2015). Containers and microservices are commonly used for modularization (e.g. id.). Microservices, representing simple services such as retrieving customer information, are encapsulated in containers and then accessed via http and RESTful APIs (Bils 2014). Based on multiple containers, digital IT can then build their applications. By isolating the applications from the operating system, containers can freely be deployed across multiple cloud environments or in the in-house data center (Delp 2015). Further approaches supporting a bimodal integration on the architectural level include well-known concepts like service-oriented architectures (SOA) and data buses (Computerwoche 2014).

Bimodal IT: Processes and Methods

Concerning the process level, bimodal IT implies a bimodality of existing operating models and processes in organizations. For instance, a “two-speed IT service management” is advised to facilitate the provision of value to the customer with new business and operating models. This concept implies the modernization and innovation of the service delivery, in particular the customer communication (Rae 2015). The traditional IT service management needs to be continued, mainly in the field of service operations (ibid.). In the field of business intelligence, "two-speed business intelligence (BI)" is described as a mean to support the operations with data and information in a bimodal manner (ComputerWeekly 2015, Tejada 2015). While the traditional BI team in a company continues to develop BI best practices focusing on security and profound business objectives, an agile mode of business intelligence needs to be established. This mode has to behave highly iterative and has to deal with unforeseen data discovery to provide agility for business by e.g. enabling self-service reporting (Tejada 2015).

Literature most frequently focusses on software development in respect of bimodal processes. For developing and deploying business-centric services with the aid of traditional IT, DevOps is most often used (e.g. Bils 2014). This is a software development method, which emphasizes close collaboration between developers, operations and quality assurance (Meier 2015). Through rapid evaluation and feedback provided by business and external users, the speed and reliability of improving services can be enhanced. DevOps is often combined with agile methods like Scrum (Computerwoche 2014, LeanIT 2015) or Kanban (LeanIT 2015) and is nowadays not only used by digital native companies like Google, Amazon or Netflix, but also emerging in traditional industries like retailing (e.g. Macy's), banking (e.g. Lloyds Banking Group) or utilities (Francois et al. 2014).

Bimodal IT: Organization and Skills

As traditional IT and digital IT fundamentally differ in their working styles and methods, the IT organization is either temporarily or permanently split up. The German car manufacturer Daimler for example chose a semi-splitting approach. Daimler set up a separate "project house" with 100-150 employees for the development of their customer-oriented services where engineers, product developers as well as sales and aftersales specialists work closely together with IT experts (Computerwoche 2014). This "project house" is highly agile by using 3-week sprints and 4 Scrum teams. Other companies prefer to outsource their digital IT in separate "digital units" (Q_Perior 2014) or subsidiaries. These units, which operate outside of the IT, such as e.g. digital-product management (Bossert et al. 2014) and viral-marketing (Gourévitch et al. 2012) act as collaboration forces between business units, customer-centric IT and the user. A third approach is to retain the IT in its traditional hierarchical organization, but to make it act as a service broker for IT-affine business units, which develop the solutions on their own (The Open Group Blog 2015). In this case, IT people act as consultants and coaches for the business units besides providing mainly cloud-based IT services (CEB 2015).

In particular when acting as a service broker, IT often partners with external vendors and third-party providers (The Open Group Blog 2015) to ensure the agreed quality and reliability levels for services by adding additional resources. Furthermore, new functionalities for services, mainly in respect of analytics and mobile development, are facilitated. This includes, as mentioned above, new BI methods like self-service BI (Tejada 2015) and predictive analytics (ComputerWeekly 2015) as well as providing the mobile back-end services (MBaaS) with user management, push notifications, server-side logic, data management and mobile integration middleware (Katz 2015). Partnerships are often not limited to IT resources like cloud platforms (Gourévitch et al. 2012) but more and more include sourcing of required skills (Avanade 2014). To enable IT as a service (ITaaS) for business, skills mainly staff security and risk specialists, developers, systems integration specialists and regulatory analysts (Telecom Asia 2014). For digital IT, external staffing further includes “digital native” skills like user experience, data science, smart machines (including Internet of Things), robotics and digital business architects (Telecom Asia 2014).

9.3.4 Bimodal IT: Discussion

While most of the cited publications consider the concept of bimodal IT as useful for addressing the rapidly growing digitalization and change of customer and consumer expectations towards digital services, some authors note that a bimodal IT organization is rather harmful to the organization. With regard to business culture, bimodal IT is mainly criticized for maintaining ”organization silos” and for creating new silos instead of facilitating business transformation combining business and IT (Katz 2015, Stöcker 2015). Dividing IT organization in fast and therefore “cool” (digital IT) and slow and thus “uncool” (traditional IT) can create a tension between the IT teams who work in these different speed modes (Stöcker 2015). Competition between the two modes could result in non-cooperation with regard to implementation in traditional IT of innovation developed by digital IT (Stöcker 2015). Agile governance linking both modes is not encouraged by bimodal IT. Rather, traditional rigid control structures are favored (Bloomberg 2014). As a result, shadow IT may further encourage ”silo thinking” (Katz 2015).

To overcome the competition between the two modes and the silos, a “multi-faceted IT operating model” (Bayley and Shacklady 2015) or “cell structure” (Wardley 2014) with multi-speed governance supporting those multiple ways of operating by the CIO are proposed as alternatives. Some authors suggest a trimodal IT structure with pioneers for digital IT, town planners for traditional IT and settlers as a mediating function ensuring that the innovation by the pioneers is turned into a mature product before traditional IT can transform it into commodities (Wardley 2014). This differentiation is helpful since IT services are not always bimodal such as e.g. enterprise service bus (Stöcker 2015) or microservices (Bils 2014), which do not clearly belong to just one mode. With an increasing number of such services, interfaces and mixed delivery models for each layer, a multiple management approach is required instead of a restricting duopoly.

To summarize, bimodal IT is being criticized as a temporary and intermediate state for pursuing a digital business transformation of the whole IT organization. While handling the most urgent challenges of digitalization, the resulting impact on the backend organization is not handled in the long term (IT Rebellen 2015). However, the life cycles for those systems are also shortened and the demand for agility, e.g. in software development is also rapidly growing in traditional IT. Therefore, resilience concerning the agility of the entire IT organization is a key factor for enterprises to stay competitive (IT Rebellen 2015). Hence, Anderson and Tuddenham (2014) recommend to iteratively reshape the entire IT, from talent to infrastructure.

9.4 Conclusion

In the age of digital transformation, business IT alignment has to be extended in order to take new digital modes of IT provision into account. As a first step, we need to better understand the challenges and implementation means that are used by companies to establish and advance a digital IT unit. In this paper, we gathered and analyzed material on the different means and methods that companies currently implement or use. Based on a literature review and a document analysis, we outlined the characteristics of digital and traditional IT. Furthermore, we investigated the need for changes in the business-IT alignment that follow the bimodality of IT. Finally, we presented some critical arguments concerning the concept of bimodal IT.

The literature review revealed some fundamental research gaps. Though most of the sources cite Gartner’s definition, a consensus regarding bimodal IT’s content has not been reached. This gap also effects the implementation approaches for IT bimodality, which clearly differ in their extent and method. Developing a clear definition for bimodal IT and formulating concrete suggestions for its implementation are therefore worthwhile next steps. A precise definition would also effect the extensions of the business-IT alignment identified in the paper between traditional and digital IT and to the business units in content and structure. In this context, the deployed methods need to be analyzed regarding their usefulness for achieving an overall alignment. The sources describe bimodal IT as a development that influences various disciplines that support the alignment between business and IT like IT service management, enterprise architecture, and project / project portfolio management. Hence, further research is required regarding the question, as to how these disciplines need to be adapted. Critical voices opine that bimodal IT would be insufficient in the long term. For companies to stay competitive, they propose trimodal and other multi-speed IT approaches in order to bridge a gap between business and IT. Whether these approaches result in a better alignment within the IT and to the business units has so far not been analyzed.

The results presented in this paper are limited due to a number of reasons. Even though the majority of the identified sources attempts to take a neutral stance regarding bimodal IT, an explicit and implicit interference with the authors' opinions is still perceptible. Furthermore, this article is limited in respect of the amount of literature reviewed. While a large number of publications has been examined, an exhaustive review has not been conducted. Research with academic background is scarce so far. Additional research is necessary to gain a better understanding of bimodal IT.

9.5 Literature

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10 Increasing the Agility of IT Delivery: Five Types of Bimodal IT Organization

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Abstract

In the age of digital business transformation, enterprises seek to increase their agility and speed of IT delivery. To accomplish this, they change their existing control-driven IT organizational structures and processes and establish separate modes for business-oriented and traditional IT delivery ("bimodal IT"). Though the concept of bimodal IT has been discussed in practice, empirical research regarding the approaches employed to implement bimodal IT is scarce. This paper presents findings from a qualitative-empirical study on the bimodal IT implementation approaches of nine companies. It identifies five different types of bimodal IT in these enterprises and shows that specific mechanisms are applied to enhance the (business) IT alignment in the respective organizational settings of each type. On the basis of similarities and differences among the types, we develop propositions for future research on bimodal IT and derive implications for practice.

10.1 Introduction

Digital disruptions, demanding shifts in business models, shorter innovation cycles, and real-time reactions to customer demand, are changing the role of IT. IT services are becoming the primary mode by which many companies—particularly those in the 'new economy'—engage customers and create and capture value. As a result, today's CIOs must find a balance between establishing new revenue streams and improving customer experience, on one hand, and the need to 'keep the lights on,' on the other. Companies of the 'old economy' often struggle with this balance because of their rigid and process-driven IT organization. To cure this lack of flexibility in companies' IT, advisory firms, such as Gartner or McKinsey, propose to establish two modes of IT delivery ("bimodal IT" or "two-speed IT") [1–3]. Mode 1 encompasses the operation of the company's core systems, including sequential and long development cycles and process-driven and control-driven IT infrastructure and organization. Mode 2 is responsible for digital innovation [1]. This second mode reacts to rapidly changing customer needs in fast, customer-facing and business-oriented IT organizations. Bimodal IT, thus, seeks to narrow the gap between IT delivery and business needs, a major goal that has been pursued by business executives and IT management for more than 30 years [4, 5].

While bimodal IT has received significant attention from practitioners, academic research is still in its nascent phase. Only two academic research papers address this concept [6, 7]. Thus, it is unclear how bimodal IT is implemented in practice and to what extent alignment between business and IT is fostered through the application of bimodal IT.

This paper, accordingly, seeks to answer the following research questions:

1. *How is bimodal IT realized in practice?*
2. *How is business IT alignment affected by bimodal IT, and what approaches do companies use to enable alignment within IT and in relation to business in the bimodal IT environment?*

The remainder of the paper is structured as follows. In the following section, we briefly describe bimodal IT and business IT alignment as the conceptual foundations for our analysis. Thereafter, we outline the methodology of our analysis and summarize the main results. Finally, we propose future research opportunities..

10.2 Related Research: Business IT Alignment and Bimodal IT

Business IT alignment is an extensively studied concept in IS research [8]. It is understood as "the optimized synchronization between dynamic business objectives/processes and respective technological services provided by IT" [9]. Previous research on business IT alignment has focused primarily at the company-wide strategic level [10, 11]. However, to successfully transfer business or IT strategies into daily business operations, constant interaction between the strategic and the operational levels is inevitable [8, 12, 13]. This, in turn, requires alignment across several organizational levels [8]. First, alignment is required at the individual cognitive level. This level forms the basis for an understanding of others' perspectives on values, beliefs, mental models, expectations, and assumptions [14], which is necessary to foster shared understanding and domain knowledge [15] based on shared cognition [14]. Second, alignment is essential at the group level such as in project settings [16]. This is mainly required to ensure that a project's outcomes fit the IT strategy [ibid.]. Finally, alignment among groups at different department and organizational levels, either within IT or between development and operations [13] or business and IT departments must be enhanced through cross-departmental interactions. This is necessary to foster informational flows, shared knowledge and trust-building throughout departments [17].

Bimodal IT is defined by Gartner as "the practice of managing two separate, coherent modes of IT delivery, one focused on stability and the other on agility. Mode 1 is traditional and sequential, emphasizing safety and accuracy. Mode 2 is exploratory and nonlinear, emphasizing agility and speed" [1]. Mode 1 involves long-term plans, goals, and development applying the waterfall methodology [18]. Information systems associated with this mode are mission- or business-critical systems that are always running [19]. For these "systems of record," business involvement in the application lifecycle is usually limited [8]. Furthermore, silos for development, testing and operations are common [18]. With highly specialized metrics to ensure stability, efficiency, safety, and accuracy [18], mode 1 is responsible for minimizing operational risks while driving service industrialization [20]. Mode 2, in contrast, focuses on the agility and speed of IT delivery to assist the business driving innovation to meet rapidly changing market requirements [18]. Using agile methodologies and new types of technologies, such as cloud-based environments [19] and microservices—simple services designed to, for example, retrieve customer information [20]—mode 2 enables the rapid development, testing, and operation of market-facing systems and services to quickly respond to market feedback [20]. These “systems of engagement” [19] are usually non-critical systems with low risk and low cost, and they are developed in an environment in which IT acts as a start-up within the enterprise, with lightweight governance models [20] and a DevOps culture [18].

Business IT alignment is affected by bimodal IT in two ways. First, unlike established alignment frameworks (e.g. [10, 15]), bimodal IT implies the existence of two IT organizations instead of a single IT. Thus, bimodal IT leads to new alignment dimensions [7]. On one hand, dependencies among systems and operations (“Bimodal IT Alignment”) produce a certain degree of alignment among IT modes. On the other, alignment between business and both IT delivery modes is also required (“Bimodal Business IT Alignment”). In the case of decentralizing parts of agile IT towards former non-IT business units, alignment with the respective business units becomes necessary (“Business Digital IT Alignment”). Second, the established alignment frameworks perceive business and IT as two separate units. As IT is becoming a major factor in value creation in the digital age, a shift towards the convergence of business and IT through, for example, merging business and IT strategy in a “Digital Business Strategy” [21] or “Digital Transformation Strategy” [22] is proposed instead. Bimodal IT is assumed to be a concept for achieving a closer integration of business and IT.

10.3 Research Methodology

Since bimodal IT has rarely been a subject of scientific research, we seek to approach this topic by applying the phenomenon-based research approach according to von Krogh et al. [23]. According to this approach, research on a phenomenon has three stages of development: embryonic, growth, and mature. Within each stage, five research strategies are identified: “distinguish,” “explore,” “design,” “theorize,” and “synthesize.” For bimodal IT, research occurs in the embryonic stage, and we use the explore strategy to analyze the implementation of bimodal IT and its effect on alignment. Therefore, we conducted a qualitative-empirical study based on nine interviews with IT management representatives from different service-related industries. Each interviewee was responsible for the bimodal IT implementation of the respective organization. The companies differed in their status quos regarding the implementation of bimodal IT: While a few were in the early stages or considering or planning the introduction of dual IT modes, others had already established bimodal structures and processes. Detailed information about the interviewees is presented in Table 23.

The initial set of interviewees was based on the authors' personal contacts. Then, a snowball sampling strategy [24] was conducted. For the interviews, we used semi-structured interview guidelines with open questions [25], which enabled the interview partners to speak freely about their individual experiences with the implementation of bimodal IT and their perceptions of the effects of bimodal IT on alignment. To analyze the effects of bimodal IT at the different alignment levels (see section 10.2), the guideline was structured based on the alignment dimensions of business IT alignment and IT alignment within and between IT delivery modes.

Table 23: Interview Overview.

ID	Position	Stage of Implementation	Company Size	Industry
1	Staff Unit for Head of IT	Planning	>2000	IT Services
2	Head of IT	Planning	<50	Banking
3	Project Manager „Agile Transformation"	Implementing	>100.000	Banking
4	Staff Unit for Head of IT	Implementing	>1000	Insurance
5	Staff Unit for Head of IT	Implementing	>2500	Insurance
6	Head of Department "Change the Bank"	Implementing	>2500	Banking
7	Head of Department "Platform Services"	Implementing	<10.000	E-Commerce
8	Senior Consultant	Planning	>500	IT Consulting
9	Staff Unit for Head of IT	Implementing	>10.000	Banking

Between December 2015 and April 2016, we conducted two on-site and seven telephone interviews, each approximately about 60 minutes in length. All interviews were digitally recorded for traceability and were completely transcribed for further analysis. To conduct the analysis, we followed an iterative process of inductive and deductive data coding [26], using the ATLAS.ti tool for support. Based on both the interview guidelines and previous work on business IT alignment [8, 9], one author identified bimodal IT characteristics and searched for evidence of business IT alignment in relation to bimodal IT using open coding [27]. Other bimodal IT characteristics, such as the category sourcing (see Table 24), were generated from the bottom up. In sum, 733 codes were used. The codes were then merged into categories like sourcing. Finally, we identified and compiled detailed descriptions of the bimodal IT approaches. Throughout this process, the findings were discussed among the authors and iteratively refined. This process of data gathering and data analysis will be continued in the future to address some of the open research questions raised at the end of this article.

10.4 Results: Five Types of Bimodal IT

This section reflects the results of the interviews, on the basis of which we identified five types of bimodal IT (see Table 24). Thereafter, we will describe the implementation approach and the alignment mechanisms for each type. We will show how agile IT is embedded in the IT organization (location) and highlight the role of outsourcing. We will further highlight the reach of agile IT in order to indicate which parts of the IT value network operate in this mode, as well as how agile IT is managed and controlled. Finally, we will show how the alignments between traditional and agile IT and between (agile) IT and business are achieved. The order in which we describe these five types is based on the extent and degree of changes a traditional IT organization needs to make in order to implement the respective bimodal IT type. We begin with the least intrusive type.

10.4.1 Traditional IT with Bimodal Development Processes

The first type of bimodal IT we identified in one organization is characterized by traditional IT, with bimodality limited to the development process, which uses both agile and traditional process-driven waterfall development methodologies. Other phases, such as planning, testing and operations, continue to follow the traditional waterfall approach, with a high level of control in each step. This bimodal development approach applies to the development of new and changes to existing ‘systems of records,’ as well as to the development of customer-centric information systems, such as mobile applications.

Because the development process is embedded in the waterfall process, agility is strongly inhibited when developing customer-centric applications. This problem occurs most frequently when a developed application leads to modifications of or extensions to legacy systems, which usually have releases only once or twice a year. In such an event, a complex change management process is initiated. Thus, the ‘systems of engagement’ can only be released in the same cycles as changes to the ‘systems of record.’

Bimodal IT alignment for this type is usually enabled through projects and through the interaction among people within each project. For example, mobile developers enable knowledge sharing with operations during the handover process. Since development and operations are not co-located in the interviewed company, knowledge sharing is achieved through formal meetings, not continuous exchange. There is no formal mechanism for interaction between projects; instead, this occurs implicitly.

Business (i.e. the customer) and IT align primarily through interdisciplinary steering committees for planning and governance. These involve boards for traditional project portfolio management and boards for making decisions on overall standards and architectural aspects, such as programming language and applied technology. At the operational level, business IT alignment mainly takes place between the project manager and the rest of the project team.

10.4.2 Traditional IT with Agile IT Outsourcing

A second mode of bimodal IT we encountered in two organizations focuses on the traditional capabilities within the IT organization. The agile IT is achieved via third party providers or subsidiaries. This results in a partly outsourced IT organization with a traditionally organized ('slow') internal IT and an agile ('fast') external IT.

Table 24: Overview of the Characteristics of Identified Bimodal IT Types.

	Traditional IT with bimodal development processes	Traditional IT with agile IT outsourcing	Bimodal sourcing IT		Bimodal IT	Agile IT
			Bimodal sourcing IT (outsourcing)	Bimodal sourcing IT (project)		
Location of agile IT	Agile development process within waterfall project	Agile project out-sourced to third party provider(s) or subsidiaries	Agile project outsourced to third party provider(s) or subsidiaries	- Agile internal project - Project members except project manager sourced from third party provi-der(s) or subsidiaries	Separate agile IT organization with multiple agile interdisciplinary DevOps teams	Unimodal agile IT organization with multiple autonomous agile interdisciplinary DevOps teams
Reach of agile IT	Development	Development	Development Operations	Development Operations	Development Operations Business (Digital Business Units)	Development Operations Business (Planning, Budget, Digital Business Units)
Role of outsourcing of agile IT	N.A.	Use outsourcing to become more agile	Use outsourcing to become more agile	Use outsourcing to become more agile	N.A.	N.A.
Control of agile IT	Managed by traditional IT project management	- Steered by traditional IT as client via con-tracts & agreements - Managed by internal project steering organization	- Steered by sourcing IT as client via contracts & agreements - Managed in developm. via formal meetings - Managed in operations via support structures	- Steered by internal agile project management - Project organization steered by project steering boards, IT controlling department & project coordinators	- Product owner technical lead for agile team - Steered by additional management regarding disciplinary & technical leadership - Program management via Scaled Agile Framework	- Self-control by autono-mous teams (Technical leadership & decision power in team) - Community control via chapters & guilds - Code of conduct per team & between teams
Alignment between agile & traditional IT	Interaction in project (e.g. knowledge sharing during handover process)	- Project management - Co-location of project team within company - Project portfolio	Not specified (external)	- Project coordinator - IT controlling departm. - Co-location of project team within company - Bimodal skill develop-ment for project manager - Project portfolio mgmt.	- Bimodal skill develop-ment for staff - Interaction CDO & CIO - Interaction in change management process	Not needed (only agile IT)
Alignment between (agile) IT & business	- Business project co-manager - Steering committee for planning & gover-nance	- Requirements engineering - Steering committee for planning & gover-nance	- Requirements engineering - Steering committee for planning & governance	- Business project co-manager - Steering committee for planning & governance - Business Architect as project coordinator on business side	- Product Owner part of agile team - Digital business units - IT-Business Relationship Management function - Steering committee for planning & governance	- Product Owner part of agile team - Digital business units - Common planning, bud-geting & governance steering committees - Lean Governance (e.g. Objective Key Results)

This type has several commonalities with the first type, such as its functional internal traditional IT organization and its waterfall-driven IT delivery with dedicated and traditionally rigid processes concerning planning, operations, and project governance. However, companies of this type have realized that agile development cannot fulfill business needs on its own. This is substantiated by the fact that business units established a parallel IT organization within their units with the help of external providers to solve their problems without involvement of the main IT department due to internal IT’s “many barriers, acceptance, security restrictions, relatively rigid processes and resulting long lifecycle,” as one interviewee stated. To prevent this emergence of shadow IT, this type of IT organization might draw upon one or multiple third party providers or subsidiaries to establish an agile IT mode externally which is internally steered by traditional IT.

The outsourcing of agile IT is primarily intended to overcome the “processual abyss” and slow speed of internal IT. Furthermore, such initiatives can build trust from business that “IT can deliver a solution which still satisfies their needs,” as an interviewee pointed out. Since the companies are operating in rapidly changing areas, time to market is further envisioned, requiring short-run IT capabilities that internal IT cannot currently provide.

To enable internal alignment at a project level, an internal project-steering organization is created that consists of the application’s business owner and the central requirements management function of IT. External project alignment is established mainly through contracts or agreements. However, alignment can also be achieved by seating external staff in-house to foster knowledge sharing among internal staff due to informal communication.

On the strategic level, there is a clear distinction between business and IT of the duties in this type. The business units are perceived as customers of the IT, resulting in individual and business-exclusive product portfolio planning and budgeting. The responsibilities of the IT department lie in condensing the resulting product portfolios into a single project portfolio. Additionally, a dedicated IT department has the task of ensuring the compliance of individual product portfolios submitted by each business unit with formal and legal requirements. During this process, the people in charge of the product portfolios from business and the IT portfolio department have to collaborate tightly. Over the course of the project, interaction between business and IT occurs within formal steering committees, which make decisions regarding, for example, scope. This applies to both waterfall and agile projects.

10.4.3 Bimodal Sourcing IT

Outsourcing one IT delivery mode while keeping the other in-house is not the only prominent approach for enabling agility in traditional IT; outsourcing both modes is also popular. As one interviewee stated, the flexibility of integrating the skills of external partners is one argument for using outsourcing services for both traditional and agile IT. Another interviewee went a step further, declaring that outsourcing is critical for agility as “our hands are tied since we do not develop the IT ourselves.” However, internal supervision is still necessary to fulfill external requirements, since “financial service providers have also to provide very detailed plans to the auditors.”

When outsourcing both IT delivery modes, two different types of corporate IT organizations that shape the role of internal IT can be distinguished:

(1) A client-supplier relationship between corporate IT and the outsourcing partner
(2) Internal IT project organization, with corporate IT as a project manager and an outsourcing partner for a project team

Each type has been identified in one organization.

The first setting resembles the traditional customer-supplier relationship in a bimodal manner, with corporate IT being the client and one or multiple outsourcing partners or subsidiaries for the IT delivery modes. In this type, the corporate IT commissions the supplier(s) for one of the modes and sets the requirements for the specific service. The delivery lies solely in the hands of the outsourcing partner, such that internal IT has little operational involvement. Internal IT also acts as the governance instance during the development phase to monitor progress through regular meetings with the partner.

The relationship with the corporate business is a traditional client-supplier structure. This implies a similar approach to the planning and the governance as used in the bimodal IT approaches described above. Governance mechanisms like steering boards are used, as are waterfall-like planning processes. Alternatively, planning is conducted and steered by dedicated business and IT departments.

The second form of bimodal outsourcing focuses on a lower degree of outsourcing. In this setting, both agile and traditional projects are steered internally, while the resources for development, testing, and operations are sourced from outsourcing providers. Thus, the internal bimodality lies in the bimodal skills of the project managers.

In this type, the project manager is in charge of the project methodology. To ensure an appropriate decision, project managers need to be able to master both agile and traditional methodologies. Thus, project managers need to be equipped with vast methodological skill sets through systematic training. Since such training is usually managed by the human resources department, all IT and business employees can apply for training in agile. However, external staff are expected to already have the requisite skills.

Alignment among project managers is fostered in two ways. The first is via the project coordinator, who is responsible for governance and determines whether the applied approach is applicable for developing the solution, particularly at the beginning of the project. This role acts as a ‘hub’ through which bilateral exchanges with all project managers occur; however, no direct exchange among the managers is facilitated. The same applies to the ongoing interaction with the central IT controlling department, which has the task of ensuring that all projects fulfill formal requirements, such as compliance and other policies. Direct interaction among project managers is ensured by locally centralizing all people in a department with fixed workplaces.

Alignment between business and IT is enhanced mainly by establishing steering boards together with the outsourcing partner to govern one or multiple projects. At the project level, alignment is fostered by appointing one technical IT and one business project manager per project. Finally, a business program manager is appointed as a business counterpart to the IT project coordinator. This business program manager continuously interacts with the business units involved in the projects and, thus, acts as a ‘hub’ for the business side.

10.4.4 Bimodal IT

Two investigated organizations decided to implement bimodal IT in-house, without giving outsourcing providers a major role. This type of bimodal IT characterizes the separation of the two IT delivery modes regarding structures and processes. The separation can culminate in separating executive leadership, with a Chief Digital Officer (CDO) being responsible for the agile IT and the CIO being responsible for the traditional IT organization.

Though it also targets “time to market, creativity and collaboration with customer proximity fostering innovation”, internal agile IT mainly ensures “higher agility, flexibility and reactivity towards customers” with internal IT for the firms. Knowledge about the organization of the agile IT is seen as “intellectual property” and is considered a valuable asset. Outsourcing is not an option for these companies. As one interviewee puts it: “outsourced competencies are lost after 3-5 years. Then, it takes decades to build this know-how within the organization again.”

Regarding the organizational structure, a separate agile IT organization and agile processes are currently being set up in these companies. While the traditional IT organization is still functionally structured and managed, new approaches for structuring agile IT, such as the concept of small (5 to 10 people) agile interdisciplinary business and IT teams, are being piloted. These are divisional teams, formed based on features as fractures of a complex service instead of the grouping of functions. The core method typically applied within these agile teams is scrum. Thus, the teams usually involve a product owner from business as well as a development team and a scrum master. The application of scrum in this context has several differences from the original scrum concept. First, the product owner is an active member of the team in all stages from planning to deployment, locally sitting together with the team instead of guiding the requirements engineering from the outside. Second, the sprint duration can be adapted to the requirements in terms of complexity and effort. However, the management structures for the agile teams are steered traditionally, with a personal union of disciplinary and technological leadership for each team. For the future, flat hierarchies within agile IT are planned instead.

Working in agile IT requires a different skillset that is sometimes not sufficiently provided by internal staff members. Thus, insourcing is a prominent approach in this type. To staff the agile IT organization, the companies apply a plethora of sourcing mechanisms. For internal talent management, events like hackathons within the traditional IT department are organized. Further actions include reviews of skill sets and training in agile methodologies as well as the possibility for job rotation. These are conducted not only within the IT organization, but via the rotation of staff with certain skill sets from different business units. External talent management is mainly executed by insourcing from outsourcing partners. The degree of insourcing varies within departments and between companies. Many solely insource staff with certain skills and a t-shaped character. Such an approach implies that the talent has expertise in one context (e.g. cloud operations) and fundamental knowledge in multiple other domains. In certain new digital areas, such as data science and UX design, the focus is more on seeking specialists. Instead of pursuing individual staffing, agile IT organizations also increasingly maintain partnerships with one or several partners with digital expertise, such as specialized agile start-ups. To insource this talent, these companies are sometimes acquired by the larger organization.

To separate traditional and agile IT at a process level, agile teams include sourced operations staff in the team structure and use cloud solutions for testing and operations environments, following the DevOps methodology. This enables agile IT to operate separately from traditional IT and further fosters intra-team alignment between development and operations. Since independency is also applied to other agile teams, the architectural concept of microservices is increasingly used in agile teams with small independent services, which can only be accessed via a standardized API. These services can then be composed into complex IT business services. However, in practice, dependencies between the two IT delivery modes still exist (e.g., through the use of data and functionalities from traditional IT legacy systems in agile IT services).

Agile IT has the role of narrowing the distance to the business organization so that IT becomes a partner instead of a service provider. While this is facilitated by the close proximity of the business product owner at the team level, similar approaches are needed at the program and strategy levels as well to improve the alignment. Frameworks like the Scaled Agile Framework (SAFe) [28] for scaling agility in a process-driven way at strategic, program, and project levels are increasingly used to approach this challenge. The SAFe framework implies an ongoing and tight partnership between IT and business throughout the delivery process from planning to deployment. For the planning phase, one organization currently argues for the use of such methodologies as design thinking or business games to deepen the business IT relationship to promote shared idea generation regarding new potential products. Finally, a step towards business IT partnership is to locate agile teams inside the business location, such that both ideally sit together in one place. Both organizations plan or have already established digital business units, which are dedicated units consisting of both business and IT staff for developing digital services. This proximity maximizes the bilateral exchange of knowledge and information and enhances shared domain knowledge.

Currently, traditional governance approaches, such as steering boards and jour fixes, are still the most common pathways of interaction between business and IT. Furthermore, a central business relationship management function for both agile and traditional IT enhances the IT business relationship by ‘listening’ into current strategic business initiatives and filtering the required IT skills to realize respective initiatives. This role also serves as central demand and IT project portfolio manager and is responsible for governance with respect to formal requirements within the studied organization.

10.4.5 Agile IT

The last type of bimodal IT, which we identified in two organizations, is characterized by an internal, unimodal, agile IT organization that seeks to drive business agility and time-to-market via a rapidly responding IT organization. Internally, this organizational setup was favored by the interviewees for driving efficiency and performance because it "prevents whispers down the lane" by "reducing the number of parties in the backseat drive." Communication overhead and long project durations are, thus, avoided, and agility is, in turn, enabled.

To realize this agility within IT at the lowest level, autonomous agile interdisciplinary teams, which have long-term responsibility for a single feature of a service, are used. Team members are responsible for the entirety of the IT delivery process, from planning to operations, as well as for quality assurance; thus, they follow the DevOps methodology. These teams have democratic structures resulting in autonomic decisions based on discussions among the team members, typically regarding how to develop the solution and team management. Unlike the agile teams in the former type, these teams act as self-organizing units. They not only have responsibility for the applied method and sequence of task completion, but are also responsible for team composition, decision structures and the overall team mission. Functional leadership for these teams is provided by the product owner, who is responsible for prioritizing the work of the team and is also a member of the team. Due to the team's autonomy, there is no disciplinary leadership. Instead, each employee has a dedicated supervisor who is responsible for the individual personnel development. This supervisor works in the central human resources department.

Every autonomous team belongs to a divisional department. While these departments are led by dedicated managers, these managers exist solely in a coaching capacity for the individual teams. Coaching includes, for instance, acting as a mediator in case of conflicts or enforcing decision-making if a team gets stuck. Furthermore, the managers can advise teams to use specialized coaches, such as agile coaches, for methodology consulting and decision support, or specialized project managers for managing projects consisting of multiple teams; these additional coaches are provided by the organization. Finally, the managers are responsible for setting up the department's annual goals, which are fulfilled at the beginning of the year based on corporate goals. For this purpose, one company follows Intel's concept of "Objective Key Results" (OKR) [29] which focuses on qualitative objectives for whose fulfillment every employee autonomously defines measurable key results. Both objectives and key results are accessible to all members of the organization.

To foster alignment within the entire IT organization, while simultaneously scaling agility, team-based frameworks, such as Spotify's model [30], are increasingly used in this type. According to this model, companies not only create feature-based autonomous teams, which are called 'squads,' but also combine them into departments, known as 'tribes', based on products. Shared knowledge and understanding among autonomous teams is enhanced throughout the organization by establishing semi-formal 'chapters' of employees with similar professional functions and 'guilds' of larger communities of interests, which allow employees to discuss knowledge and practice. While chapters usually reside in one tribe, guilds enable organization-wide communication.

Alignment with business is enabled not only by including the business product owner as a team member, but also by establishing digital business units by integrating the team inside the business unit using the developed digital product. At the executive level, business is involved in the product portfolio management process, as well as in meetings for budgeting new products. Unlike in the types described above, in this type, budgeting negotiations are product-driven instead of project-driven.

Governance and compliance at the team level is kept simple through OKR and support via monitoring tools. Currently, there is no monitoring for team effectiveness; instead, teams follow codes of conduct. The way in which the teams reach their solutions is also not monitored. This applies to the organizational level, as well. Instead of process monitoring and optimization, the IT organization governs the success of the business models.

10.4.6 Cross-Type Alignment Analysis

Comparing the alignment approaches of the five bimodal IT types shows that each type uses distinct mechanisms based on the respective setting (see Table 24). However, a comparison of all five types also shows some similarities, especially regarding business IT alignment at all organizational alignment levels [8]. At the individual level, cognitive business IT alignment is trained primarily on the job for all types. However, given the increasing extent of bimodality within the organizations, dedicated business skill development for IT staff needs to be a core focus. 'T-shaped' people have not only IT skills, but also business knowledge gained during training or on the job. IT training for business staff is not common, but is mainly achieved through job rotation. At the personal and team levels, business IT alignment further depends on the extent of involvement of the product owner in the team setting. This role transports the overall strategy into IT by transforming business goals into product requirements. All types incorporate business product owners within their agile projects. The function of this role differs among the types. While, in the first four types, the product owner functions merely as outside requirements engineering, in the 'Bimodal IT' and 'Agile IT' types, this individual plays an integral part of the team. At the program level, traditional formal business IT alignment mechanisms, such as steering boards and process controls, still dominate in all types. These include highly formalized planning processes, such as portfolio management and requirement engineering. Only small steps towards agility have been taken by bimodal IT, mainly in the 'Agile IT' type, which has introduced Objective Key Results and lean management and governance. At the organizational level, a larger part of agile IT leads to a shift from a process-driven functional towards a product-based divisional IT organization. This culminates in interlinking, dedicated, autonomous agile teams with corresponding business teams as business digital units. A higher level of agile IT requires more comprehensive changes to the operational business.

Although a formal separation between traditional and agile IT is envisioned in bimodal IT, alignment between the modes is still necessary for establishing a shared understanding. For this purpose, well-known alignment mechanisms are widely applied at all organizational levels. At the individual level, the individual employee trains in bimodality on the job via working in projects and engaging in related interactions for most of the types. In addition, dedicated bimodal skill development, such as training in agile methodologies, is available for staff members. At the team and department levels, traditional formal mechanisms, such as common project steering boards, IT controlling functions, and formal project portfolio management, are still dominant in all types for aligning the IT delivery modes. Agile IT also enables direct bimodal IT interaction within change management processes to modify legacy systems based on requirements. For 'Agile IT' and 'Bimodal IT', the DevOps methodology of incorporating existing operations staff into agile teams is further introduced to align traditional and agile IT. For the types using outsourcing, alignment is facilitated mainly by formal mechanisms, such as contracts and agreements, as well as by steering meetings with the outsourcing partner. At the organizational level, alignment currently focuses on shared understandings based on ongoing interactions between the CIO and the CDO.

10.5 Discussion and Practical Implications

Our research was motivated by the lack of empirical research on bimodal IT implementation and alignment mechanisms. By conducting an exploratory study with a small set of service-related organizations, we identified five types of bimodal IT (see Figure 11) that are adopted in practice, each of which has distinct characteristics regarding bimodality and, in particular, regarding the location and reach of the agile IT organization (see Table 24). With regard to the second question, “How is alignment affected by bimodal IT?” our study confirms that the heterogenic nature of IT in bimodal IT leads to three new forms of alignment dimensions: ‘Bimodal Business IT Alignment,’ ‘Bimodal IT Alignment,’ and ‘Business Digital IT Alignment’ [7]. However, our results further enrich the three dimensions by observing different alignment mechanisms among the identified bimodal IT types. While ‘Bimodal Business IT Alignment’ is evident in all five types, for the majority of types, alignment either focuses on traditional, sourcing IT or takes place solely between business and agile IT. ‘Bimodal Business IT Alignment’ between both delivery modes [7] is evident only in ‘Bimodal IT’, in which both modes directly interact with business. ‘Bimodal IT Alignment’ is also present in all types except ‘Agile IT.’ However, our study shows that, due to the outsourcing of one or both modes in half of the types, this alignment dimension needs to be extended via an external dimension to incorporate the fit between the internal IT organization and the corresponding outsourcing partner(s). Regarding ‘Business Digital IT Alignment,’ no heterogeneity is identified.

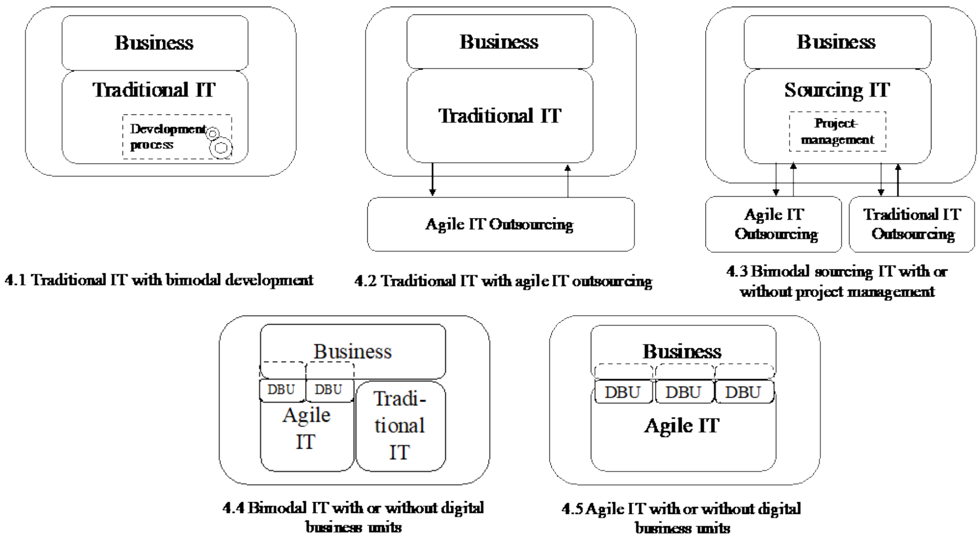

Figure 11: Identified Bimodal IT Types.

Previous literature on alignment advocates optimizing the fit between business and IT at the strategic and operational levels (e.g. [4, 10, 15]). While established alignment frameworks, such as [10], address the fit between a single, homogeneous, traditional IT and the business side, bimodal IT implies further types of fit between new and multiple forms of IT delivery, all with differing expected outcomes and visions. Moreover, agile IT aims to converge with business. In this regard, our study supports Bharadwaj et al. [21] and Matt et al. [22], who advocate the closer integration of business and IT, considering the differing needs of the digital age. By highlighting useful existing organizational approaches for business IT convergence, such as ‘digital business units’ and ‘Objective Key Results,’ based on the findings, we provide the missing link in the strategic operationalization of these concepts.

For practitioners, this study is relevant because the results highlight the multi-faceted nature of bimodal IT. Driven by the desired outcome and the desired speed of this outcome, as two contingency factors influencing the organizational arrangements, executives must choose a specific bimodal IT strategy. The bimodal IT strategy is inextricably linked to the sourcing strategy, since a move towards agile IT creates new requirements for sourcing arrangements. Alternatively, given a lack of internal capabilities, it can be a solution for realizing agile IT.

With respect to alignment, new solutions are needed to enable a new business IT alignment by integrating business and IT more closely. In terms of governance, ways to loosely couple bimodal governance approaches to fully enable speed in agile IT, while still achieving high control in traditional IT, must be developed. In sum, companies need to be very clear about whether bimodal IT is their desired target state or a transitory state for them. Some practitioners are defining bimodal IT as a targeted state, while others see bimodal IT as a step towards achieving full agility in their IT organization.

Examining our results critically, we conclude that the ‘Agile IT’ type is exceptional in our study. If a strict definition of bimodal IT is applied, ‘Agile IT’ would not be bimodal IT, since it is characterized by internal and unimodal agile IT organization. However, as companies of this type still divide their systems into internal backend and customer-centric systems, they struggle with some of the issues encountered by companies engaged in bimodal IT.

10.6 Conclusion, Limitations and Outlook

Although bimodal IT is perceived as an inevitable step towards digital business transformation, research on its implementation and its effects on alignment mechanisms remain, thus far, scarce. We have addressed these concerns by examining and structuring the practice-driven concept of bimodal IT and its relation to bimodal (business) IT alignment. We confirmed that several implementation approaches, ranging from bimodal development to a transformation towards agility of the whole IT organization, exist in practice. We also found that bimodal IT still mainly implies the transformation of the IT organization and does not focus on transforming the whole organization; this continues to separate business from IT.

Our study is mainly limited by its small sample size. Further, the data of our empirical study are restricted to service-related industries in a single country. Therefore, generalizing our results is possible to only a limited extent. We approached this limitation by choosing organizations of different sizes and from different industries. Further, we were careful to choose only interview partners who were experienced in bimodal IT. Still, our results require further input from different industries and regions.

Future research might address the question of how alignment is enabled within the IT function and in relation to business. Thus, research on best practices and contingency factors that foster or hinder alignment is necessary. Finally, further inquiries into the contingency factors influencing the different bimodal organizational designs must be conducted.

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11 Bimodal Enterprise Architecture Management: The Emergence of a new EAM Function for a BizDevOps-based Fast IT

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Abstract

During the last years, many companies established fast IT or digital IT units dedicated to build and operate digital customer-facing services. These units adopted agile methods, new tool chains as well as new organizational settings like BizDevOps teams. BizDevOps teams are responsible for continuously (re)defining business functionality of certain (micro-)services, (re)developing and running them. In these new fast IT environments, the role of enterprise architecture management changes dramatically. BizDevOps teams have a high degree of autonomy in designing both, the functionality and the architecture of their (micro-)services and thus contribute to business-IT-alignment in a new way. Nevertheless, a central enterprise architecture management (EAM) function is still required for supporting the teams regarding cross-team and cross-service issues. Furthermore, as many companies still run the traditional IT function side-by-side with the new IT function, the EAM functions of both parts have to cooperate. Based on a single case study, we discuss the emergence of a new EAM function (“fast IT EAM”), changing tasks and processes, implications for EA models and challenges for the integration of the traditional EAM and the fast IT EAM functions.

Keywords

Enterprise Architecture Management, DevOps, BizDevOps, Fast IT, Digital IT, Agile

11.1 Introduction

Enterprises in many industries face a challenge that is often summarized with the term "digitalization". As a reaction, they foster the automation of internal processes and develop new digital services for their customers. The development of new customer-facing digital services and their continuous improvement leads to challenges that are new compared to those that have been associated with the role of the IT department in the past. Hence, many enterprises build a new digital unit as a center for the ideation, creation, development and operation of these new digital services. This change often leads to a situation, in which two different modes of IT provision coexist. This has been characterized as "bimodal IT" in recent publications [4][7][8][9][18].

New digital service units (often labeled "fast IT") are different compared to the role of the IT department regarding several aspects. First, they are intended to have a much closer relation to customers and partners of the enterprise than the traditional IT (or "slow IT") [8]. Second, the organization is often based on interdisciplinary teams that are responsible for a certain business capability or domain. Within this capability or domain, the teams are not only responsible for the development of the services, but also for its operation (DevOps) and in some cases even for business aspects (BizDevOps) [18]. Third, on the technology side, new vertical architectural patterns like loosely coupled microservices are used to encapsulate business and IT in a new vertical structure [13].

The impact of the emergence of fast IT units and bimodal IT on IT management is manifold. While some areas have already been covered in publications, the changing role of enterprise architecture management has only been analysed and discussed in a brief manner. We draw on existing publications from scientific and non-scientific sources as well as on insights from a single case study to gain a better understanding of the changing role of enterprise architecture management (EAM) in the age of digitalization and bimodal IT.

In this article, we address the following research question: *How does the emergence of fast IT units change the EAM function and which are the differences compared to the traditional EAM function regarding its role, tasks, EA models and meta-models?* By answering this research question, we seek to contribute to the current streams of research on EAM, bimodal IT and digitalization.

This introduction is followed by section II, in which we summarize related research. Section III describes the methodological approach we employed as well as the context of our case study. Section IV comprises the results from the case study. In section V, we discuss the theoretical and practical implications of this case study. The article closes with a summary and an outlook.

11.2 Related Research

11.2.1 Enterprise Architecture Management

The function of EAM is established in many companies today. Research on EAM-related topics often goes back to the early publications of the Zachman framework in the 1980s [26]. Today and due to the broad adoption of EAM in practice, research on EAM covers many different sub-topics including its role for business-IT alignment, processes, meta-models and models, visualizations and its integration with other business functions [5][12][16][20][23]. EAM is often defined as one important field of IT governance and management and is therefore part of according frameworks like COBIT 5 [11]. EAM specific frameworks (like TOGAF) include detailed descriptions of tasks, processes and responsibilities as well as suggestions for meta-models [22]. For frameworks like TOGAF, EAM represents a key business capability and encompasses the full enterprise architecture domains from business to more IT-related domains such as information, data, applications and technology. Therefore, the overall accountability is with the CEO as the "chief architect" in order to drive the fusion between business and IT, using EAM as a supporting function for business transformation and for realizing greater value from IT. In close collaboration with business and IT executives as well as with the architecture board, the CEO needs to establish an architectural vision as an architectural baseline in alignment with enterprise strategic objectives and migrates this vision via implementation strategies and target architectures across the whole enterprise [22]. Furthermore, the executives or a specific enterprise architecture function makes architectural decisions like e.g. standards, taxonomy, procedures, or architectural governance requirements top-down and enforces them [11]. Traditional enterprise architecture management therefore acts as an instance of planning and control for the architectural development of the enterprise.

11.2.2 Fast IT & (Biz)DevOps

Digitalization of the business as well as shorter innovation cycles and changing customer demand result in new requirements towards the IT organization. Today's IT organizations are not only responsible for maintaining operational excellence by ensuring stable, secure operations of existing IT systems, but they also need to develop new IT services for the business to enable enhanced or new (digital) business models. In order to be able to fulfill this duopoly of functions of IT, companies increasingly implement a bimodal approach by “managing two separate but coherent styles of work” [4].

The first mode of work – traditional IT – aims at stability, predictability, safety and performance of the systems [4][9]. Therefore, this mode is responsible for driving the industrialization of services by exploiting the legacy systems while minimizing their operational risk [7]. This mode encircles the operation of the company’s mission-critical core systems with long and sequential development cycles, usually based on waterfall development, and control-driven IT organization and infrastructure [7]. However, this mode is also responsible for renovating the legacy environment so that these “systems of record” [3] are fit for a digital world. The second mode – fast IT – completely focuses on digital fitness of the enterprise by enabling digital business innovation in close collaboration with the business side to fulfill rapidly changing customer needs [4]. The resulting business-centric services – so-called “systems of engagement” [3] – are then developed in an environment where IT acts like a start-up within the enterprise with a non-linear and agile organization and lightweight governance structures [7]. The needed agility and speed of IT delivery is further facilitated by automatizing application development, test and operation following the continuous principle [7].

Fast IT commonly follows the DevOps philosophy where high-quality deliveries of software with short cycles is envisioned by enforcing continuous communication, close collaboration and smooth integration between development, quality assurance and operations [1][10]. For realizing rapid delivery of software solutions to the end user, DevOps needs a high degree of automation which is enabled by a variety of tools for each phase of the delivery process (e.g. Jenkins for Build or Puppet for Deployment) [15]. DevOps therewith enables continuous development and frequent releases of the software to the end user, which in turn may result in earlier solution delivery [10]. By continuously monitoring the process as well as based on ongoing feedback by the end users, DevOps further emphasizes continuously improving the solution as well as the processes to the changing requirements [1][15]. While DevOps strives for closing the gap between development and operations, it is still mainly IT-centric. DevOps perceives the IT department solely being responsible for the creation of solutions and is thus excluding the business side from the team members. An extension to the DevOps concept, which focuses on narrowing the gap towards the business philosophy is the concept of BizDevOps. This approach gives the business departments an active role in the creation of digital services and application software [6]. Therewith, the business side is deeply integrated in the whole delivery process. This further accelerates the necessary knowledge exchange between business and IT and leads to faster feedback cycles [21].

Elements from DevOps are also used in the microservice concept [1]. Microservices fragment applications to a more finely grained, modular level and are built around business capabilities [14]. Each service has its own lifecycle and runs its own process, thus being independently deployable [17]. Communication between the services is enabled by lightweight mechanisms such as APIs via HTTP [17]. Central management of microservices is usually rather limited. Instead, feature-driven teams independently manage their associated services in a decentralized way [14]. However, each service has impacts on other services due to call dependencies (either at development or at run time). These dependencies have to be identified, analyzed, as well as validated in order to allow a better management of the overall system’s increasing complexity. Furthermore, the increased deployment frequency and distribution level of the services needs to be handled [25]. Therefore, microservices need a DevOps environment where constant visibility and transparency on deployed services as well as corresponding versions and dependencies is provided.

11.2.3 Enterprise Architecture Management, Fast IT & (Biz)DevOps

Research on enterprise architecture management in fast IT environments and with references to microservices in particular is scarce. So far, only a few authors like e.g. Zimmermann et al. [25] or Bogner & Zimmermann [2] addressed the problem of how to integrate microservices into the enterprise architecture models. They conclude that it is needed to establish a holistic and easily adaptable “digital enterprise architecture” which is able to support the digitization of products [2]. The authors use TOGAF as the reference model and their “Enterprise Service Architecture Reference Cube” (ESARC)” [2] for supporting the representation of microservices. Microservices are represented in two layers of the architecture cube: information systems and technology [25]. While the information systems architecture stores the utility, tasks or rule services, the technology architecture encompasses e.g. services for messaging and choreography. However, the authors admit that their architectural framework is not completely suitable for microservices and needs adjustments since microservices differ from the service concept known from the SOA architectural environment. Therefore, the authors argue for "formalized small-decentralized mini-metamodels, models and data on microservice descriptions (enterprise architecture mini-descriptions)" [2] which consist of layers of partial enterprise architecture data, models and meta-models in association with microservices [25].

Enterprise Architecture in an agile environment is also seen as a key function in approaches for scaling organizational agility such as the Scaled Agile Framework (SAFe) [19]. Here, the function of the enterprise architect is mainly technology-focused, being responsible for the strategic technical direction. Thus, enterprise architects are established to drive the collaboration across programs and teams for following a common technological vision via e.g. giving recommendations for the technological stack as well as interoperability of the solutions. The assurance of aligning the overall technical vision to the individual programs or projects under progress is the responsibility of the roles of system or solution architects, e.g. by being involved with defining nonfunctional and higher level functional requirements on solutions which analyze the major subsystem and components and technical tradeoffs and building the technical basis the infrastructure provided for the agile teams to deliver the features on solutions without excessive refactoring (architectural runway). The authority for making the majority of architectural decisions is however delegated to the agile teams since they do the actual work on the solution. Therefore, enterprise, systems and solutions architects are rather guides for the empowered and self-organizing agile teams from a technological point of view in order to ensure the conformity of the individual program and project strategy to the enterprise objectives.

The DevOps philosophy is also clearly engrained in the Scaled Agile Framework thinking, e.g. in the main goal of enabling continuous delivery of solutions to ensure a faster value flow for the user [19]. To operationalize this vision from the operations side, the role of the system team was introduced. This team is a special agile team which is responsible for the operational aspects of a release, especially continuous integration, infrastructure, and automated builds. The team is grouped and collaborating with other agile teams as well as the business stakeholders and product management forming a large cross-functional team of teams across the DevOps lifecycle, the so-called "agile release train" [19], in order to deliver continuous flow of incremental releases of a solution to the users. The team meets together regularly, continuously integrates and demonstrates what they are building iteratively and the business side as users continuously provides feedback.

11.3 Method and Context

In this paper, we draw upon a single case study [24] that has been conducted in cooperation with a large company from the retail sector. The company is a relevant case for our research question as it has a fast IT unit in place, in which several BizDevOps teams are responsible for planning, developing and running a microservice-based online store.

As the fast IT units of enterprises act on the interface to the highly dynamic environment, getting access to these units for research purposes is not easy. For our research project, we combined several data sources for getting deeper insights into context. The first major source was a set of informal interviews and workshops that we conducted as a part of a sub-project focusing on the aspect of architecture-based cost distribution for microservices. The second major source was information about the current architecture and its EA model that we received from an enterprise architect. The third source was a discussion with a consultant who knows this enterprise and its architecture quite well for several years. Additionally, we had three master theses that were conducted in this context and we exchanged information with the master students. Step-by-step, we refined our insights on this case and discussed the results with the consultant and the master students for validation purposes. For sustaining the anonymity of the company, we call it “Alpha”, do not name precise data of the company (revenue, exact number of teams) and rename some of the platform component and team names.

Alpha company is a large, international operating multi-channel retail company. In our case study, we focused on the electronic commerce part, which acts as a fast IT unit for the web shop. This unit has been partly reorganized based on agile concepts including the DevOps approach since 2011. In 2016, more than 10 BizDevOps teams are responsible for developing and running approximately 130 microservices. The EAM function in this company follows a bimodal design. While one EAM team is responsible for the traditional IT, the eCommerce part of the company established a second EAM function with a completely different role and set of activities. Both teams use their own EAM tools and build their own EA models in these tools. This leads to an overlap between both tools. Central elements of this model (like business objects) are shared. However, we did not find a synchronization process for harmonizing the models stored in both tools.

11.4 Case Study: EAM in a BizDevOps Environment

In this section, we present the results of our case study. We start by describing the BizDevOps Environment at Alpha and the new role of EAM in the fast IT unit. This is followed by an analysis of the new tasks and processes of this function. Afterwards, we discuss the current EA meta-model and EA model that are used in the company. Finally, we evaluate the current state of EAM in the focal enterprise.

11.4.1 The BizDevOps Environment at Alpha

At Alpha, more than 10 BizDevOps teams are planning, building and operating a microservice-based architecture. Each of these teams is fully responsible for several microservices. In each team, a person with a role called “business designer” defines what will be developed in the upcoming iterations. The developers in the teams work in an agile, Scrum-based mode for building, testing and running parts of the eCommerce platform. Each team also has a “technical architect” who acts as a software architect in the team and coordinates architectural issues with other teams and the fast IT EAM function. The teams are dedicated to four basic parts of the platform functionality, including (1) navigation & search, (2) product details, (3) recommendation and (4) order processing. Each of the teams is responsible for a set of microservices (approx. 10 per team in average). Figure 12 provides an overview of the platform parts, teams and microservices. Each small box represents a microservice. Each arrow symbolizes a relation between microservices (one microservice is calling the API of another microservice). The dashed lines show that the teams own sets of microservices that form an integrated functionality for the platform. While the microservices are loosely coupled in general, some microservices are more closely interconnected. For each of the roles in the teams (business designer, developer, technical architect) there is one central role (enacted by one or a few people) in the department which has the task to orchestrate the activities of the teams for these activities. Due to the high degree of team autonomy, these roles cannot be understood as heads for these areas in a hierarchical sense. Instead, their goal is to coordinate and support the teams in these three dimensions.

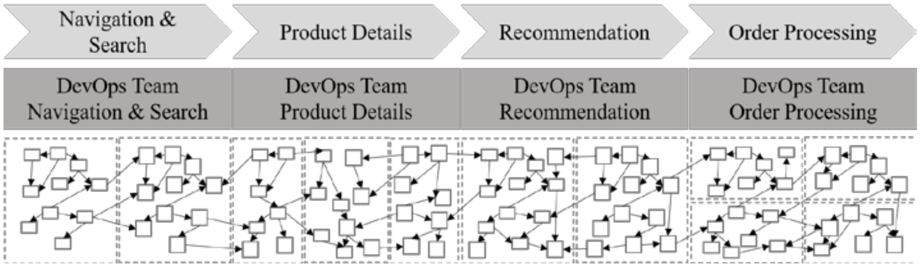

Figure 12: Platform Functionality, Teams and Microservices at Alpha.

11.4.2 The New Role and New Concerns of EAM at Alpha

Several years ago, Alpha established the EAM function as a part of the eCommerce department. Due to the changed methodological approach and the high degree of autonomy for each team, the EAM function takes a new role and faces other concerns than the EAM function as described in the literature. As a starting point, we characterize the new environment of the EAM function by stressing a set of four basic organizational and technical principles:

1. High degree of autonomy for all teams: If the concepts of BizDevOps, Scrum and microservices are fully applied (like in this case), the autonomy of each team for making decisions relevant to architectural elements is higher thus leading to a decentralized decision-making process.

2. Limited architectural transparency: Consequently, the teams do not necessarily need to provide information about the architecture they use for developing and deploying their microservices. The central EAM function in this environment only focuses on the cross-microservice level and leave the architectural responsibility for the inner structure of each service to the technical architects in the teams. The EAM function thus deals with microservice architectures as (at least partly) “black boxes”.

3. Recommendations instead of guidelines: Due to the high degree of autonomy, there are no centrally defined strict guidelines for using certain types of technology. Instead, some recommendations exist, but each team might still decide on its own, which technology it uses.

4. Scalable and highly flexible (“fluid”) architecture: The architectural elements (esp. on the technical layers) are not as stable as assumed in traditional EAM approaches. Software defined infrastructures allow to rapidly change the architecture on demand.

Consequently, the role of the central EAM function is now a supporting and consulting role. While the traditional role enforces technological standards, approves projects and tracks changes of the EA enterprise-wide on a detailed level, the new role seeks to support the teams regarding their architectural questions as a consultant. The new role mainly focusses on cross-team issues and it is not in charge of allowing or disallowing certain technologies or making and enforcing architectural decisions. Hence, the business designer and the software architect in each team now make major architectural decisions on the detailed level thus acting as a decentral EAM function on a microservice level with a very limited scope but full responsibility. Due to the autonomy of teams, not only architectural decisions are left to the teams but also the way of their documentation (granularity, tools, etc.).

11.4.3 New Tasks and Processes

Compared to the traditional EAM function, fast IT EAM has different tasks and responsibilities. In our case, we identified three major fields of activity: (1) support cross-team and cross-microservice architecture development, (2) keep track of the permanently changing IT architecture, (3) provide an information basis for allowing cost transparency for each team / microservice.

1. Support cross-team and cross-microservice architecture development: While many changes can be conducted with a single or a few microservices, some business requirements will lead to changes that effect multiple teams and services. For each of these larger tasks, the teams need to exchange information and to coordinate their activities. The new EAM function is able to provide information about the architecture as a whole and about interrelations among the involved microservices. Such larger requirements are for example voucher handling, abonnement or seasonal offerings. Each of these requirements effects several parts of the system including product details (for certain products), recommendation and ordering.

2. Keep track of permanently changing IT architecture: Due to the shorter development cycles and the autonomy of the teams, the architecture evolves faster than in traditional IT environments. For example, the calls between microservices increase with a growing functionality of the platform. Hence, tracking this evolution at develop and run time will allow to identify where, when, why and in which scale this happens. This in turn will contribute to decisions whether the original shaping of microservices is still appropriate

or reengineering is required. Automatically gained data from DevOps tools will help to track the architecture's evolution. Without such tools, the effort for documenting the changed would be too high.

3. Provide an information basis for allowing cost transparency for each team / microservice: In the case, teams are supported by infrastructural resources and IT services in line with demand. Agile allocation of resources/IT services is required due to a broad range of reasons stemming from exploring new technology in test beds to eruptive changing consumer behavior at run time. In order to equip autonomous teams with abilities for housekeeping and cost control, transparency about their used resources and cost is needed. This requires collecting detailed information such as relating required resources/IT-services to microservices and teams, providing costs per resource usage, keep track about reasons of claims and degrees of capacity utilization. The focal company is currently developing and exploring a prototype that use the data from the DevOps tools and from the EA tool in order to provide a good cost analysis to each of the BizDevOps teams.

We assume that this list of new tasks does not comprehensively cover all activities of the fast IT's EAM team. Nevertheless, the practitioners agreed that the three above mentioned tasks capture major activities. But they also stressed that they see communication with the teams about arising questions regarding the architecture as their major field of activity.

The to-be architecture for the whole e-commerce unit is not comprehensively planned any more. As the teams have a great autonomy, they could change the plan at any time. This leads to a reduced importance of long-term planning activities. Instead, the EAM function has to trace changes in the architecture and support discussion among the team about best practices, used technologies and other cross-team issues.

11.4.4 EA meta-model extensions and self-reporting architecture

The two different EAM functions in the focal company use two different EA tools with different underlying EA meta-models. While the tool of the fast IT EAM function uses a simple and fixed meta-model, the traditional IT uses a tool, which allows intensive customization of the fine-grained meta-model.

In the fast IT, the EA meta model is extended to the following aspects: With the increasing importance of software development processes for the enterprise, the enterprise architecture model in the e-commerce unit now also covers development processes and autonomous BizDevOps-teams and the infrastructure needed for development, deployment and operations. This is reasonable, as the web shop represents a core part of the enterprise and as the development processes are now core processes of the enterprise. In the EA meta-model and the EA model, the e-commerce EAM team uses unique identifiers to model a microservice across different layers. By selecting entities on different layer that use the same unique identifier, the teams and the EAM function can now select components related to one microservice (including capabilities, business objects, application systems and infrastructure components). The APIs between several microservices are modelled as interfaces between different components. As the number of interfaces between the high number of small components increases dramatically, it is a major task to keep track of the APIs and calls between different services and document this information in the EA as well.

As the fast IT is characterized by continuous agile development, teams are neither able nor willing to permanently document their "micro" changes in an EA tool. However, by gathering and integrating the data from the DevOps toolchain (including tools like Git, Jenkins, Ansible and Docker) with a self-developed "DevOps Scanner", the fast IT EAM function is still capable of extracting data relevant for the architecture from the code and the running instances (see Figure 13). Each microservice now offers an interface, which can be queried for receiving information about this microservice. Gathering the data from all running instances only takes a few minutes. This leads to what can be called a "self-reporting architecture", in which some changes of the EA model are conducted automatically. After extracting the data, it can be imported into the EAM tool for updating the EA model. As the underlying technical infrastructure is highly virtualized, the information about the technical layers is now coming from the DevOps toolchain instead of the CMDB (see Figure 13). A CMDB might still be required for keeping track of physical components, but with the increasing use of "hyper-converged" infrastructures, the underlying technical components can be more easily separated from the application infrastructure.

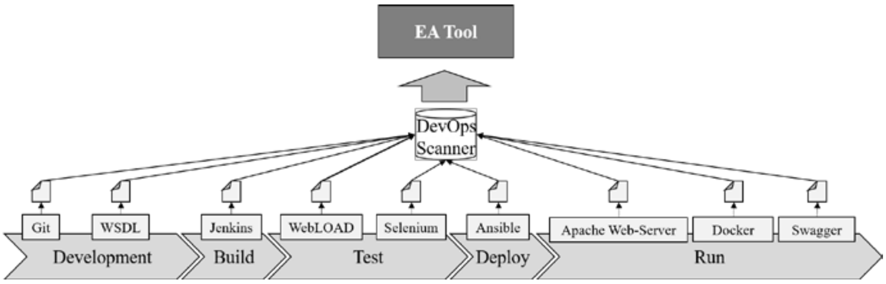

Figure 13: Using a DevOps Scanner for Realizing a Self-Reporting Architecture.

Nevertheless, this approach lead to new practical challenges as well as to the questions of (1) how frequently should snapshots of the constantly "streaming" self-reporting architectures be taken, (2) where should data sequences be stored and (3) how should they be analyzed and visualized. While the DevOps Scanner is in place and working, it also highlights that a common meta-model is necessary for analyzing the overall architecture. Hence the highly automated EAM processes in the fast IT will – to a certain degree – also support a standardization of the architecture. An example for this need for standardization was related to the challenge of managing the costs for the underlying virtual infrastructure. The EA model is also used as a basis for analyzing the costs for the infrastructure related to each microservice. As the infrastructure is capable of adopting itself to the demand, the consumption of resources differs over time. By drawing on the EA model, the costs for IT resources can be distributed across the different microservices.

11.4.5 Evaluating the Current State of Traditional EAM and Its Alignment with Fast IT EAM

The people in the e-commerce unit of the enterprise in our case study appreciate the current role and activities of the fast IT EAM team. It helps the teams with their work by providing information about interfaces among the services and by acting as a consultant for different architecture-related questions that occur during their day-to-day work. The co-existence of two different EAM teams with different tools is not seen as a major problem. There are clearly defined interfaces between the two models. As the interfaces between the frontend (web shop) and the backend (procurement) do not change very often, the fast IT EAM team can update their model regarding the interfaces to the traditional IT systems when required. Vice versa, the traditional EAM team will not keep track of the changes in the web shop's architecture. However, both teams need to exchange information about shared entities like business capabilities, processes and business objects. A common terminology (e.g. of what an "order" is) and a coherent modelling of such business objects help to ensure successful communication between the teams. Such activities can only be the first steps towards a better integration of both EAM modes.

11.5 Discussion

Based on the findings from the case study, we discuss the theoretical contribution as well as the practical implications. Furthermore, we show the limitations of our findings.

11.5.1 Contribution to Research: Comparing Two Modes of EAM

In the case study, we described the emergence of a new EAM mode that supports the enterprise in its customer-facing fast IT e-commerce environment. This new mode of EAM is different from the traditional understanding of EAM in the literature and in the frameworks. Table 25 summarizes the differences between both modes regarding the two dimensions “Governance, tasks and alignment” and “EA meta-model, EA model and EA tool”.

The row labeled “role of EAM” addresses the changing role of the EAM function. Instead of being an instance that directs the architecture evolution in a top-down manner, the fast IT EAM is in a supporting and consulting role. While the governance structure is rather central for the traditional IT mode, it is rather decentral for the fast IT. In the new world, the EAM function has only limited transparency on the enterprise scale, compared to the intended state of the traditional EAM. Furthermore, the relations of the EAM function to other major IT management functions like project portfolio management and IT strategy changes as these roles also undergo a dramatic change. The new mode of EAM also affects the models and tools used by the architects. Meta-models need to take account for the vertical structure of microservices. Due to the high frequency of changes, it seems reasonable to increase the number of updates of the architecture model. This task might be supported by a new tool chain and a higher degree of automation compared to the traditional EAM function. The EA models also change because development and operation activities and their tools are now becoming a core part of the enterprise. If the digital platform is the core channel to the customer, the processes of IT development and operations become an important part of the core business. The new EAM mode challenges existing frameworks. For example, fast IT EAM is very different from COBIT’s perception of the EAM as a top-down function for planning and controlling the architectural development and management [11].

In fast IT EAM, the architectural vision and target plans are not top-down formulated by a central architecture body. Instead, they are the result of ongoing negotiation processes in the teams, among the teams and with the new EAM function. BizDevOps teams will receive advice from the central EAM function regarding the architecture of their services. Again, and due to their autonomy, they can decide on their own if (or at least when) they will follow this advice or not. However, if important cross-team issues arise that are of major importance to the overall business success, the EAM function might inform the heads of the unit in order to discuss these issues with the teams in their regular meetings.

The case we have analyzed provides several good reasons for why fast IT units require an EAM function that is different from the traditional understanding of EAM regarding several dimensions. With two different IT modes and two different EAM functions, the task of achieving business IT alignment becomes even more complex than before. In our case, the business departments now interact with two IT units working in different modes.

11.5.2 Practical Implications

We assume that many other companies are currently building up their customer-facing fast IT in a similar way like in our case study. By doing so, they need to rethink the role of their enterprise architecture management function for this new part of the enterprise as well as its relation to the existing EAM function. Based on our case study, we see a dramatic shift in the role and tasks of the EAM function in an agile environment. While it is not necessary to establish the new EAM function with the first agile projects and teams, it will become necessary to have someone in charge for overseeing the whole architecture and for analyzing overarching architectural issues without challenging the autonomy of the BizDevOps teams.

Table 25: Comparison of Traditional and Fast IT EAM Functions.

	Traditional EAM	Fast IT EAM
Governance, tasks and alignment		
Role of EAM	plan, define & control	supportive / consulting role (for teams and initiatives)
Tasks	• analyze as-is, define to-be and guidelines • ensure conformity (based on to-be architecture / guidelines) by checking and approving projects • decision support (for CIO, IT Strategy, etc.) • project support	• facilitator and moderator for cross-team exchange • cross-team architecture development • keep track of permanent changes, permanent documentation • basis for building cost transparency for the teams based on the architectural model

Governance structure	• central, with some decentral support • architects in the projects (sometimes)	• decentral, with some central support • architects in the teams (technical software architects)
Focus & Level of Transparency	yes, global/enterprise-wide	transparency within the teams, limited transparency on the enterprise scale
Link to project (portfolio) management	• EAM approves and supports projects • control projects' results	• no projects, no project (portfolio) management • EAM supports and monitors cross-team initiatives
Link to IT Strategy	• IT strategy provides guidelines for EAM	• customer-focus more important than strategy
EA meta-model, EA model, EA tool		
Meta-model	comprehensive and often complex, dedicated to capture all major parts of the EA and their interrelations	simple and focused on vertical slices, microservices and cross-microservice interfaces and interdependencies
Frequency of changes	rather seldom, e.g. at the end of projects, with new releases, two times per year, etc.	very often, flexible dynamic architecture, high frequency of changes in the functionality, "daily snapshots" of IT systems
Tool integration	with process modelling, project management tools	with development and deployment toolchain
Degree of automation	rather low, manual processes for updating the architectural model, some interfaces to other tools	"self-reporting architecture" for technical layers, manual processes for business-related layers and artifacts (capabilities, business objects, etc.)
Development processes and modelling of tools	IT internal processes (plan, build, run) and tools are often not considered in the architecture	high relevance of DevOps processes and tools, therefore, they are now considered in the EA model
Role of existing Frameworks	• COBIT, TOGAF, etc. provide useful guidelines for EAM	• dominant role of agile methods (Scrum), some frameworks capture the new role of the enterprise architect (e.g. SAFe) • established enterprise architecture frameworks need to prove their value in the agile BizDevOps world

We propose three major issues that enterprises should think of if they increase the number of agile teams:

1. Establish a fast IT EAM function with a growing number of agile teams: The adoption of agile development methods and DevOps are often seen as a contradiction compared to the understanding of the EAM function. We propose to establish a new (fast IT) EAM function with a different role and new tasks. This function can help to solve cross-team, cross-microservice and other overarching issues.

2. Ensure alignment between the two EAM modes: In our case, we see a coexistence of two different EAM modes and an informal alignment process with a high degree of manual work. As a first step, we recommend to ensure that communication and cooperation between the two teams working properly. As a second step, using the same EAM tool

(instead of two different tools) would allow having a comprehensive overview. A shared understanding and meta-model for the business layers can help to keep a common view on all business-related entities in the EA model including business capabilities, organizational units and processes. In the long run, the future of the two EAM modes and the necessary alignment mechanisms will depend on the future structure of the IT.

3. Analyze potentials for automatically extracting data about the EA for the EA model / self-reporting architecture: With the increasing level of automation and virtualization even on the application layer, changes in the EA happen very often. Thus, the infrastructure and the application layer should be enabled to report their characteristics and interrelations automatically. In order to perform this step, a heterogeneous set of tools has to be integrated. Snapshots of the architectural model should be saved and analyzed to learn from the impact of changes in the software on the architecture.

11.5.3 Limitations

For this paper, we only draw on a single case study. This is a limitation for the generalization of our results, as the emerging fast IT units in companies are diverse in their nature as we have learned from other studies. With more than 10 DevOps teams, it is of a middle size (we know others with one or more than 150 BizDevOps teams). Nevertheless, the case is relevant as the company is quite successful with its e-commerce activities in terms of business performance.

11.6 Conclusion and Outlook

In this paper, we asked the question of how the EAM function changes due to the impact of digitalization and bimodal IT regarding its role, tasks, EA models and meta-models. Based on a single case study, we could identify the emergence of a new fast EAM function. Overall, the new and the traditional EAM mode are devoted to different parts of the whole enterprise architecture (traditional back end systems vs. customer- and partner-oriented applications). As the interfaces between these two parts seem to be rather stable, a coexistence of two EAM modes is a feasible option (at least in our case study). Nevertheless, a common meta-model could be used to reintegrate the business layer thus supporting overarching strategic decision making and co-evolution of both parts. Furthermore, the new mode is different from the traditional EAM mode regarding several dimensions: (1) due to the agile and self-organized BizDevOps teams, the EAM function rather engages in a supportive and consulting role (instead of a directing and controlling role) (2) due to the high frequency of changes in the microservice landscape, the manual documentation has to be partly substituted by a self-reporting architecture (3) a cross-team EAM function stills turns out to be useful for addressing inter-team topics such as large changes effecting several teams and microservices or for addressing overarching issues of architecture evolution. By identifying these differences, we contributed to the field of EAM research, as known roles, tasks, meta-models and alignment mechanisms with other IT management functions get challenged by the new organizational and technical structure in fast IT units. Furthermore, we derived several implications for enterprises that are in a similar situation like the enterprise in our case study. For future research, we see the need of more qualitative and quantitative in-depth case and cross-industry analyses about the changing role of enterprise architects and the EAM function. The field of “self-reporting architecture” demands for new methods and tools that gather and aggregate data. Furthermore, the fit of existing frameworks such as COBIT and TOGAF with new technical approaches such as BizDevOps and microservices as well as the integration of distributed autonomous teams into these models needs extensive and more in-depth research. We also see the need of rethinking the way of structuring and documenting the business architecture for enterprises that have undergone a large step of digital transformation like the one in our case.

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12 IT Governance in Scaling Agile Frameworks

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Abstract

Dynamic business environments call for companies’ organizational agility as being able to sense the changes in competitive environments and respond accordingly. A flexible IT environment facilitates this aim but contrasts with the structuration of IT organization through IT governance. We analyze how scaling agile frameworks as blueprints for agile IT organizations solve the contrast between structuration embedded in IT governance and agility. We see converging business and IT in structure and strategy as facilitator for resolving this conflict. In detail, we compare eight scaling agile frameworks on how IT governance is covered, how IT governance decisions are made and whether business IT convergence is achieved. We conclude that IT governance is still predominantly top down decision-making and focuses on traditional business IT alignment instead of business IT convergence. With our analysis, we provide a comprehensive base for organizations to choose from when approaching their specific agility challenges.

Keywords

Organizational Agility, IT Agility, IT Governance, Business IT Alignment

12.1 Introduction

Highly dynamic business environments involve increasing market uncertainties and a volatile pace of change in customer expectations for companies. Companies have to compete in these turbulent environments in order to survive, but how to face these dynamics proposes a huge challenge for many organizations which has yet to be solved. For responding to the turbulence, research increasingly answers with emphasizing organizational agility as solution, having the ability of sensing opportunities for innovation and competitiveness in these environments [1] and responding with ease, speed and dexterity [2]. As digital solutions become the primary mode by which many companies do their business, IT is an enabler of a company's agility capabilities [3]. Both sensing emerging trends and responding to changes by being organized in a way to facilitate rapid realignment is required [4, 5]. This extends the demand for agility beyond IS development and agile project management which merely focus on the response dimension [1, 3]. IT agility also implies that using agile, lean and continuous methods is suitable for achieving rapid response to changes [3, 6, 7]. The challenge remains how the call for agility impacts the existing structure of the IT organization.

The structure of the IT organization is highly dependent on its IT governance, specifying the decision rights, authority and accountability for strategic IT planning and control [8]. It formalizes the structures, processes and relational mechanisms to ensure that IT follows the business objectives [9], usually supported by frameworks such as e.g. COBIT 5 [10]. IT governance is part of corporate governance [10] and exercised by the board, executives and IT management [9]. If IT seeks to achieve agility in the large, commitment from all involved units is needed and this cannot be achieved without governance. While some authors already call for agile IT governance based on empirical analyses [6, 11], practices for specific governance decisions like Continuous Planning [12, 13], Agile Portfolio and Product Management [14, 15] and Continuous or Lean Budgeting [12, 16] are mainly proposed. A holistic overview is yet missing.

Rapidly responding to changing needs with the right services can be facilitated by structurally converging the business and IT side in order to reduce communication distances and foster shared understanding. Companies usually introduce autonomous self-organizing, self-disciplined delivery teams 'managed' by a Product Owner from business but require new forms of leadership [17]. Other form "BizDev(Ops)" teams with business and IT team members or locate agile IT teams in business units [18]. Some approaches also promote strategic convergence related to IT governance decisions. In strategy development, a central Digital Business Strategy [19] or Digital Transformation Strategy [20] for the whole organization is proposed and strategy execution may use Continuous Planning [12] to integrate developers in strategic business decision-making. The topic on convergence in relation to agility is not systematically addressed by research yet. The approaches focus on different perspectives and are only loosely coupled. It also remains unclear whether a traditional business IT alignment with IT and business as strategically and operationally aligned but distinct entities [21] might be favorable for agility. This imposes the question on how business IT convergence impacts IT governance.

To analyze the contrast agility vs. structuration through IT governance, we examine scaling agile frameworks as a common way for organizations to achieve agility by providing blueprints of agile organizational setups. Following a qualitative analysis on identified scaling frameworks, we seek to answer the question "*How can businesses solve their conflict of structuration vs. agility with the help of scaling agile frameworks?*" The question cannot be answered by existing comparisons since they do not address the subject of IT governance [22–27]. Moreover, they compare general dimensions like e.g. focal point, appropriate team size, suitable organization type, framework adaptability, adopted agile practices or key risks and concerns.

The remainder of this paper is structured as follows. In the next section, we explain the research method that will help us with our analysis. As the next step, we will present our results. In the last section, we summarize and discuss the findings and present implications for future research.

12.2 Research Methodology

Our qualitative analysis of scaling agile frameworks encompassed two steps. First, we conducted a literature review to obtain a comprehensive overview on existing scaling frameworks in their 'vanilla' form without modifications by practice. We searched in large IS databases such as ACM, AIS electronic library, EBSCOHost, Google Scholar, IEEE and Springer Link for existing peer-reviewed research. We also conducted a Google search to identify additional information on the frameworks by the frameworks' creators and further frameworks we have not identified in research before. For both searches, we used combinations of search teams of “scaling agile” or “scaled agile” and “framework” or “approach” and optionally added “comparison” for identifying existing comparisons between frameworks in research and practice. In sum, we found 35 approaches which explicitly address scaling agile, show how scaling agile shall be achieved and what should be introduced to scale agility and are not replications of other approaches in structure and content (see Table 26).

Table 26. List of Scaling Agile Frameworks.

Organization Focus		**Transformation Focus**
Enterprise-focus	*Inter-Team focus*	
- Disciplined Agile (DA) (Disciplined Agile Consortium 2020) - Enterprise Agility (Eliassen Group) - Enterprise Unified Process (EUP) (Ambler 2015) - laCoCa Model (Slogar) - Recipes for Agile Governance in the Enterprise (RAGE) (cPrime) - Scaled Agile Framework (SAFe) (Scaled Agile 2020) - Scrum@Scale (Scrum Inc.) - XScale (XSCALE Alliance 2020)	- Crystal Family (Wikiversity) - Driving Strategy, Delivering More (DSDM) (Agile Business Consortium 2017) - Enterprise Scrum (Beedle 2010) - FAST Agile (Cron Technologies 2017) - Goal Driven Agile (Xebia Group) - Large Scale Scrum (LeSS) (The LeSS Company B.V. 2017) - Nexus (*Scaling Scrum with Nexus*™, 2017) - PRINCE 2 Agile (AXELOS Limited) - Scrum of Scrums (Agilest 2017) - Scrum Pattern Language of Programs (PloP) (Scrum Pattern Community 2017) - Spotify Model (Kniberg and Ivarsson 2012) - Sustainable Cultural Agile Release in the Enterprise (SCARE) (Heusser 2014) - Matrix of Services (Continuous Agile 2017) - Scrum Lean in Motion (SLIM) (Growing Agile 2017)	*Transformation Process:* - Agile Culture Model (Sahota 2012) - CollabNet Agile Transformation Strategy (CollabNet) - EBM - Agility Path (Schwaber 2014) - Enterprise Transformation Framework (ETF) (Agile42 2014) - Leading Agile (Leading Agile 2017) - ScALeD (DasScrumTeam AG) *Transformation Progress:* - Aditi Agile Transformation Maturity Model (Krishnan) - AGILE Maturity Map (Packlick 2007) - Agile Maturity Model (Humble and Russell 2009) - Agile Capability Maturity Model Integration (Shelton) - Comparative Agility (Comparative Agility) - Roadmap for Agile success (Emergn) - Scrum Capability Ratings (Scrum Inc. 2014)

We identified two streams of scaling agile frameworks. **Transformation-focused** frameworks center around process agility by offering a transformation roadmap with necessary steps (*Transformation process*) and/or assessing companies regarding their state of transforming towards organizational agility (*Transformation progress*). **Organization-focused** frameworks in turn focus on product agility and the “blueprint” agile organization. This stream also has two sub-streams. While *Enterprise-focused* approaches address a vertical scaling mind-set with organizational levels from strategy to execution, *Inter-Team focused* frameworks address horizontal scaling with coordinating large numbers of agile teams. Although this kind of frameworks could generally be applied on program or portfolio level, they traditionally solely focus on solution delivery without describing planning and monitoring activities. As IT governance comprises both planning and monitoring, we exclude the inter-team focused frameworks for deeper analysis. Furthermore, transformation frameworks are also excluded since they address the planning steps of a transformation instead of IT governance in the target organization.

As second step, we conducted a qualitative content analysis on the remaining frameworks. Our analysis had three parts: First, we examined whether and how comprehensive governance is addressed (with e.g. processes, roles, practices etc.). We used common IT governance roles, practices and processes addressed by research (Haes and van Grembergen 2004) and governance framework COBIT 5 (ISACA 2012) and roles (e.g. Product Owner), practices (e.g. backlogs) and principles from the agile philosophy. Second, we analyzed whether a top-down (authority-led) or a bottom-up approach (autonomy-led) is taken. Third, we examined how business IT convergence is integrated by the approaches by examining who is mainly responsible for its execution. As theoretical foundation for the analysis on the eight remaining frameworks, we used the five IT governance decision domains by Weill & Ross (Weill and Ross 2005) as widely acknowledged governance approach (see Table 27). While the *IT principles* domain focuses on the strategic role of IT in the organization, *business application needs* and *IT architecture* decisions focus on the needs to be fulfilled or the technological basis to be applied. *IT infrastructure strategies* addresses the decision on whether the realized services can be individualized for each business unit or whether it should be central. *IT investment and prioritization* focuses on the funding of IT.

12.3 Scaling Agile Frameworks and IT Governance

The following comparison shows the level of coverage of IT governance and differences and similarities between applied practices between the frameworks. Per governance decision domain (Weill and Ross 2005), the frameworks are further compared regarding their mode of control and the overall responsibility.

12.3.1 IT Principles

The IT governance decision domain of IT principles is evident in five frameworks with EUP and SAFe giving the most details. However, both frameworks differ in their overall logic. For strategy planning, SAFe derives IT strategy via strategic themes based on business objectives for each SAFe portfolio. Since the SAFe portfolio does not need to cover the whole IT organization, a common IT strategy is not necessarily guaranteed. EUP in contrast perceives one common enterprise strategy which integrates the IT strategy as crucial. The roles responsible for planning also differ. As IT strategy is closely linked to portfolio management, SAFe proposes responsibility for a “Lean Portfolio Management”. This function usually includes business managers and executives who understand the enterprise’s financial position. EUP in turn uses a specific “Enterprise Business Modeler”. The strategic planning process is similar using lightweight methods and being collaborative in close alignment with enterprise stakeholders and the enterprise architecture discipline for technological input. Other approaches only cover parts of IT strategy. DA captures a planning process with themes like in SAFe that are captured in a business roadmap as main practice describing the near term, intermediate term (3-12 months) and long term (1 year and more) vision. In Scrum@Scale, a general IT strategic vision aligning and setting strategic priorities is developed by a “Executive Meta Scrum” led by the executive Product Owner, i.e. the CEO or Strategic Vice President. The laCoCa model is a real exception among the frameworks. It proclaims a “Dynamic Corporate Strategy” which integrates business and IT strategy. This strategy is developed by “StraDevOps” teams who include “customer and or departments, business strategists, Enterprise Architects, [..] and close the gap between the existing business strategy and regular DevOps teams” (Slogar).

In sum, IT strategy remains a top down governance decision domain in the agile frameworks. Also, the responsibilities of business and IT executives are traditional. Although they collaborate closely on strategy development, business is still perceived as mere stakeholder from IT. Alignment between them is still the dominant practice.

12.3.2 IT Architecture

Five frameworks directly address IT architecture with DA, EUP and SAFe covering both principles, process, roles and practices. All three frameworks propose a strategic architecture role model with specific enterprise architects from IT for resolving technical dependencies on portfolio level and solution/system architects or chief architecture owners on program level.

DA also proposes the role of architecture owners as team member who is responsible for a single team’s architecture. The practices applied in the frameworks differ. While EUP uses traditional planning artefacts with a largely predefined “Enterprise Architecture (EA) Model” and reference architectures (“candidates”), SAFe and DA architects create a high level common technological vision and guidance and derive strategic architectural initiatives which will then be integrated in the portfolio. For initiative execution, SAFe uses “Enabler Epics” as requirements descriptions which are realized to build a central “Architectural Runway” for all teams. In contrast, DA promotes an adaptive, context-sensitive strategy to architecture. Based on the specific goals, architects identify the process decision points to be considered. For each point, a range of strategies to choose from is provided. The laCoCa model proposes a Lean EA management with specifically tailoring the EA framework TOGAF without giving guidance on how to tailor, conducted by the enterprise architects in “StraDevOps” team. All four frameworks also propose bottom up architecting by actively seeking validation and feedback by the teams and identifying their needs for architecture optimization. Radical bottom up Incremental Architecture solely emerging from solution implementing by teams instead of up-front planning is only proposed by Enterprise Agility. They perceive architects to be consultants rather than leaders like in traditional architecture management.

Table 27. Comparison of Scaling Agile Frameworks.

	Scaled Agile Framework (SAFe)	**Disciplined Agile (DA)**	**Enterprise Unified Process (EUP)**	**Enterprise Agility**	**laCoCa Model**	**Scrum @Scale**	**Recipes f. A. Governance (RAGE)**	**XScale**
IT Principles	4, t	4, t	4, t		3, t	4, t		
IT Architecture	1, m	4, m	1, m	1, b	3, m			
IT Infrastructure Strategies	1, b	1, m		1, b	3, b			1, m
Business Application Needs	4, t	4, t	4, t	4, t	3, t	4, t	5, t	4, t
IT Investment and Prioritization	4, m	4, t		4, m			5, t	4, t

Legend

Coverage *Why?*-Principle *What?*-Process *Who?*-Role(s) *How?*-Practice(s)

Responsible **1**- *IT* **2**-*Business* **3**-*Convergence* **4**-*Alignment* **5**-*Not specified*

Control **t** – *top down (Authority-led)* **b**-*bottom up (Autonomy-led)* **m**-*mixed*

Overall, a shift towards architectural autonomy of the teams is seen in the frameworks as Enterprise Agility states: “Rather than decide the architecture in advance, let it emerge as you implement stories” [29]. As architecture is technological in nature, responsibilities are still mainly with architecture roles based in the IT organization. Due to having an enterprise architecture function, the roles also have a high business proficiency.

12.3.3 IT Infrastructure Strategies

The mapping of this IT governance decision domain was challenging since Weill & Ross [8] imply governance of a multi business unit organization. IT infrastructure strategies addresses which IT services need to be provided as shared services for all business units and which can be individually changed. We transfer this challenge to the agile organization in the way that the degree of autonomy of a single agile team regarding choice of IT infrastructure is focal in this dimension. Since this is inextricably linked to the IT architecture, we highlight topics not covered before.

Five out of the eight analyzed frameworks address IT infrastructure strategies, mostly regarding the topics continuous integration, delivery and deployment. In all frameworks, teams are empowered to own their process, the concrete selection of practice patterns and tooling such as e.g. 1 Click Deploy to self-determine how they will work together. In order to achieve continuous delivery, automation of tasks and decoupling of solutions are perceived as key enablers in the frameworks. While XScale solely proposes behavior driven development - a common language between business representatives and agile teams for creating successful automated tests - as solution, SAFe proposes an extensive set of practices with e.g. the Continuous Delivery Pipeline. This contains the assets and technologies (workflows, activities, and automation) needed to deliver solution value as independently as possible. They further introduce the “System Team” next to their agile teams (DevTeam, Scrum Master, Product Owner) assist in building and using the Agile development environment, including continuous integration, test automation and continuous deployment. In the other frameworks, capabilities for continuous delivery are directly embedded into the teams.

For all frameworks, governance refers to avoiding technical debt. While XScale proposes "XP core plus weekly retrospectives" as suitable practice to achieve this goal, SAFe emphasizes data and security management. These areas are monitored by "Shared Services" who are specialists that help teams with their professional skills regarding e.g. data security or enterprise architecture. The architectural runway as technology roadmap also serves for monitoring technical debt. As exception, DA addresses the responsibility of a specific IT governance process that should guide and monitor the teams to ensure that they leverage and evolve the IT infrastructure effectively so that the infrastructure is sound. This also includes data management as well as security.

Comparing to the other IT governance decision domains, this area has the highest level of autonomy by the teams with minimal interference of authority. Since IT infrastructure is IT architecture from a technological perspective, business involvement in this domain is also limited in the frameworks.

12.3.4 Business Application Needs

All approaches except the laCoCa model explicitly address this IT governance decision domain as portfolio management for scaling agile. In the laCoCa model, business application needs is covered by Agile Requirements Management.

For guidance on how to achieve and maintain the overall portfolio, the frameworks show different levels of detailed descriptions, e.g. for proposed practices. SAFe is extensive with detailed descriptions on the three main process areas "Strategy and Investment Funding", "Agile Program Guidance", and "Lean Governance". For managing the portfolio, SAFe proposes using a Lean/Kanban Portfolio system with corresponding backlog containing both business and technical requirements. Overall responsibility is with the specific "Lean Portfolio Management" function which closely collaborates with architecture and business stakeholder. Other approaches like DA and RAGE also favor dedicated individual functions or roles using "Portfolio Owner" as authority over selection and prioritization. Scrum@Scale and XScale in turn propose group approach like the "Executive Meta Scrum" with executive leadership and stakeholder members or a "Portfolio Squad" with business and technical leaders as more suitable. XScale further uses a "Portfolio Leader" and "Portfolio Coach" as 'Leadership as a Service' function for intelligently liaising with the business's executive team to manage the organization’s finances. Practices for portfolio management are largely provided by the frameworks. XScale advises to adapt a high-cadence “Continuous Adaption Cycle”, preferably weekly, with e.g. team retrospectives and the Portfolio Squad meeting to improve and refactor a portfolio to avoid technical and cultural debt. RAGE and Scrum@Scale also propose specific meetings such as portfolio planning and grooming or backlog prioritization sessions for conducting portfolio management. RAGE further addresses specific documents to be used like a business case, an agile charter containing the product vision, a decision matrix with the priority value of all initiatives and a portfolio backlog containing the descriptions of the initiatives. Practices for monitoring of the results are not explicitly addressed the approaches except SAFe. However, the need is addressed by the majority.

In sum, the frameworks propose the traditional top down portfolio management approach as it still “entails two major activities: Making [strategic] decisions about what initiatives to execute or fund, and making decisions about whether or how to continue work on initiatives that are already in progress” [32] as RAGE states.

12.3.5 IT Investment and Prioritization

Five of the examined frameworks directly address the IT governance decision domain of IT investment and prioritization. For all, budgeting decisions are inextricably linked to portfolio management and need a flexible model underlying. Thus, SAFe or Enterprise Agility link funding to value streams or products. The concrete budgeting mechanisms differ between both frameworks. The Enterprise Agility framework proposes a couple of mechanisms such as “Capacity Based Investment” with funding based on a portfolio or a line of business. The amount of funding then determines the number of teams dedicated the line or portfolio. As alternative, “Viable Increment based Investment” is proposed with the investment community getting together on a regular cadence (e.g. once per iteration or quarter) and prioritizing the next MVIs from each area against each other. SAFe and also DA use a continuous budgeting approach with lean or “Rolling Wave Budgeting” using lean business cases which are iteratively readjusted based on learnings. Although fiduciaries have control of spending, the value streams are empowered for rapid decision-making and flexible value delivery. Each value stream budget can then be adjusted over time based on its relative value to the portfolio. Furthermore, epic funding and governance is used for funding substantial, crosscutting or significant local investment concerns based on a lean business case. These may be funded by an overall budgetary reserve, reallocation of personnel, budgets from another value stream or by buffers in the existing value stream budget. Nominally, these budgets area adjusted twice annually to not impede agility, but create planning security for the teams. XScale’s approach of “Throughput Accounting” is similar to lean budgeting, but uses the bottleneck that dominates throughput per value stream and portfolio and budgets accordingly. RAGE is the only traditional approach which uses project funding supported by a traditional static business case.

Since IT investments are inextricably linked to portfolio management, most budgeting approaches have a similar shape. Decisions are made top down by portfolio management in alignment with business and technical stakeholder. One interesting exception, however, represents Lean Budgeting by SAFe as “dramatically different approach to budgeting, one that reduces the overhead and costs associated with traditional cost accounting, while empowering decentralized decision-making [to value streams]” [33].

12.4 Discussion and Concluding Remarks

Our research aimed at showing how the conflict between structuration through IT governance and agility is solved in selected scaling agile frameworks. As a facilitator for achieving this goal, we originally proposed structurally and strategically converging the business and IT side to close the gap and foster shared understanding.

Our research indicates that the frameworks try to solve the conflict of structuration vs. agility by presenting themselves as the structuration in which agility is framed. The governance setups in the frameworks enable rapid response to changing needs by e.g. updating the program and team backlogs based on new decisions from the governance body. However, the agile empowered self-organized autonomous teams [17] as imperative for agility are limited by a traditional governance structure on the higher levels. Most decisions, especially more business-related, are still solely top down without using input from the teams. Information flows back to the governing body focus, similar to traditional IT governance frameworks [10], on mere team performance monitoring instead of qualitative feedback on e.g. how valuable is the service to the customer. These findings are in line with earlier analysis by Weill & Ross [8]. However, the required new forms of leadership [17] have not been embedded yet. Thus, IT governance on each level – especially program and portfolio – needs further inquiry on how to integrate agility and which balance between autonomy and authority is needed.

Second, our results highlight that the conflict of IT governance and agility by long term formalized decisions and inhibiting flexibility in response to changing needs has not been solved by the frameworks. Planning on strategic level mostly follows the traditional short term cadences via quarterly or semi-annually time frames. Continuous lifecycles including continuous business strategy and planning [12, 13] are only scarcely existent. This approach however raises the question how continuous learning as central element to agility [12] needs to be reflected on the strategic level.

Finally, we show that most scaling agile frameworks still perceive themselves as interfaces to non-agile enterprises. A structural and strategic convergence is only in its nascent phase within the frameworks while traditional business IT alignment [21] is rather promoted. However, when approaching a convergence, the IT governance structures are reshaped by e.g. having a "StraDevOps" team for continuously planning and controlling ITG decisions. Also, the strategic approach is affected by strategic convergence of business and IT strategy towards a "Digital Transformation Strategy" [20] or "Digital Business Strategy" [19] to realize IT's role as trigger for business opportunities [19]. When aiming for structural convergence, integrating the product owner as 'master' of the product backlog is implied. The "BizDevOps" vision [18] including further business members within the teams is only in its nascence or merely a vision [28]. Our results pose the question whether organizational agility needs a business IT convergence as enabler or whether the traditional business IT alignment needs to be achieved. In more detail, it is still unclear for which decision domains convergence needs to apply and for which decisions alignment is favorable.

For practitioners, a main contribution of our research is the reveal of principles, practices, process steps and roles for IT governance in the frameworks. Thus, we provide companies a comprehensive base of approaches to choose from for working on their specific challenges. These insights both can be used for the challenge to holistically adopt IT agility as well as for solving specific problems like the adoption of an agile portfolio function. As next step, companies can assess the suitability of the variations to their specific needs. Another major practical contribution of our research is the reflection of gaps of the frameworks in case companies strive to achieve a profound agile enterprise. For example, the comparison illustrates that IT governance is still mainly traditionally shaped. The 'right' balance between autonomy and authority has not crystalized yet as each framework handles the decision domains differently. This also holds true for finding a 'right' cadency of decision-making for each domain.

Our research is mainly limited by its selective analysis based on a small number of scaling agile frameworks. Furthermore, the findings are based on an interpretative and therefore subjective analysis on agility frameworks. Also, high level public descriptions of some of the frameworks limited our research. For those approaches, we used news articles or presentations at conferences by the frameworks' authors as knowledgeable information source to fill information gaps.

To sum up, this analysis serves as a good foundation for future research in and between the agile and business IT alignment communities by identifying research gaps that need further investigation. Confirming the assessment by experts or applying other IT governance approaches to the scaling agile frameworks might also provide valuable additional insights. An in-depth analysis of the frameworks' application by companies as well as comparing proposed business-related agile governance mechanisms in research to the frameworks' practices may further 'optimize' the frameworks' structure and use regarding IT governance and business inclusion.

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13 Agile Portfolio Management: Design Goals and Principles

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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

13.1 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.

13.2 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 through-out 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.

13.3 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 28). 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 data-bases 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.

Table 28: Participating Organizations of the Cross-Industry Empirical Study.

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

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, complete-ness 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 de-sign 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.

13.4 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.

13.4.1 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 2016a). 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. 2015a). 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. 2015a).

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 (Bogsnes 2009; Hope and Fraser 2003).

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 (Chan and Reich 2007; Reich and Benbasat 2000). 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).

13.4.2 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 29 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 2020). 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 rating 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.

Table 29: Agile Portfolio Management Design Principles and Excerpt of Testable Propositions.

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)

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.

13.5 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 14). 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.

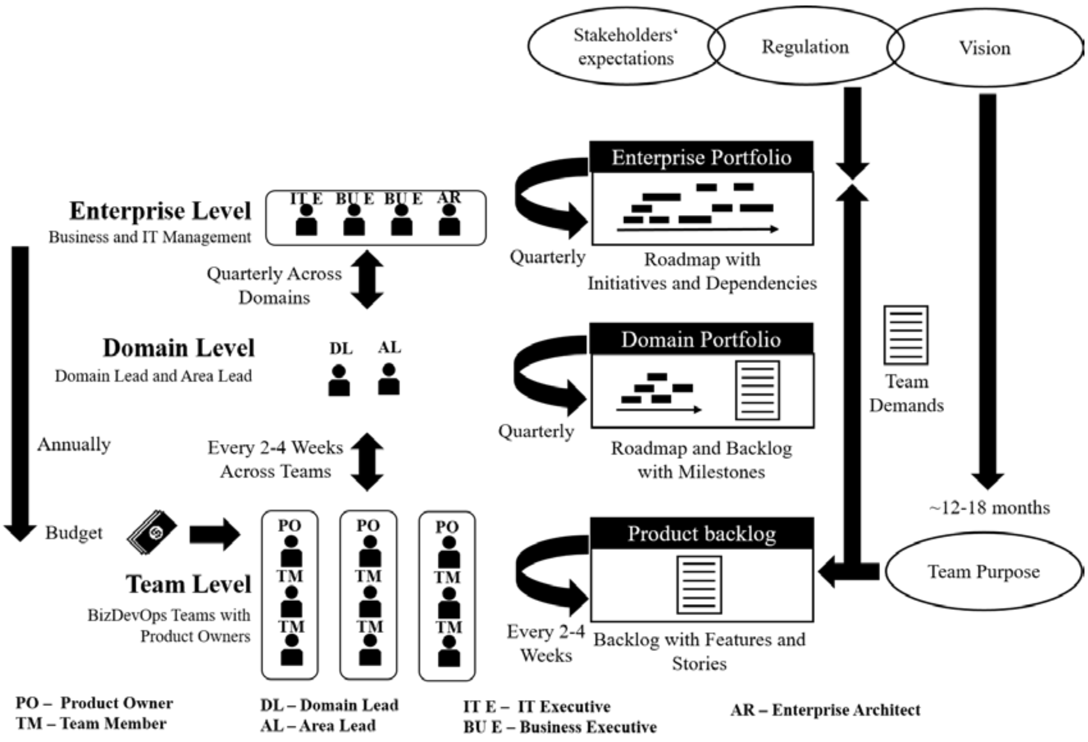

Figure 14: Agile Portfolio Management System at RetailCorp.

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.

13.6 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.

13.7 References

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14 Everyone's Going to be an Architect: Design Principles for Architectural Thinking in Agile Organizations

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Abstract

Organizational agility is a prominent aim for companies to thrive in today's volatile business environments. One common building block of agility are (semi-) autonomous teams for continuously fulfilling and surpassing customers' needs. However, these teams still need to see the enterprise's 'big picture' of strategic objectives, business processes, and IT landscape to prevent organizational inertia or technical debt. This requires architectural thinking to inform these 'non'-architects' decision-making. To aid companies towards achieving sustainable agility, we propose six design principles as underlying logic on how to realize architectural thinking in agile organizations. The results are based on insights from interviews with sixteen employees and consultants with expertise on architecture management and organizational agility across several industries. Our work closes a gap in the agility literature, which so far mainly focused on non-generalizable blueprints for agile setups without showing their underlying logics, or approaches and role set-ups for enterprise-level architecture management.

14.1 Introduction

In today's hypercompetitive business environments with the power shifting to customers [1], more and more companies strive for organizational agility by becoming proactive in sensing customers' needs and responding with speed and innovation to fulfil and surpass customer demands (e.g. [2,3]). Otherwise, customers can often easily select another service (provider) from a vast array of opportunities in the market [1]. A common building block for increasing agility are (semi-)autonomous teams with high decision-making power and ownership for (parts of) services, their delivery and improvement [4]. These organizations seek to scale agile principles and values beyond the traditional agile 'realm' of software development to become an agile organization.

Despite the teams' autonomy, they need to be aligned with each other and the strategic objectives, as the organization may expect certain outcomes being delivered that may require collaboration across several teams [5]. As individual teams often have only a local view on 'their' services and aim to fulfil their goals, organizational mechanisms are needed for leveraging synergies and dependencies between teams and services [6,7]. The absence of such mechanisms may result in unsustainable decisions that may cause organizational inertia in the long-term [8], technical debt [9] and inconsistent, redundant, or conflicting solutions [10].

Both in traditional and agile organizations, Enterprise Architecture Management (EAM) is seen as one approach for addressing these issues [8,11,12]. Traditionally, EAM involves modeling, planning and controlling changes from an architectural perspective [13,14] in a top-down, centralized way with a dedicated function predefining architectural standards [15]. This enforcement-centric view of EAM, however, is at odds with the agile teams' autonomous nature and may create organizational inertia itself by preventing teams to respond to market changes based on their rules. With distributed decision-making in agile organizations, mostly by 'non'-architects, everyone instead of solely the EAM function [13] needs an 'architectural thinking' mindset [10] to consider the consequences of their actions for the whole organization in their decisions and balance the demands in a sustainable manner. Given the limited insights on how such an architectural thinking could be facilitated in agile organizations, we conducted an exploratory qualitative study to answer the question: *Which principles can foster architectural thinking in agile organizations to support organizational agility?*

The remainder of the paper is structured as follows. In section 2, we briefly describe organizational agility, architectural thinking and management as conceptual foundations for our analysis. Afterwards, we outline our research methodology. In section 4, we highlight our main results, the six principles for architectural thinking in agile organizations. Finally, we discuss our findings and conclude with future research opportunities.

14.2 Research Background

Organizational agility may involve optimizing existing service offerings to improve current market positions and innovating business opportunities for new product-market domains [16] for fulfilling agility's dimensions of sense and response [2,3,17]. Thus, agility implies three dimensions: 1) co-opting customers in exploring and exploiting opportunities to leverage their voice in service delivery, 2) leveraging the suppliers' and service providers' assets, knowledge, and competencies through partnerships and alliances for fast service delivery and new opportunities, and 3) a dynamic organizational and operational setup [2]. The latter implies scalability and (re)integration in processes, structures, and knowledge [2,17,18], so that organizational capabilities are in a constant flux [18,19].

Many companies started their agile journey with small agile teams to increase delivery speeds [4]. With digitalization deeply intertwining IT and business logic [20,21], these teams are increasingly becoming cross-functional with business and IT team members to bridge operational level gaps. To be effective, agility on the team level also requires a corresponding agile mindset, structures, and processes on the enterprise level to enable a fast and continuous delivery flow with as little friction as possible. The term 'agile mindset' means being aware to delight the customer with continuous learning and not only to adopt a set of agile practices [1]. A variety of frameworks for scaling agility, such as Disciplined Agile and the Scaled Agile Framework (SAFe), also provide structures and processes [22]. These are based on short and interconnected planning and feedback cycles for coordinating the teams' incremental work products. Various coordination mechanisms within and across all levels, like scaled product ownership and Scrum of Scrums can be set up to help linking the teams to the company's strategic objectives [6,7,23]. Nevertheless, companies strive for organizational agility in many ways, as the current debate on bimodal organizations shows [24,25].

Agility increasingly involves the use of information technology (IT) to provide strategic directions, which calls for a suitable IT infrastructure [2,3]. This is only realistic if everyone has a clear blueprint of the IT architecture and its link to business functionalities [11,26]. Some frameworks [22] and an increasing number of research approaches (e.g. [8,11,27]) refer to (enterprise) architecture management, traditionally an IT corporate function [13], as one main mechanism for designing and integrating this blueprint, e.g. via to-be architectures [14]. Recently, researchers pointed out that, in an agile world, the EAM role changes from enforcing technological standards, approving projects, and tracking changes in the enterprise architecture (EA) enterprise-wide and on a detailed level to advising teams in their architectural decisions [12,27], resulting in a decentralized decision-making process [9,28]. Thus, the new EAM roles mainly focus on cross-team issues with harmonizing governance requirements across teams and guiding them through business and technical roadmaps [15,23]. Similar to traditional settings, most approaches propose two distinct architecture roles [26,27]: First, specific enterprise architects from IT can help resolving technical dependencies on a portfolio level and support shaping the overall strategic vision [9,12]. Second, strategic governance and corresponding solution/ system/ software architects or (chief) architecture owners on the program or team level can give guidance for individual programs, projects, or teams [9,23]. Team members, e.g., senior developers, with architectural knowledge mainly become responsible for architectural decisions within teams on a detailed level, as they are close to the code [11]. For overall coordination, e.g. for architectural guidelines [27], group-based decision-making [9], e.g. via communities of practice [27,29], is prominent, as it fosters everyone's commitment based on raised common concerns or domains [29].

While EAM provides knowledge about the whole organization, it is criticized in agile organizations as being too far from the actual delivery and planning and, thus, not valuable for stakeholders [10,11]. Especially local decision-makers on the operational level argue that EAM does not provide the necessary information [11]. Yet, sensing potentials and obstacles by knowing about (parts of) the system and their interdependencies is still essential, as working, fitting, and integrated services truly delight the customer [1]. This connected mindset of architectural thinking [10,13] is even more critical, as business and IT logic merge with digital [20,21], but governance and management structures are highly distributed. In addition, the link to the strategic objective is to ensure the fit of aspired services with the enterprise picture. While maintaining this mindset may involve the support of EAM functions, as research suggests

[23,26,28], it is not discussed by architectural thinking approaches. Instead, architectural thinking mainly implies practices for considering holistic, long-term service aspects and fundamental system design and evolution principles in decision-making by 'non'-architects [13], which may be both from business and IT [10]. Yet, it remains unclear on how such an architectural thinking could actually be put into practice in agile organizations.

14.3 Research Methodology

To contribute first insights on how agile organizations realize architectural thinking for supporting organizational agility, we conducted an exploratory qualitative cross-industry study. The study participants were selected based on three criteria: First, they have experience in or are responsible for architecture within their organization or provide consulting services to clients with focus on architecture management. Second, the organization(s) the expert works in or consults for is undergoing a transformation towards organizational agility by reshaping (parts of) business and IT. Finally, the participants hold a position with in-depth insights on the overall organizational system. Table 30 gives an overview of all participants.

Table 30: Participants of the Empirical Study.

Interview	Position	Main Industry Affiliation
INT-1	Program Manager [1]	Telco
INT-2	Program Manager [1]	Telco
INT-3	Chief Product Owner [1]	Telco
INT-4	Enterprise Architect [1]	Banking
INT-5	Enterprise Architect [2]	Banking
INT-6	PMO [2]	Energy
INT-7	PMO [1]	Government
INT-8	CEO Tool Vendor A [1]	Energy, Transport, Health
INT-9	CEO Tool Vendor B [1]	Government, Banking
INT-10	CEO Tool Vendor C [2]	Insurance, Telco, Energy
INT-11	Consultant [1]	Government, Telco, Banking
INT-12	Consultant [1]	Banking, IT, NGO
INT-13	Consultant [1]	Banking, Energy
INT-14	Consultant [1]	IT , Government, Banking
INT-15	Consultant [1]	Insurance, Utilities, Government
INT-16	Consultant [1]	Retail, Utilities, IT

Interview format: [1] Face-to-face meeting [2] Video call

We used semi-structured interviews, preferably in face-to-face meetings (see Table 30), for a detailed exploration of the participants' experiences and views. Based on our understanding of architectural thinking and agility, we asked each participant to thoroughly describe their or their key clients' organizational setup and how decisions in relation to architecture are taken and realized. This includes planning and monitoring processes, procedures for design and documentation of decisions, and the roles involved. The interview sessions lasted 45-75 minutes and were audio-recorded and transcribed. If further details were required, additional interviews were conducted by phone or video call. For triangulation and further insights, we also reviewed public and private internal and external documentation. These included process specifications and architectural documentation such as meta-models or service designs, where permitted.

For our analysis, we conducted an abductive qualitative analysis inspired by the grounded theory coding process of open-axial-selective coding [30]. Initially, the first author assigned open codes to the transcripts such as “architecture as support function”. In addition, we compared the codes based on the abstracts of the manifestation of organizational agility with sense and response and different process areas of EAM (plan, model, communicate, transform and document) in this stage. The codes then were constantly compared, which resulted in consolidated codes such as “groups for discussing architecture across teams” based on the identified common character of enabling synergies. To attain the final empirical results, we continued to iteratively consolidate the codes by their commonalities in relation to agility, until the final principles emerged. In case of conflicts, the authors discussed the different perceptions until they reached a joint assessment.

For generalizability and validity [31], we evaluated the principles with three additional experts working as architects in an agile organization. The participants were asked in face-to-face meetings for qualitative feedback on the principles’ structure, applicability, level of detail, and utility [32]. We also requested feedback to identify further design principles to refine our results. However, the findings showed that our results are comprehensive; only minor revisions like extending some principles’ descriptions in style and phrase were needed. Requested patterns on concrete recommended actions, however, were shifted to our next research steps.

14.4 Results

In this section, we describe the six identified design principles for organizational agility with architectural thinking (see Table 31). Similar to the seminal work for EAM principles by [33], we show the rationale behind each principle based on the goal of agility, and the resulting implications for shaping architectural thinking in form of proposed implementation mechanisms. Our principles are designed to be as independent as possible from organizational setups and specific reasons for pursuing agility, so that architectural thinking can be realized in various ways, e.g. via (agile) projects or via stable ‘product teams’ with an end-to-end focus on service delivery. While the principles show the general form and function [34], the mechanisms, however, act as exemplary representations we identified in the analyzed companies. Thus, organizations may choose to implement principles with different mechanisms.

14.4.1 Architect around the Business Ecosystem

The first identified design principle is to extend the EA perspective towards the surrounding business ecosystem to be able to sense environmental changes and respond in a timely manner. All interviewed experts have declared in unison that today’s environments require a thorough understanding across the organization of who the external customers are, what value is for them, and how they create value to be able to always deliver the ‘right’ product or service offerings. In other words, doing so would require companies to think from the external customers’ perspective across business and IT. This implies identifying and understanding customers’ experiences and behavior in day-to-day life and extracting the resulting customer needs and problems. In addition, this involves thinking about integration points of the customer value creation with the organization by identifying which parts of the overall value creation the company contributes. As INT-4 states, the question is: “*How do I look at that whole end to end flow across my organization from my customer, from an outside perspective?*” and analyze the resulting customer problem. According to the interviewees, companies should therefore be able to ‘visualize’ this information in order to communicate and subsequently act on it. Most interviewees spoke about the *customer value stream*, which then splits into multiple customer journeys that address specific customer needs, resulting in customer problems that need to be solved. Since (parts of) customer journeys may rely on business partners, e.g., by offering their services (semi) exclusively on a platform, organizations may also be required to understand the partner journey(s) and continuously be aware of fulfilling the supplier experience to prevent weakening the affected parts of the customer value stream. Finally, companies need to monitor third parties such as regulators and auditors, as they also indirectly influence the customer value. Since most business ecosystems are highly volatile, identifying, monitoring, and analyzing the ecosystem needs to become a truly continuous activity.

14.4.2 Continuously Map Internal and External Views

A prerequisite for acting on identified (changing) customer needs is the ability of organizations to continuously adjust their internal service design and delivery. First, from a strategic architecture perspective, this may require mapping the customer value stream, its journeys, and the integration points to the organizational value proposition(s), which define the internal promises by the organization towards the customer within one or multiple business models. Second, the interviewees recommend extending the mapping to the enterprise vision as the organization's self-perception and to the corporate strategic goals to ensure that no frictions exist among the organization's strategic moves. The ongoing changes in the ecosystem lead to continuous mapping, however, and the enterprise vision may need adjustment over time. Third, mapping involves continuous analysis if the company has the right capabilities and corporate services for fulfilling and surpassing customer needs.

To respond with ease and speed, flexibility in the business architecture is perceived as necessary, as first setting up standard procedures and processes, and then mapping the service delivery around them is seen as too rigid for fast shifts. Instead, the key is to think about the 'ideal' internal responses to recurring customer needs and problems in one or multiple journeys, which we call 'solution thinking'. A solution is the (innovative) response to a slice of customer value by addressing one specific recurring customer need. It involves corporate services to offer to the customer, and the steps towards achieving the slice of customer value, called 'internal value streams'. Value streams are designed end-to-end, as INT-12 states: "*It starts with the customer and it ends with the customer and even areas like legal and finance and so forth, supporting them, are part of that same single value stream*." The internal value stream uses and alters (parts) of business processes, includes required business capabilities, internal services, all innovation, design, development and delivery activities and the used (parts of) the application systems and infrastructure. Together with the needs and customer services, solutions form a new 'comprised entity' spanning across the whole EA and its borders to customers. In addition, they span across and expand the usual 'end-to-end logic' in software development and delivery (plan-build-run) which has traditionally been outside of EA's scope. Solutions are fluid in nature, as the response to the problem might change due to different needs. Thus, they span both capital (capex) and operational expenditures (opex) due to their end-to-end logic from a plan, build, and run view. With this overarching logic, solutions also merge traditionally separated business and IT thinking for service provision. Due to this novelty, interviewees call for new architectural representations for enabling such an integrated and holistic view from customer with external value streams and journeys to solutions with customer services, internal value streams and its elements. To date, no such representations are known.

Table 31: Design Principles of Architectural Thinking for Supporting Organizational Agility.

Design Principle	Rationale by Organizational Agility	Main Implications for Shaping AT
DP1: Architect around the business ecosystem	- Understand customer value & its creation - Identify business partners' role in value creation - Continuously evaluate ecosystem for gaps	- Provide (linked) information about the ecosystem (e.g., customer value streams, customer & partner journeys)
DP2: Continuously map in- and external views	- Outline company's role in value creation - Ongoing mapping & gap analysis of external demands with company's value propositions and long-term strategic goals - Continuous mapping & gap analysis of external needs with operational internal delivery (e.g. service features)	- Provide (linked) information on enterprise vision, strategy, business model(s), external needs & problems - Integrate architecture in portfolio decision-making to analyze the link of (business) processes, capabilities & internal delivery with external needs
DP3: Create value-oriented architecture support	- Continuous alignment of internal service delivery to customer & business value - Ongoing monitoring that services fit to the expected value	- Support portfolio management in tailoring 'ideal' delivery organization - Put alignment mechanisms in place across the organization, e.g., shared purpose and metrics.
DP4: Empower local stakeholders to make architectural decisions timely	- Empower decision-making as much as possible within set frame (aligned autonomy) - Enable fast, but informed decision-making	- Decentralize architectural decisions as local as possible (e.g., skills in teams) - Ensure fast support across company by, e.g., shared architecture service function
DP5: Provide long-term guidance for continuous architecting	- Foster continuous improvement & innovation (service, business model, process) - Enable adjustments to portfolio in case of novel/ complex locally derived innovations that require overarching decisions	- Establish collaboratively built and easily adjustable architectural vision - Consolidate and integrate models and data from time to time, e.g., via chapters - Support exchange among 'architects'
DP6: Make architecture discussable and visible	- Identify dependencies and collaboration partners early as possible, e.g., to resolve issues - Prevent unnecessary rework based on misunderstandings	- Enable non-architects to understand architectural models - Make architecture decisions & rationales transparent & easy to find

Most interviewees stated that the responsibility for continuous mapping would be best placed within the portfolio management, as it is the link between solution ideas or concepts and their realization. However, the setup and focus will change, as INT-13 explains: "*I think the portfolio planning would take the place of strategic planning that we may call it today. So I think we scale up portfolio management to bridge across capex and opex. We staff, where was portfolio* *offices or perhaps EPMOs, with people who have high levels of business acumen, business management, strategic knowledge and management skills and less of the project management process staff, which you tend to see a lot of today.*" The all-embracing nature of the portfolio would then require an overarching vision of the organization, both from a business and a technological perspective, which makes architecture one integral component in the portfolio design and decision-making. While this may imply enterprise architect involvement, labelling the role 'value managers', who would need a strong architectural mind-set, would be more suitable for an emphasis on seeing and switching between the customer and the business value and its implications for necessary changes in the company's solution landscape.

14.4.3 Create Value-Oriented Architecture Support

Solely mapping the ecosystem and the strategic level is seen as insufficient for organizational agility, as this may prevent a seamless delivery because the operational level is still 'siloed'. Instead, the whole operational side of solution delivery should be aware of and be aligned with the customer needs in their daily operations and their long-term mind-set.

The first alignment mechanism involves the required work items to satisfy the customer needs, traditionally depicted in form of programs and projects. In line with solution thinking, organizations are moving towards thinking around 'for what' they are working (value) instead of planning concrete features. Value involves both 1) the external customer value, but also 2) the internal business value with brand and staff, 3) strategic, and 4) financial value. The gaps from mapping external and internal views (see section 14.2) are then contrasted to the value quadrants and result in "*a very clear vision statement, which is supported by perhaps a purpose statement. And out of that it has five or six strategic goals.*" (INT-13) Based on the goals, which serve as the overall purpose, the portfolio items – outcome-oriented changes or new solutions – are derived based on the thinking "*You've got 20 million, what is the best thing we can achieve? And that will deliver one or more contributions to those [four] value [..] quadrants.*" (INT-13) The delivery functions then pick up the items for value delivery and value capture via their backlogs. In the consequent backlog planning on operational level, value implies for all parties, especially those being involved in decision-making like product owners, to move away from the typical internal product focus based on "*How do I get the best, the most features of my product?*" (INT-15). For creating alignment throughout the organization, mechanisms with customer-oriented metrics and KPIs following approaches like Objective and Key Results (OKR) can be used to map value to individual benefits and services. As those usually do not include other parts of a value stream, further illustrations for picturing the extract of the overall value creation – like business capability models – can also support.

Following the value stream logic, the second alignment mechanism is to ‘group’ teams around a common customer problem-based purpose, based on the overall solutions in the portfolio. Grouping in this sense implies having a shared mind-set among a team on what to achieve via the purpose. That does not necessarily imply a structural setup, although some companies start to restructure in this way with stable product teams. For larger solutions, teams are sometimes organized around domains or tribes as the collection of teams with the same purpose. Each domain includes a maximum of 100-150 people, since a higher number does not enable stable social relationships between its members. Within the tribe, teams are responsible for one or more services and systems, as INT-3 states: “*Every single customer that joins basically you then need to have in the CRM and you then use that to understand all their usage so that you can bill that. Those systems all play out that way. So from a systems perspective, if you follow along the [customer] journey, de facto it ends up becoming sort of product tribe. So some IT systems will be exclusive to a product tribe or [customer] segment tribe. But they will be all over that as well*.” For continuity, insights on changed customer needs shall flow back from teams to the portfolio for reconfiguration.

14.4.4 Empower Local Stakeholders to Make Timely Architectural Decisions

Time is a key building block of being agile. With respect to the organizational setup, time implies to ensure that decisions are made in a timely manner with as little friction as possible. Frictions can be prevented by empowering the autonomous teams to make decisions as local as possible and within the shortest possible timeframes (such as 2 or 4-week sprints). As INT-13 states, “*[..] the difference from today is that those self-managing teams are very, very clear on what it is they’re trying to achieve. And again, because the highest leaders have set up strategic direction in five or six goals, crafted a number of business objectives and communicate that really well down for your organization. And at the same time emphasize their communication capabilities so that everybody in the organization has a very clear perspective on what it is that they as an individual and they as a team all be empowered and almost self-leading to a point [..]*.” Cascading decisions can be translated to the architecture into a similar fashion, so that architectural decisions should be made as local as possible, preferably within a team. To establish a certain coherence among local decisions, organizations can set up high-level business and technology-related overall architectural standards at portfolio level around security or the choice of cloud vendors, but these would usually be more outcome-oriented guidelines instead of concrete rules. Via the backlog items, these architectural guidelines / standards are then cascaded down do domains and teams, which then decide how to act upon them. Thus, agile organizations foster decentralization of architectural analysis, modeling, and decision-making as much as possible in order to reduce friction and to limit coordination efforts. Lean practices such as Hoshin Kanri, Kata, or the A3 method [35] can be used for local decision-making, as they capture "*What are the [customer] pain points? Based on these pain points, the definition of the current state, what's the definition of awesome? [..]. I need a definition of awesome. I need a target state of some sort, not just flail around and struggle with the current state, but dream a little bit what the target state might be like. And then based on that tension, identify some specific counter measures. What initiatives do you think would be helpful in getting you towards that target state? And then pick the most important out of those and break it down into three specific small tasks that you can do [..]*" (INT-14).

To ensure decentralized decision-making in a complex context, different architectural skill sets (e.g., those of software, business, or solution architects) ought to comprehensively grasp the implications. These skill sets should preferably be with people having these roles within the teams. The interviewees proposed two not mutually exclusive general possibilities to support the skill development or provide extra support for complex situations such as large cross-domain initiatives or projects, which are usually combined: 1) one or multiple shared services that are dedicated to architectural thinking or 2) access to all necessary architectural information (see also section 14.4.6 below). The first alternative seems to be the most prominent at the moment. Although slightly differing in design, most organizations have some 'architectural keeper' in place. As INT-6 states "*[…] you'll see somebody at or adjacent to the development team level. So quite often on the one level up from the development team […] you'd have some tech leads that say who would be doing some solution design. [And] we have an architect sitting there, so that they can have that discussion and negotiation with whatever role it is that's forming the product management function. So that you can be: Okay, you want to do this stuff and we understand why from a market perspective that makes sense. It order to achieve that, we need to invest in the platform that's going to slow down what you want to do. But then actually it will speed us up later. So you need the right voice at the right level to be able to have that discussion.*" However, most interviewees emphasize that everyone should be 'wearing an architecture hat', so that specific architect roles – especially for technology – are not always required. Moreover, people with architectural awareness are key, as INT-12 sums up: "*Architecture is a competency, not a function [...] There needs to be somebody with that competency, with the knowledge and view of architecture. And in the technical space, any reasonably experienced technologist should be able to step into that space.*"

14.4.5 Provide Long-Term Guidance for Continuous Architecting

Even though agile teams are empowered with a high decision autonomy, unnecessary redundancies and resulting costs are to be avoided in agile organizations like in traditional ones. Thus, interviewees state that some form of overarching architectural vision and guidance is needed to prevent long-term deficiencies in the architecture. As INT-11 elaborates: "*Let's take the target architecture out and it's more than that target [..]. It's more nudging where things are going. But I think we still have matariki. We still have a north star […] we do have long-term goals for architecture. Absolutely.*" This 'north star' is mainly business-related and represented in the portfolio with items depicting individual goals to be fulfilled. However, some interviewees also mention a more specific common technological vision to enable swift switching between teams by preventing a plethora of different tooling and technological bases and the resulting time-consuming efforts to learn the new skill.

The way of achieving a truly shared and sustainable architectural vision or guidance may involve a collaborative process to develop such a vision together across the organization instead of imposing one top-down. Besides Scrum of Scrums, a community of practice is the most common practice. These are groups with representatives from different teams, which have a collective view across all teams, define guidelines, and are accountable for them. Most also manage the personal development of architecture roles of members, as so-called 'chapters'. While the representatives may be in architectural positions, everyone with an architectural mind-set (who 'wears an architectural hat') is eligible as member. However, the participants' main job is outside the chapter, as INT-12 states: "*And it's part of other work. I've seen a situation where there was one person who was permanently and only in that community of practice, they ended up taking very much a librarian position as well. [..] So that single individual was very, very busy looking across everything [solely in this group] that was going on, coordinating a lot.*" Thus, people with architectural roles still ought to be hands-on working within teams or being an explicit shared service function instead of being solely documenting – and, thus, not value-contributing – ‘PowerPoint architects’.

Since the main purpose of the teams as ‘ear’ of the customer is to deliver continuous improvement and innovation to always fulfill and surpass customer expectations, it’s in the organization’s interest to foster continuous architecture across all levels in and among teams and domains. This implies a need for a certain flexibility in the architectural vision. Chapters can play an important role in this regard, as they can check the new ideas, especially with new technologies involved, and can alter the guidelines based on their knowledge. Further, chapters may be innovation radiators themselves by proactively thinking about possible uses and ‘business cases’ for technology innovations. Teams then have the opportunity to choose to integrate these ideas into their own backlogs. If ideas are ‘too new’ or very complex, they could be radiated up to the domain backlog or even to the portfolio to be evaluated and perhaps selected as a (part of a) a new solution.

14.4.6 Make Architecture Discussable and Visible

The new thinking embedded in the previous principles challenges traditional notions of architectural models and modelling, which are usually quite abstract and in a language that specifically addresses architects and their peers. Especially with team members and product owners from the business side and other non-architect roles involved in architecture decision-making, there ought to be ways to make the complexity of both business and technical architecture and their relations understandable and discussable. The specific format of how architecture should be represented was secondary for the interviewees. For them, the main issue is to enable everyone to grasp the chosen architecture representation format and therefore its content. Most interviewees propose value stream mapping as the high level business architecture representation. As INT-14 states: *“Hold on, we know this. There’s value stream mapping, right? Value stream mapping for people that are familiar with the concept is tremendously powerful because essentially it says: How do I know how value gets to the customer? What needs to be sort of happening to get the value?”* Other existing approaches such as customer personas are often used alongside, as they can put the customer perspective in simple words. For defining the resulting workload, mechanisms from agile software development such as themes, epics, and features were frequently mentioned. Those approaches can describe an expected outcome as a representation of value, both from a business and technical perspective, and from portfolio level (themes, epics) down to domain (epics, features) and team level (features, stories, tasks).

However, making architecture discussable has a second dimension: visibility of architectural decisions. As INT-11 states: "But it's only when they took the time to stand back for a day, because there was lack of visibility of work and when you visualize the work, you can suddenly see that each development team is not asking much of infrastructure. But in the next three months, they're all asking stuff of infrastructure and there's this huge snowstorm of work on the infrastructure board." Therefore, formats such as big room planning or obeya rooms in particular, can be used within the organization. An obeya room (also called 'war room' or 'big room') is a room filled with all information that is relevant for decisions and managing a group. Information is depicted on the walls – usually by manual boards and paper or post-its – includes objectives, expected outcomes, actions, issues and metrics [36]. Everyone can walk into an obeya room to get information and find out the corresponding person or team(s) in case of identified dependencies. The rooms are usually installed on each level from portfolio to team to grasp the whole picture, especially when planning capacity and work. Thus, planning meetings with representatives from different groups are usually held in those rooms to have the underlying architecture present at any time when discussing and making decisions.

Finally, tool-based consolidation and integration of models and data from time to time can support both a common understanding on architectural decisions and a common information retrieval point, independent of a physical space. Usually conducted by architectural shared service members, they mainly store the data in knowledge management tools such as Microsoft SharePoint or Atlassian Confluence. Together with data automatically gathered from cloud services and development tools, teams can create a 'self-reporting architecture' based on that information for gaining insights on the underlying complexity of decisions. However, the most important overall issue is achieving architectural transparency. As INT-14 sums up: "*So if you are capturing it somewhere, then print it out, put it on the wall and make sure that you have people with pencils or pens or whatever and let them sketch and change it. So don't let it kind of linger in an information refrigerator, make it an information radiator.*"

14.5 Discussion and Conclusion

In this paper, we propose six principles for how agile organizations can enable architectural thinking for aiding the goal of organizational agility. The principles were developed in an exploratory empirical analysis of sixteen interviews with companies and consultancies in the private and public sector. Taken together, these principles are intended to support the realization of architectural thinking throughout an organization alongside its journey towards increased agility.

Realizing our six principles would lead to several changes to traditional set-ups for EAM functions. First, the architecture scope would change so that it extends end-to-end from the customers and partners to the underlying technical solution components. Second, architecture has now an increased role in and importance for strategic, tactical, and operational decision-making from the portfolio level downwards. Third, the architectural decision-making approach now includes a larger number of roles, and perhaps even puts ‘traditional’ enterprise architects into a supporting role. Lastly, all the new non-architect roles would have to be aided in their decision-making by making architecture and impacts of changes visible and discussable.

While there is an increasing number of approaches for architectural management in agile organizations, most of them only address parts of the ‘big picture’ – for instance, by proposing lightweight approaches [9,10] or by focusing on the interaction between dedicated architects and agile teams [14,15,27]. Some also show deeper insights on how an architecture management function changes in (singular) agile IT organizations [28]. In contrast, our principles address a set of aspects – both regarding the architecture content and the organizational setup – that may help to establish architectural thinking beyond traditional architecture functions or roles. The overarching link between external environment and internal organization, although increasingly addressed in theoretical concepts such as business ecosystem architectures [37,38] – but either without the notion of agility, or reduced to solely calling for such a partner-orientation without providing architectural solutions [2,28] – potentially reduces frictions between architecture layers (e.g. customer and business operations, or business operations and IT). This may foster sound architectural decisions, which may in turn help agile teams to accelerate their organization’s ability to deliver new or changed services.

At its core, agile architectural thinking still requires stepping out of local decision-making contexts and thinking about the ‘big picture’ [11,12], but now with many more people and roles involved. Also, in agile architectural thinking the global architecture view is achieved not anymore through efforts by dedicated enterprise architects making sense of the architectural complexity as “*heroes [that] don’t scale*” (INT-9), but through collaborative discussions on architectural issues among peers and across teams and domains (see also [14,28]). While some organizations may have (or still have) specific architectural functions as shared services involved in and enforcing these conversations [8,27], we see organizations that tend to follow a new philosophy of architecture as a competency instead of a full-time role, which ‘delegates’ the responsibility to non-architects. Similar to existing literature [27,29], these organizations employ a group-based approach interlinked across the organization for gaining a consensus on architectural decisions, perhaps supported by a shared architecture vision. However, the approaches also differ, as the group is also used for personal development of the people wearing an ‘architectural hat’. On the operational level, these people may be mainly (senior) developers, whereas on the strategic level they may be mainly portfolio or value managers. Our findings therefore also indicate a future point of convergence between strategic portfolio and value management on the one hand and strategic EAM on the other hand in the organizational agility context.

Increasing the level of agility also often leads to an increased speed and volume in changes in the service structure and landscape, which leaves the architecture to be in a continuously ‘unfinished’ state [9], similar to the organization itself being chronically unfrozen [18,19]. The decentralized innovation management empowers teams to continuously think about improving existing services and creating new ones (see also [24,25]). This essentially decentralizes the place of architectural thinking, which, at first, reduces the overall architectural transparency. In contrast to the traditional EAM literature, which advocates for documenting a complete as-is picture or having a detailed target architecture model, agile organizations respond to the puzzle of local architectural decisions, planning, and knowledge by merely striving for a shared outcome-oriented architectural vision and sufficiently detailed architecture models to support teams’ architectural thinking and conversations. Both the vision and underlying architecture models are kept rather lightweight by focusing on only having the necessary information present, and in a format that is clear for many different backgrounds, since – as mentioned before – many non-architects are now involved in the architecture-related decision-making.

In line with business ecosystem research [37,38], we finally extend Sambamurthy et al.'s (2003) [2] agility types of customer and partner agility. We highlight the organization's continuous awareness of the entire ecosystem surrounding an organization (including – but not limited to – customer and partner actions, behaviors, and needs), and the resulting identification of all these changing needs as potential drivers for a subsequent rapid internal response. Here, our notion of solution thinking provides a specific mechanism for bridging this continuous external awareness via thinking from a customer problem perspective within the whole organization and channeling the gained insights towards actual internal strategy as well as operational service (re)design and delivery. Our findings illustrate that a corresponding architectural representation can help substantially to grasp the complexity in the corresponding decision-making processes, and also to identify the actual gaps between the various external needs and the internal capabilities in the process of the delivery of a new or changed product or service that successfully addresses the changed needs. We therefore also extend the traditional EAM scope, which usually does not consider the wider business ecosystem [26,28].

Of course, our research is not without limitations. Most importantly, we build our results on knowledge gained in an exploratory empirical study with representatives from multiple organizations in a single country. To address the resulting generalizability and validity issues, we recruited interview partners from a variety of industries and job positions. In addition, we deliberately included consultants in our study to use their experiences with different clients (and, with some, in different countries as well) to gain an even broader view on architectural thinking and organizational agility. For achieving a further generalizability of our results, we plan to extend our study to multiple countries as a next research step. We also strongly encourage future studies to empirically validate our findings.

A second limitation of our research is the complexity of architectural management in agile organizations. With architecture being a multi-level concept spanning all organizational levels, and agile organizations focusing on decentralization as much as possible, many different roles are involved in the decision-making. Although we addressed this limitation with interviewing multiple perspectives in our study, the views from a number of roles such as (chief) product owners and agile team members are still missing. Thus, we recommend corroborating our findings with in-depth case studies from multiple perspectives. This could also lead to further insights on the interrelations of architecture with strategic management, especially strategy formulation and portfolio management, in agile organizations.

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15 Reconceptualising Business-IT Alignment for Enabling Organisational Agility

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Abstract

Organisations increasingly strive to increase their ability to proactively sense and respond to market opportunities and threats to remain competitive by embracing organisational agility. As doing so often blurs traditional boundaries between business and IT, this has considerable implications for the business-IT alignment (BITA) concept. Based on empirical data from focus groups and interviews with 36 practitioners from multiple positions and industries, we identify four organisational challenges for BITA in agile contexts: 1) to establish an effective focus on the business environment, 2) to balance the autonomy of single teams for decision-making concerning the development and use of IT 3) and service functionalities with the organisation-wide optimum, and 4) coping with the fluidity of the organisation’s structure and processes. We subsequently derive four design goals and five design principles to address these challenges. In addition, we contribute to research by reconceptualising BITA for agile contexts. Organisations can draw on our findings to guide their agile transformation journeys.

Keywords

Agility, Business-IT Alignment, BITA, Architectural Alignment

15.1 Introduction

The digital age with its hyper-competition and volatile business environments deeply challenges established companies. Power shifts to the customer who can select a preferred service from a vast array of possibilities (Denning, 2010; Denning, 2016). Consequently, companies more than ever strive for being able to always provide the 'right' customer services, often accompanied by a required timeliness in delivery (Overby et al., 2006; Lee et al., 2015). This dynamic calls for corresponding organisational responses to foster and improve their ability in being proactive in sensing the needs and responding with speed and dexterity to fulfil and surpass customers' expectations (e.g. Sambamurthy et al., 2003) – or in other words, to embark on a transformational journey to increase organisational agility.

While literature on the understanding of business-IT alignment (BITA) in traditional IT environments is extensive and mature, the agility debate is rather disconnected from alignment research. Although evidence shows that at least a high degree of social alignment facilitates agility (Tallon, 2008; Tallon & Pinsonneault, 2011; Liang et al., 2017), paths on how to achieve this form of alignment in detail are yet scarce. Existing approaches on how to integrate agility within the organisation also provide limited insights on implications for BITA, as most approaches primarily focus on the acceleration and optimisation of the IT delivery despite agility increasingly being perceived as an enterprise-wide concern.

Firstly, operational approaches lack an enterprise-wide perspective. Scrum (Schwaber and Sutherland, 2019) or self-organising IT teams show the merge of IT development with IT operations via DevOps (Kim et al., 2016) on the team-level, and thus lack a holistic agility perspective that also includes the business side. Frameworks for bimodal IT (Haffke et al., 2017a,b; Horlach, 2017) or large scale agile transformations of the whole (IT) organisation (Scaled Agile, 2019; Disciplined Agile, 2019) try to include an organization-wide perspective, but limit themselves primarily to scaling agile in the IT side.

Thus, concrete recommendations for agile organisations on how to integrate their business with their IT and underlying rationales remain an area of research. This integration, however, is highly relevant as digital innovation deeply intertwines IT and business logic (Melarkode et al., 2004) and fusion-focused constructs like digital business strategies are proclaimed as essential for shaping a responsive organisation (Bharadwaj et al., 2013; Kahre et al., 2017). Therefore, more specific recommendations are needed on how to achieve effective agile transformations that retain and improve BITA. Moreover, since agile transformations commonly blur traditional distinctions between business and IT, the question arises how to adapt the BITA concept itself. Thus, we seek to answer the following questions:

RQ1: What BITA-related challenges do organisations face in their agile transformations?
RQ2: How can organisations address these challenges effectively?
RQ3: How is BITA to be reconceptualised for agile organisations?

To provide our answers, we draw on data collected in two phases comprising focus groups and expert interviews with CIOs, CDOs, and further roles from multiple organisational levels as well as external consultants in the area of enterprise-level agility. To answer RQ1 and RQ2, we then derive challenges, design goals, and design principles for alignment in agile organisational contexts by conducting an abductive qualitative analysis. In this analysis, we employ theory-inductive coding informed by BITA and agility research and additional open coding inspired by the grounded theory approach (Strauss and Corbin, 1991) in order to not miss out on important aspects based on a narrow theoretical perspective. To answer RQ3, we then take a step beyond the identified challenges, goals, and principles and develop a conceptual model for BITA in agile organisational contexts.

15.2 Research Background

As business organisations have become very dependent on IT services to achieve their goals, the synchronisation of those entities, commonly known as business-IT alignment or BITA, is regarded as a key issue for business and IT executives and managers (Gerow et al., 2014; Luftman et al., 2017). BITA is of a complex character, as it involves multiple dimensions (Chan and Reich, 2007; Ullah and Lai, 2013). First, there is the strategic or intellectual dimension, as the business and IT strategy and plans must be understood by both business and IT (King, 1978; Lederer and Mendelow, 1989) and need to be in agreement (Kearns and Lederer, 2000). Second, approaches such as the Strategic Alignment Model (SAM) by Henderson and Venkatraman (1993) also call for a fit and close links between business and IT on the structural level, which include decision-making rights, (de)centralisation of IT, or IT personnel deployment (Chan and Reich, 2007; Chan, 2002). The third dimension is the social dimension. A shared understanding of business and IT professionals and enabling trust between the two functions (Broadbent and Weill, 1993; Kashanchi and Toland, 2008) is seen as a baseline for committing IT support for the business strategy and vice versa (Haki and Forte, 2010) and the commitment to each other’s plans, objectives, and mission (Reich and Benbasat, 2000). Fourth, social alignment is closely linked to the cultural fit (Luftman et al., 1999) with its planning and communication styles (Pyburn, 1983; Chan, 2002) for sustaining successful communication between both groups (Van de Zen and Jong, 1999). Thus, despite the variety along the dimensions, business IT alignment can be characterized as orchestrating the separate entities of business and IT to have them work together towards a common (business) goal (Luftman et al., 1999; Henderson and Venkatraman, 1993).

In the agility literature, BITA is covered rather implicitly as an influencing factor (Tallon, 2008). According to the Agile Manifesto (Beck et al., 2001), agility on the team level emphasises close collaboration between the business (as the customer) and the agile team. In more recent times, BizDevOps proposed to increase the autonomy of the agile team by having parts of the business as customer within a team (Fitzgerald and Stol, 2017). However, agility as the ability for sensing changes in the environment (Sambamurthy et al., 2003; Lu and Ramamuthy, 2011) and reacting with dexterity, speed, and innovation (Liang et al., 2017; Roberts and Grover, 2012; Conboy and Fitzgerald, 2004) increasingly advances beyond a single team perspective. An example is the rise of bimodal IT and the resulting establishment of digital units for faster delivery of digital services with multiple agile teams. This results in a debate on how to enable organisational agility while ensuring cross-team alignment (Kniberg and Ivarsson, 2012; LeSS Company, 2019; Moe et al., 2019) through communities of practice (Paasivaara and Lassenius, 2014) or common principles (Faraj & Xiao, 2006). The communication capabilities (Roberts and Grover, 2012; Fink and Neumann, 2007) shall also span business and IT, as both business and IT logics are intertwined in digital service provision based on direct customer insights (Melarkode et al., 2004; Bharadwaj et al., 2013; Kahre et al., 2017). A similar evolution is seen in the second popular direction of large scale agile, which positions agility as an enterprise-wide concern. An increasing number of frameworks providing blueprints for agility on the organisational level (e.g. Scaled Agile, 2019; Disciplined Agile, 2019) emphasise that practices for coordination across the enterprise such as cross-unit business and IT roles (Scaled Agile, 2019; van Oosterhout, 2006) or a central portfolio management (Laanti, 2008; Hoffmann, 2017; Horlach et al., 2019) need to exist to achieve alignment and agility simultaneously (Bradley et al., 2012; Tiwana and Konsynski, 2010).

However, as most approaches limit scaling the agile context to the IT organisation (Scaled Agile, 2019; XSCALE, 2019) despite BITA being an enterprise-wide concern, alignment is not explicitly addressed regarding its concrete involvement (Disciplined Agile, 2019). Instead, BITA is often only emphasised as a goal, similar to the debate on the unit level. Only some authors target the direct link between alignment and agility (Tallon, 2008; Tallon & Pinsonneault, 2011; Liang et al., 2017). These authors emphasise that social alignment in particular does positively influence agility, while a high degree of intellectual alignment may lead to inertia and myopia, as business and IT executives tend to focus on internal concerns while losing the external perspective concerning the fit between the changing environments and the internal strategy and delivery. These authors call for IT to be embedded in key business processes (Denning, 2017a,b) for collaborative decision-making (He and Wong, 2004). Dynamic alignment (Vessey and Ward, 2013; Sushil, 2015) with dynamic decision-making (Smith, 2014; Doz and Kosonen, 2010; Tiwana and Kim, 2015) shall manifest the shared understanding between business and IT executives to recognise changes and be able to react rapidly.

However, it is still unclear how organisations could establish effective BITA in the most favourable way in their agile journeys. The existing blueprints are of not much help in this regard, as most of their advice is too specific to account for the diversity of existing organisational contexts. Thus, analyses and mechanisms for answering these calls by strategic and structural practices is yet in its nascence. The same applies to the cultural dimension of alignment, although the culture is seen as key for the ability of mobilisation of core capabilities, knowledge, and processes (e.g. Lee et al., 2015; Goldman et al., 1995). Yet, as BITA naturally becomes a focal point during agile journeys, answers are required on how is it to be shaped for companies to enable agility’s dimensions of sense and response.

15.3 Research Methodology

To inform our BITA reconceptualisation for agile contexts and to give companies actionable guidance, we follow a duality of knowledge goals. To capture effective prescriptive knowledge by design theorizing to produce pre-artefact and pre-design-theory design knowledge (Weick, 1995; Baskerville et al., 2015), we first identify challenges that organisations face on their agile journey and then derive design goals and principles based on the obstacles, following the guidance by Gregor and Jones (2007) and Drechsler and Hevner (2018). Design goals and principles are perceived as abstract yet desirable knowledge for design or action (Kuechler and Vaishnavi, 2008), as giving more specific advice (‘instantiating’ the abstract design principles for specific companies) would require tailoring to the respective corporate contexts (Drechsler and Hevner, 2018). Second, we generalise and conceptualise our gained understanding in form of the reconceptualised BITA model which captures observed and generalised patterns with respect to the alignment concept in the new context of agility. This model represents pre-theoretical knowledge as a result of theorizing (Weick, 1995) or sense-making (Drechsler and Hevner, 2018) of the findings. The findings are based on insights from a two-phase cross-industry qualitative study with 36 participants from various organisational contexts (see Table 32).

Table 32: Participants in the Empirical Study.

	Interview	Position	Main Industry Affiliation	Size (in ’000 pers.)	Setting
Focus Group	FG1	CIO	Banking	50-100	Face to face
	FG2	CIO	Utilities	5-25	Face to face
	FG3	CIO	Insurance	0-5	Face to face
	FG4	CIO	Insurance	0-5	Face to face
	FG5	CIO	Retail	50-100	Face to face
	FG6	CDO	Government	5-25	Face to face
	FG7	CDO	Utilities	0-5	Face to face
Interviews New Zealand	I1	Program Manager	Telco	5-25	Face to face
	I2	Program Manager	Telco	5-25	Face to face
	I3	Chief Product Owner	Telco	5-25	Face to face
	I4	Enterprise Architect	Banking	0-5	Face to face
	I5	Enterprise Architect	Banking	0-5	Video call
	I6	PMO	Energy	5-25	Video call
	I7	PMO	Government	0-5	Face to face
	I8	CEO Tool Vendor 1	Transport, Energy, Health	Diverse	Face to face
	I9	CEO Tool Vendor 2	Banking, Government	Diverse	Face to face
	I10	CEO Tool Vendor 3	Insurance, Energy, Telco	Diverse	Video call
	I11	Consultant	Telco, Government, Banking	Diverse	Face to face
	I12	Consultant	NGO, IT, Banking	Diverse	Face to face
	I13	Consultant	Energy, Banking	Diverse	Face to face
	I14	Consultant	Government, Banking, IT	Diverse	Face to face
	I15	Consultant	Insurance, Government, Utilities	Diverse	Face to face
	I16	Consultant	Utilities, IT, Retail	Diverse	Face to face
Interviews Germany	I17	Product Owner	Retail	50-100	Face to face
	I18	Product Owner	Retail	0-5	Face to face
	I19	Team Architect	Retail	50-100	Face to face
	I20	Enterprise Architect	Retail	50-100	Face to face
	I21	Enterprise Architect	Retail	25-50	Telephone call
	I22	PMO	Utilities	0-5	Telephone call
	I23	Chief Product Owner	Retail	50-100	Face to face
	I24	Consultant	Automotive, Insurance, Banking	Diverse	Telephone call
	I25	Consultant	IT, Retail	Diverse	Telephone call
	I26	Consultant	Retail, Automotive	Diverse	Telephone call
	I27	Consultant	IT, Retail	Diverse	Telephone call
	I28	Consultant	Retail, Banking	Diverse	Telephone call
	I29	Consultant	Automotive, Banking	Diverse	Face to face

The first data collection phase encompassed a cross-industry study with IT executives (CIO or CDO) in a single country from seven public and private organisations. The participants were identified by the following criteria: 1) their organisation is undergoing a transformation towards organisational agility that is reshaping both (parts of) business and IT, 2) they hold a position with in-depth insights on the overall organisational system, and 3) they are willing to partake in open information sharing among the researchers and the companies. For understanding the individual agile transformation efforts, we first conducted a single semi-structured interview with each participant. Each interview session took ca. 60 minutes and was audio-recorded and transcribed. To gather further details on the agile transformations and deriving patterns based on comparison, we conducted three single day focus group workshops (Krueger and Casey, 2014) with the same participants in spring and summer of 2018 and in winter of 2019. In multiple sessions, the participants discussed the nature of their decision-making and coordination, the reasons for their approach, and the consequences for their organisational setup.

The second phase involved a cross-industry study with 22 participants across two countries for gaining broader perspectives on agility's operational, tactical, and strategic level implications. Similar to the first phase, we conducted semi-structured interviews and asked each participant to describe their or their key clients' organisational setup and the nature of the decision-making and coordination including planning and monitoring processes, procedures for design and documentation of decisions, and the roles involved. The interview sessions lasted 45-75 minutes, were audio-recorded and transcribed. For our analysis, we integrated all transcripts into the qualitative analysis tool MAXQDA. Inspired by the grounded theory coding process of open-axial-selective coding (Strauss and Corbin, 1991), we then conducted an abductive qualitative analysis (see Table 33).

Table 33: Example for Analysis Process of Empirical Data.

Quote	Code (Challenge)	Mechanism (D. Feature)	Requirement (D. Principle)	Outcome (D. Goal)
"Think about Nokia: from boots to mobiles. There was a clear decision. [..] On corporate level, it may be similar to the old product, but one level down is totally different. Because you need electronics engineers and no chemists." (translated from German)	Strategic fit internal: Clash strategic goals, products, and skills	Skill mapping for matching people to product	Ensure right people working on right product at right time	Alignment of internal resources with external demands
"You need to follow the market. When I know what they want, it is like building a house: How do I realize it? If you have a vision, mission and perhaps a roadmap for next year, you ask: How do I structure for achieving my set goals?" (translated from German)	Strategic fit external: customer and internal structure	Forming capabilities along vision based on customer needs	Ensure right resources available for fulfilling needs rapidly	

As a-priori codes, we used Henderson and Venkatraman's (1993) SAM model as the most prominent alignment representation with its strategic (external) and operational (internal) dimension, the individual components, and their links (e.g. strategic fit) to organise challenges and mechanisms for agility in the interviews like e.g. cross-functional teams. Concepts in the transcripts that are not included in the model (e.g., customer journey mapping) were assigned with an open code to signify a potential alignment gap. Via constant comparison within a code area (e.g., 'functional integration internal'), we consolidated the codes by a common character (e.g. collaboration of autonomous teams to achieve alignment across services). For instance, the two codes 'meetings among product teams in 2 weeks for coordination of backlogs' and 'architectural advice for product specification' were consolidated into the single code 'mutual cross-team coordination'. These represent the design features as the general mechanisms for addressing the identified challenges. To attain the final results, we then iteratively continued to consolidate the codes across code areas by commonalities regarding underlying requirements, which resemble the design principles, and subsequently derived aspired outcomes of each requirement as the design goals. Beyond the examples in Table 33, this resulted in codes like 'flexible planning process on all levels for fast configuration' (design principle) or 'outcome-oriented decisions for customer reflection' (design goal).

To improve validity and generalisability (Benbasat and Zmud, 1999), we evaluated the identified challenges, goals, and principles with four experts from different backgrounds: a manager of an agile enterprise, a product owner in another agile company, an experienced agile consultant, and a researcher on agility. The experts provided comprehensive qualitative feedback by breaking down the results' structure, utility, level of completeness and detail, and applicability (Hevner et al., 2004). The results showed that our results are comprehensive and valid, as they cover the main characteristics of agility and the resulting needed changes for alignment. However, revisions such as e.g. refinement of goals' descriptions are required. For instance, one evaluation partner explained that not only do external threats influence the shape of the resulting organisational response on how to cope with the risk, but also the company's aspired business goals are an influencing factor to identify suitable mechanisms.

15.4 Challenges, Goals, and Principles for BITA in Agile Contexts

In this section, we first show that organisations respond differently in the light of agility but have to overcome common alignment challenges. Based on those, we then describe the identified design goals and principles to achieve alignment and agility and show examples of more concrete design features as corresponding mechanisms. These challenges, goals, principles and features then form the foundation for our reconceptualisation of BITA. We follow the recommendations of Meth et al. (2015), Legner and Löhe (2012), and Drechsler and Hevner (2018) concerning the presentation of the goals and principles, with one key difference, however. We formulate design goals instead of requirements as agile contexts are continuously changing themselves, and therefore goals as a representation of long-term aspirations for organisational change are a more suitable concept than requirements which imply that they are to be demonstrably fulfilled by a specific (and static) solution. Table 34 gives an overview based on the identified BITA-related challenges in relation to agility.

Table 34: Challenges, Design Goals, Principles, and Sample Features for BITA in Agile Contexts.

Challenge	Design Goal	Design Principle	Design Feature (examples)
C1: Establish an effective focus on the relevant business environment(s)	**DG1: Understand the ecosystem response alignment gap:** Identification of threats in the business ecosystem and subsequent required multi-dimensional response of the organisation (addresses C1, C4)	**DP1: Understand and explicate the ecosystem:** Clarification and visualisation of customer value, needs, and touchpoints to the organisation to prepare for fit with customer and partner needs (addresses DG1, DG2)	- Customer value stream (I12, I20) - Partner value stream (FG5, I28) - Customer journey (I3, I29) - Persona (FG1, I27)
C2: Balance local autonomy concerning the used IT with the organisation-wide optimum	**DG2: Foster alignment between external and internal value propositions:** Persistent focus on customer and partner needs instead of focus on internal affairs (addresses C1)	**DP2: Employ customer vision-oriented strategic direction:** Definition of outcome-based goals based on identified current and potential future customer needs to ensure fit with them (addresses DG1, DG2, DG3)	- Enterprise vision (I14, I25) - Strategic goals (FG5, I18) - Roadmapping (I2, I29) - Product vision (I13, I17)
C3: Balance local autonomy concerning services and their functionalities with the organisation-wide optimum	**DG3: Enable continuous (re)alignment:** Ongoing fit between external customer and partner needs and internal organisational services, structures and processes to fulfil these needs (addresses C2, C3, C4)	**DP3: Align delivery 'structure' around customer value flow:** Optimal combination of business and IT capabilities for frictionless delivery of the 'right' customer services as fast as possible (addresses DG2, DG4)	- Cross functional team (I2, I8) - Product team (FG6, I12) - Internal value stream (FG5, I7) - Capability mapping (I10, I27) - Objectives and key results (OKR) (I1, I17) - Purpose setting (I11, I25)
C4: Cope with the fluidity of the organisational structure	**DG4: Empower corporate engagement:** Continuous converged proactive involvement of business and IT staff (addresses C2, C3)	**DP4: Enable autonomous, yet informed decision-making:** Information points for coordinating concerns regarding services and capabilities within and between levels (addresses DG3, DG4)	- Strategic product owner (I18, I22) - Open planning room (FG1, I2) - Open tool access (I10, I28) - Community of practice (I6, I12) - Architectural vision (I5, I20) - Shared services functions (I1, I20)

		DP5: Set up a meta-reorganisation capability: Continuous information exchange and adaptation procedures across organisation (addresses DG2, DG3)	- Skill to kill (FG1, I23) - Short cadences (FG2, I26) - Decentral team planning (I3, I20) - Central meta-planning (portfolio) management (FG3, I6)

15.4.1 Challenges for BITA in Agile Contexts

In this section we identify a set of BITA-related challenges that the participants reported facing.

First, we note that different types of organisations tend to choose different structural configurations for their agile organisational set-ups. Small organisations with a low number of IT personnel compared to IT systems and services and public organisations tend to employ a team-based approach towards agility. These use agile project teams with a stable service owner coming from business, who is responsible for the delivery and improvement of the service, next to the rest of the team which is more fluid. These organisations use projects for continuously balancing their scarce resources or for fulfilling regulatory requirements for change initiatives, as public projects have to be tendered, for instance. In contrast, companies with a B2B focus tend to use the unit-based approach towards agility: a structural bimodal IT setup with digital units, often relying on internal as well as external resources. As FG3 elaborates: "*Internal employees have an organisational baggage because of our history. If we want to disrupt existing business models or products, we cannot think with an existing mind-set.*" While some digital units may still use projects to deliver services, these organisations increasingly switch to stable product teams with an end-to-end responsibility for their services within a specific business or product domain in order to support productivity by combining knowledge and autonomy. Finally, we see that organisations with a B2C focus tend to use the enterprise-wide approach for agile transformation. They also transform towards stable end-to-end product teams but their transformation encompasses the whole of the IT and business organisation. The rationale for these organisations is that they are much closer to the customer than B2B organisations and, thus, are more threatened by market volatility.

Despite these differences in organisational set-ups, we found four common BITA-related challenges in agile transformations among the companies (see Figure 15). Figure 15 distinguishes the team level, unit level, and enterprise level within an organisation. Figure 15 further highlights that – due to the teams' and units' increased autonomy in agile contexts – BITA considerations (represented by the SAM matrix) need to take place independently on each level as well, and also independently for each team and unit, as each element interacts autonomously with their relevant parts of the surrounding ecosystem.

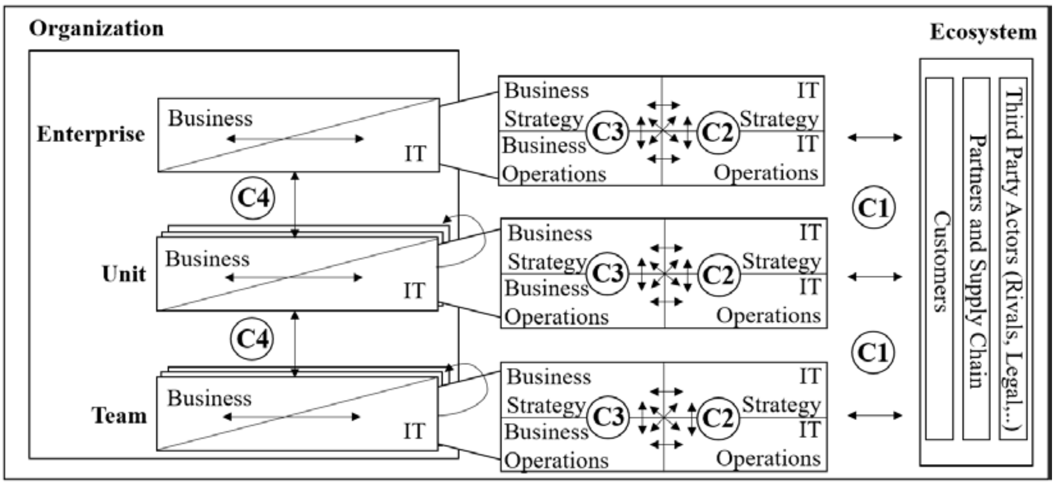

Figure 15: Challenges to Business-IT Alignment by Agile Contexts.

The first common alignment-related challenge among the organisations is to **establish an effective focus on the business environment(s) (C1)** they are acting in for (fore)seeing changes and subsequently adjusting their products or services. As the actors (customers, partners, and third parties) within the business environment are (in)directly influencing each other in the market, the awareness involves the whole network of the business ecosystem and the subsequent service ecosystem(s) for the organisation's individual products or services.

The two next challenges are **balancing the autonomy concerning the used IT (C2)** and **concerning service functionalities with the organisation-wide optimum (C3)**. The idea behind autonomy on the team and unit level is to facilitate rapid responses to perceived market or product gaps. Yet, as customer products or services usually are composites that involve multiple teams or may have re-usable business or IT components across products or services, there needs to be an active balancing of local concerns for each unit or team with the (hypothetical) global organisation-wide optimum.

The fourth and final challenge for organisations is to **cope with the fluidity of the organisation's structure and processes (C4)** for enabling a fast response. Traditionally, organisational structures and processes are established as a stable 'arena' for the different units, teams, and individuals within an organisation to work together in an aligned fashion. However, in agile contexts changes to organisational setups are explicitly encouraged, and thus limiting the extent of stability and alignment that they can provide. In this regard, alignment must enable flexibility in the structural setup while simultaneously enabling people to work together as frictionless as possible.

We found all the identified challenges to be addressed by each organisation, but with varying mechanisms. As mechanisms that are effective for one organisation may be not applicable to others, we subsequently take a more abstract view in the form of design goals and principles. To support concretising these abstract considerations, we also show examples of design features implementing the goals and principles in the form of concrete alignment mechanisms that some of the organisations rely on.

15.4.2 Design Goals for Achieving Alignment in Agile Contexts

Based on the identified challenges, we now derive design goals for achieving alignment in agile contexts. These design goals provide a stable, long-term and high-level orientation for agile organisations.

The first design goal calls for **understanding the ecosystem response alignment gap (DG1).** This requires identifying the current and potential future threats in the business ecosystem (C1) and defining the internal desired position and business goals, e.g. cost leadership, as their combination defines the degree of criticality and the resulting organisational response, e.g. introducing digital units. The threats in the ecosystem that influence the company's success can range from high-competing markets with a high turnover to improving the position by communication channels with new technology or manifestation of leading market positions. The degree of necessary change is also shaped by the company's position in the ecosystem (e.g., platform provider or participant), distance from the customer (e.g., B2B vs. B2C), or the organisational capabilities (e.g., low or high capacity for change). Understanding the ecosystem alignment gap gives a clear mission on how to evolve the organisation (C4).

Once the underlying problem is understood, actionable response initiatives are required to fill the identified gap by **fostering alignment between external and internal value propositions (DG2)**. First, this is because the picture of the customer has changed: "*Traditionally from the IT perspective, we perceived the customer as the people from controlling and marketing. But I always say: No, it is the end customer on the 5th Avenue. […] It is a total customer and consumer obsession.*" (FG5) Second, the power shifts to the customer so that companies need to focus on the *customer experience* more than ever. As many organisations' success is more than ever dependent on fulfilling customer needs, BITA in agile contexts requires extending the traditional alignment notion – which comprised the internal domains of business and IT – by considering the external business ecosystem as well (C1). Since (parts of) the value-creation rely on involvement of business partners, e.g., by (semi)exclusively offering their services on a platform, organisations need to understand any partner needs as well. This requires the alignment also to span the *supplier experience* to prevent a weakening of the affected parts of the customer value by moving to rivals. Finally, knowing competitors' actions and sensing changes in the organisation's remaining business ecosystem such as regulatory and legal changes are still essential, as they may also indirectly weaken the customer value creation.

With the customer perspective in focus, agility involves the ability of continuously providing customer value (which is now regarded as a moving target) at any time, as "*you don't have a start and end anymore, but a continuous lifecycle [of engagement] to consider*" (FG5) for being able to embrace changes. Thus, organisations need a **continuous (re)alignment ability (DG3)**. The ability involves two dimensions: (1) continuous re-evaluation of the ecosystem, its needs and the fit of the company and its value creation (*external view*), and (2) the ability for continuously aligning the organisation in case of changing (parts of) the corporate value creation (*internal view*). When striving for agility, both dimensions are relevant, but presumably to a different extent and with varying alignment mechanisms. The external dimension mainly involves continuously scanning the ecosystem, and whether it still fulfils the customer need to predict movements in the ecosystem relevant for the company (C4). The internal dimension then encompasses the ability to use this information and reconfigure the affected parts of the internal value creation according to the identified change requirements (C2&3). This refers to the systemic ability for adaptation by swiftly shifting organisational contexts based on changing prerequisites. This requires both a corresponding structural and processual organisational setup to enable smooth changes of resources towards different contexts and change readiness of individuals.

The continuous change involves an active enterprise in order to stay responsive. Thus, we see a final design goal encompassing the ability for a **proactive corporate engagement (DG4)** to reflect agility's proactive nature. We posit that merely striving to align the different parts of an enterprise is too passive, as both business and IT need to proactively shape the corporate reality

(C2&3). As especially digital services deeply intertwine business and IT logic, continuous business and IT engagement is key for fast and smooth service delivery. As FG5 elaborates: "*So if we talk about introducing voice as topic, no one tells me: I am logistics, customer service, HR or IT. No, we are all in this together.*" Thus, while there will also be support functions in IT and business with a more limited access to the customer, every part of the organisation needs to understand their importance in the value delivery to the customer. Striving for continuous engagement and change also involves the mandate for continuous service innovation, which is a responsibility for both business and technological service optimisation opposing the traditional separation of plan, build and run, as "*you have a common goal by business and IT: the customer*. *There is no blaming of the other*." (FG6). Thus, the joint mandate for continuous service innovation involves the engagement of both exploitation of existing ones as well as exploring potentials of new ones to always be "*one step ahead*" (FG1).

15.4.3 Design Principles for Effective Alignment in Agile Contexts

In this section, we present design principles for effective alignment in agile contexts that are suitable to fulfilling the previously derived design goals and addressing the challenges for agile organisations.

As agility is a response based on the immense power of customers today, the awareness that customer value creation and the right response to their needs (at the right time) is more than ever directly linked to corporate success or failure. This mind-set requires organisations to be able to **understand and explicate the ecosystem (DP1).** This mainly involves the explication of the customer, whether internal or external, and the partner value creation following DG1 and DG2, but also addresses a consideration of competitors' moves. We call the overall understanding of the experience by the customer in a specific ecosystem (the 'lifeworld') the *customer value stream*, which involves all steps that customers partake in value creation overall to see "*How do I know how value gets to the customer? What needs to be sort of happening to get the value?*" (INT-14). The customer value stream splits into multiple customer journeys that address specific underlying recurring customer problems and the resulting needs such as the need to travel from place A to B. Both dimensions help identifying the 'touchpoints' of the company with its services and the extent that these currently cover to see potential optimisations, e.g. regarding which partner should be integrated and whether services can or should cross different customer journeys to ease customer value stream(s). While information gathering approaches with social interaction and data analyses are unsurprisingly part of this, explication also involves visualisation for awareness within the organisation, e.g. via value stream mapping or personas for customer characterisation. To enable everyone to act in alignment with the goals, making these visualisations accessible to everyone in the organisation is key. Furthermore, the entire endeavour of understanding the ecosystem is an ongoing activity, as changes in the ecosystem may occur at any time.

The biggest change we see within the organisation is not only recognising, but incorporating the mind-set of customers as powerful, yet impatient ecosystem participants. Thus, the mind shift of continuously putting the customer in the centre of attention (DG2) starts at the strategic level with a **customer need-oriented strategic direction (DP2)**. Thus, a strategy is depicted as a vision of expected changes of customer needs and a set of aspired goals instead of concrete actionable plans. Vision orientation is perceived as essential for aligned agility (DG3), as "*a vision is always forward-looking, so that you cannot rest by focusing on your current business model and strategy. […] You can use hypotheses or goals for it, but basically you need to be constantly challenged, if your ideas are what the customer wants*" (INT-23). The strategic goals are derived by customer value creation being continuously mapped to the organisational value proposition(s) within one or multiple existing business models as well as with the underlying business capabilities of the organisation to see where the corporation should move next (DG1). Every initiative then has to show that it contributes to the goals, so that strategic planning artefacts like business cases increasingly include the link to the outcomes as mandatory information. On the unit and team level, most organisations use product visions for contrasting their future roadmap with the needed abilities and metrics (like Objectives and Key Results – OKR) to identify whether a team achieved its goal or not. Strategy now integrates and fuses IT and business planning, essentially removing the need for alignment after their formulation.

Anchoring the entire alignment effort with the ecosystem also needs a new way of thinking for linking the delivery organisation by **aligning the delivery 'structure' around the customer value flow (DP3)** for limiting potential frictions as much as possible to ensure a high speed of delivery (DG2). One challenge that organisations face regarding their structure is the mismatch between services and the IT architecture. As INT-29 elaborates: "*The business side […] thinks in products. They describe end-to-end the services offered to customers. These are transformed into functional requirements per component, the technical specification. They are handed over to the individual component teams, but those do not see the link. Why do I have to implement a* *certain feature or change a component? They do not see that it's linked to the end-to-end journey for a customer."* Thus, organisations aim for value flow-driven structures to improve the alignment of business and IT, e.g. by establishing cross-functional feature teams that are end-to-end responsible for a certain customer service and involve all required capabilities for its fast delivery and adaptation. Such teams are embedded in the overall value flow via *internal value streams* (DG4). They are the counterpart to the customer value stream and journeys and comprise all necessary capabilities for providing a part of a customer value stream and allocate the involved enterprise resources, systems, and information for realising the capabilities.

While a value flow-driven structure enables the alignment between the operational and the strategic perspective in a structural way, it does not enable speed and flexibility in the process per se. Thus, we see that organisations need to **enable autonomous, yet informed decision-making (DP 4)**. Empowering the teams and units to make decisions as local as possible is a common facilitator for agility. Defining the services they deliver as part of a customer product or service requires information exchange to support informed decision-making. By setting up cross-functional teams including all key functions needed to create customer value like marketing, UX, or IT engineers, organisations seek to foster local decision making (DG4). Yet, information from others only enables teams' success, as certain services may require specific capabilities or other services: "*[The teams are] are like boy football. Everyone is active, but nobody scores. And that is indeed a problem, as you do not progress that way. That is why we come together.*" (INT-17) In addition, everyone needs to understand the consequences of their actions. Thus, open and continuous information sharing is a prerequisite, which comprises e.g. the strategic development, product visions and shared concerns like security or architecture. Especially the architecture vision is perceived as critical due it being prone to enforce organisational inertia, as units are optimised for local optima, but not for seeing the global effects by their decisions (DG3). Architectural decisions are made based on discussions and common consent instead of based on authority: "*If you've got an architect [and] […] Chinese whispers start happening, you lose. […] The ivory tower architects come up with something that people on the ground discover that doesn't work, they don't bother saying anything. They just code around it."* (INT-12). To avoid such a disconnect, prominent practices include common areas for visualising the work, open communities of practice for coordinating specific topics or open tools including information from visions to the single tasks and features.

As the business ecosystem is in flux, we see that **a meta-reorganisation capability (DP5)** ought to be in place that allows a fast shift in direction and structure while still enabling the frictionless delivery (DG3). The structural flexibility is enabled by teams' and units' outcome orientation so that they can be readjusted along a value stream or transferred in an easier way by defining a new purpose (DG2). The ability regarding direction further includes teams' end-to-end responsibility concerning continuous improvement of customer fit with the services. This implies a 'skill to kill' to be able to shift their focus towards new contexts. Although the meta-organisation capability is decentralised, the organisations perceive that a central meta-analysis process is still required. This is often constructed as a value portfolio management process, in which business and IT executives should be equally involved: "*At that level, somebody needs to have an organisational view. The ideal person, that's the CEO and his team, because they should have that big picture of the organisation. […] I would say that it's another community of practice, but it's working at that highest level. In holacracy, it is your governing circle […]. They should be looking at the overall structure of the organisation on a regular basis*." (INT-12)

15.5 Towards a Revised Model of BITA for Agile Contexts

In this section, we move beyond agile BITA design goals and principles to reconceptualise BITA for agile contexts. Taken together, the previous findings result in four new alignment dimensions in contrast to the traditional BITA perspective (see Figure 16). First, we propose **ecosystem alignment** as new dimension to consider the need for continuous fit with the business ecosystem, mainly customers and partners, to realize DP1. Second, we propose that strategic fit rather acts as an **enterprise vision alignment** to ensure that the customer value aligns the products or services along the common vision following DP2. Third, **architectural alignment** is required as further dimension for DP3 and DP4, as the capabilities, structures and processes for delivering the services and their business and IT components need a fit with the services and vice versa. In this regard, the SAM's cross-domain alignment on enterprise level becomes the integration between the different visions of customer services and their fit to internal corporate services that they might use. Within each customer service, cross-domain alignment occurs between the sub-services and between the responsible autonomous teams and units as consequence. The traditional functional integration becomes part of the teams or units' mandate to achieve functional convergence, especially when business and IT skills are located within the teams or units. The fourth dimension involves the **continuous re-alignment** across the organization for being able to adapt to changes in the ecosystem, as depicted in DP5. In sum, our new understanding of alignment is now *a continuous and rapid, reactive and proactive (re)fitting and (re)converging of internal business and IT capabilities, structures, and processes across all organizational levels to adjust with, i.e. meet the needs and possibly also influence, the surrounding business ecosystem.*

The first dimension of ecosystem alignment is not new per se, at least for customer alignment. Other disciplines like service science have emphasised customer orientation for quite some time, as creating effective offerings involves a co-creation of value by the customer and the organisation (Vargo and Lusch, 2004; Grönroos, 2011) based on their contextual expectations and perceptions. A broad toolbox for explication of the value creation parts 1) customers' value, 2) the reflection of the customer services, and 3) the interaction in-between and their touchpoints does also already exist, e.g. in interaction design with service blueprints, interaction sketches and customer journey maps (Kalbach, 2016). Our research shows that agility involves the service and value logic on both the individual service and the strategic level for being able to adapt to changes in the ecosystem. As organisations are depicted as one big overall service system, similar to service ecosystems (Lusch et al. 2010; Meynhardt et al., 2016; Vargo and Lusch, 2016), this involves the fit of the whole enterprise vision to the customer value creation as customers' needs for the strategic functional integration. Second, ecosystem alignment involves partner alignment, since customer value creation may rely on business partners, e.g., by offering their services (semi) exclusively on a platform. The customer and partner alignment is also to be reflected within each subset, each involving a socio-technical and dynamic value co-creation configuration of resources like information and people (Maglio et al., 2009; Böhmann et al., 2014).

The second dimension of enterprise vision alignment is the equivalent to the traditional strategic fit, but with a different orientation. In contrast to traditional long-term strategic plans targeting the concrete scope and approach of solutions – as most alignment research is focusing on – a shift to a long term outcome-based vision with corresponding adjustable strategic goals shall foster agility, as the outcome logic leaves enough freedom. Yet, explicating the end-to-end customer experience and how everyone contributed to it requires mechanisms on all organisational levels to enable this outside-in view. Therefore, alignment in the sense of achieving strategic fit now means actively aligning the internal organisation with the external ecosystem view via the fit of individual visions of products or services with the enterprise vision instead of a mere orientation towards the external dimension of business strategy and business operations (Henderson & Venkatraman, 1993). Then, the concerns are separated on the service level instead by business or IT via the service vision, which in turn serves as new angle of vision-oriented alignment on team level by providing the input for the purpose and resulting sub-services of the individual team and determine the resulting decisions in their backlogs. For most organisations, a common enterprise vision and strategic goals instead of separate business and IT strategy, similar to the digital business strategy that is increasingly emphasised in research (Preston & Karahanna, 2009; Bharadwaj et al., 2013; Kahre et al., 2017), is also seen as essential as precondition.

Architectural alignment as the third alignment dimension in agile contexts rather targets the functional integration. Encapsulating each individual team, unit and the enterprise – both regarding the IT direction and the direction of the services they offer to customers (see Figure 16) – shall facilitate speed in delivery as much as possible by socio-technical modularization. However, as the autonomy of each element results in an individual perspective on the understanding of the ecosystem due to its local focus and knowledge creation, the fit within and between the autonomous levels is essential regarding their understanding of the ecosystem, the resulting gap to the customer services and the consequent organisational response. To overcome the locality, architectural alignment is required, which involves two directions. With customer value as overarching architectural element, architectural alignment implies aligning the different parts of a product's or service's entire architecture of capabilities, functionalities (sub-services) and corresponding IT architecture to ensure to deliver the 'right' customer service. This leads to functional convergence by socially merging business and IT capabilities for each sub-service and for each service, e.g. via cross-functional teams. Yet, the horizontal fit across capabilities, functionalities (sub-services) and IT architecture is also essential to ensure a shared understanding between teams. Thus, and in contrast to traditional alignment research (Reich & Benbasat, 2000), architectural alignment realizes the call for social alignment (Tallon, 2008; Tallon & Pinsonneault, 2011; Liang et al., 2017) both on the operational and the executive level by creating a social link within and between units and teams based on the customer value.

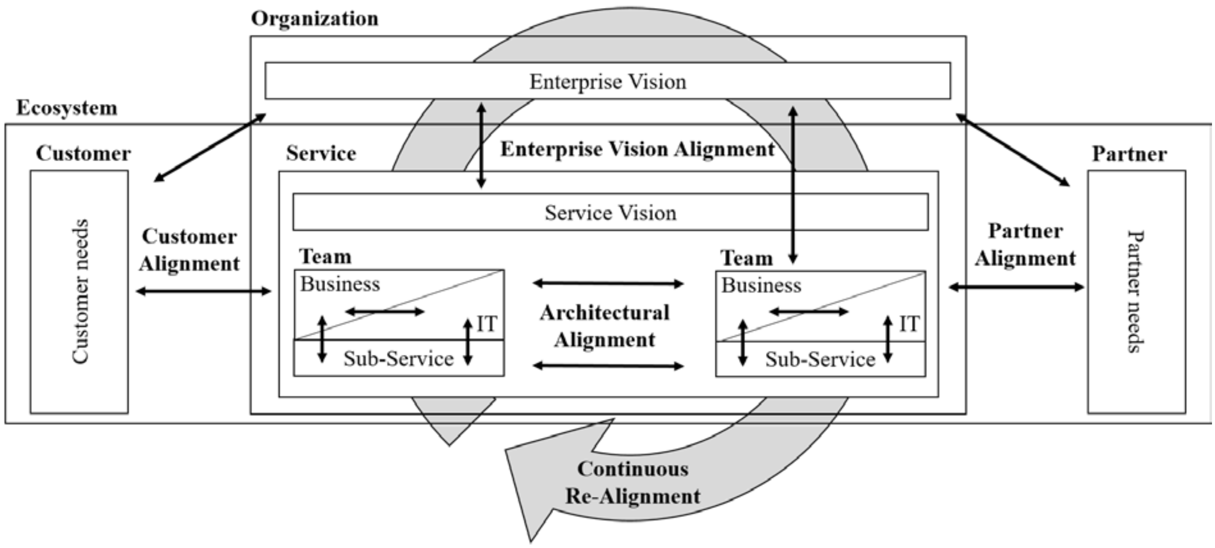

Figure 16: Business-IT Alignment Model for Agile Contexts.

Finally, the ongoing consideration of the external view requires a continuous organizational re-alignment ability in order to adapt to new contexts. As the individual teams continuously gather customer insights, continuity in alignment occurs by continuous cross-organisation fit with short feedback cycles to get a shared understanding and revaluate the fit of value within and across customer services. In turn, this results in 1) the 'right' services, as the units use the external needs as driving force instead of internal interests and 2) the flexibilisation of underlying business processes and IT architecture by enabling an adaptive strategic fit by translating value into processes and architectures (Henderson & Venkatraman, 1993). Thus, continuous re-alignment involves the optimization of the offered services, the service structure in terms of its functionalities as well as the continuous re-evaluation of the involved capabilities. In this regard, organizations continuously strive to achieve optimal internal capabilities through a continuous resource (re)allocation and tailoring (e.g. people, skills and IT architecture) in order to provide the best possible service – but without ever reaching a stable optimum.

15.6 Discussion and Conclusion

Based on an exploratory study with a multitude of business and IT professionals and experienced consultants in the agile field, we contribute four BITA-related challenges (answering RQ1), four design goals and five design principles to address these challenges (answering RQ2), and a reconceptualisation of BITA itself for agile contexts (answering RQ3): First, alignment in agile contexts is not only about the internal fit of the different parts of the organisations but also encompasses a much closer connection to the surrounding business ecosystem. Second, we show that alignment in agile contexts is primarily concerned with the architectural fit of all of a product's or service's components, in order to allow the organisation to be highly responsive to changing ecosystem needs. Architectural alignment supersedes the alignment of business and IT functions, as the latter may not even exist at all in some organisational setups due to structural convergence and common strategies. Moreover, our BITA reconceptualisation places a stronger emphasis on continuous external as well as internal changes and places therefore a greater emphasis on continuous (re)alignment on all levels.

Of course, our research is not without limitations. Although we base our research on a multitude of roles involved in organisations striving for agility or conducting consulting work for such companies, we did by far not cover all business and IT perspectives. Especially support functions, which are merely indirectly affected by the changing ecosystem needs and the resulting organisational adjustments, are missing in our view. As these functions are also rarely the focus of research on BITA next to their yet missing analysis in relation to agility, we encourage further studies in order to gain a more comprehensive view, especially concerning how these support functions contribute value to the other organisational parts in the best way to achieve agility and how they should be aligned in the overall context in order to not create new frictions. We also do not cover the strategic perspective from the business side. Although some of the interviewed CIOs are part of the corporate executive board, more insights regarding a strategic fit is required. This needs in-depth analysis of the strategic development and execution process of corporations that are transforming to highly responsive enterprises. The insights would also contribute missing knowledge in regard to agility on the strategic level, which is often depicted as a black box by research and the scaling agile frameworks.

A second limitation is the conceptual nature of our findings. Although we aim to cover a broad spectrum of different industries, organisational sizes and the resulting organisational responses with our design goals and principles, our results require verification by additional studies. Therefore, we encourage further research on the underlying differences between the organisational responses like large scale agile companies. This would especially support a better understanding on the first design goals of identifying the right response for the individual alignment gap and help creating more in-depth recommendation on which approach should be fostered for the individual situation. While we see some patterns in this regard, a more profound analysis of contingency factors would gain more detailed insights. Finally, we encourage to extend our insights on alignment and agility with detailed analyses on specific alignment dimensions, as these are missing by large extent in the academic debate. While this applies for the 'right' structural and strategic alignment at the moment, we perceive that inquiries are particularly required concerning achieving a cultural alignment within the organisation. Many organisations are currently in the transition stage and explore different mechanisms for achieving agility in their structure, processes and strategies. However, as "culture eats strategy for breakfast", the cultural alignment will be crucial for sustaining alignment in the long run.

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17 Appendix A: Steering IT For Speed and Dexterity – Towards Re-Shaping IT Governance for Organisational Agility

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Abstract

Organizational agility for embracing today's volatile business environments by sensing the right strategic moves and responding with speed increasingly depends on the optimal utilization of IT, particularly concerning digital technologies. As ensuring their delivery and optimization still requires careful planning and directing, this has considerable implications for the IT governance concept. Based on the insights of 40 practitioners from various agile organizational backgrounds and roles, and drawing on Weill and Ross' (2004) IT governance approach, we show how agility re-shapes IT governance. IT governance for agility moves towards enterprise-wide guidelines for converging digital capabilities that continuously address ecosystem concerns. Simultaneously, decision-making is decentralized within capabilities along socio-technical guardrails. Finally, governance for agility incorporates the continuous (re)configuring of capabilities as an organizational meta-capability. The paper thus provokes a critical examination of a well-established IT governance approach and the corresponding IT and business decision-making.

Keywords

Organizational Agility, IT Governance, Principles

17.1 Introduction

With the rise of the digital age, where digital technologies often move to the core of the business (Bharadwaj et al. 2013; Urbach et al. 2019), companies perceive the need to proceed with their own digital transformation (Ross et al. 2019). As companies also see that ‘going digital’ often leads to entering volatile business environments with an ever-changing plethora of possibilities for customers to choose from (Urbach et al. 2019), they consequently strive to increase organizational agility (Denning 2016). These companies’ goal is to facilitate embracing the volatility by being able to proactively sense changes in the environment and respond with speed and dexterity (Overby et al. 2006; Tallon and Pinsonneault 2011). Thus, agility involves anticipating and realizing improved or new strategic moves with business models, products or services (Overby et al. 2006; Sherehyi et al. 2007) and the organization that enables such a flexibility (Denning 2016; Liang et al. 2017). As opportunities often involve digital technologies, companies increasingly depend on the successful utilization and governance of IT (van Oosterhout et al. 2006). This raises the question of how to shape planning and directing IT in agile contexts in order to encourage a desirable behaviour in the use of IT, to achieve corporate goals, and to ensure accountability at all levels (Weill and Ross 2004).

While there is substantial research on what agility embodies (e.g., Sambamurthy et al. 2003; Sherehyi et al. 2007), and IT’s role in it (e.g., Liang et al. 2017), there are limited insights on how agility shapes IT governance. Most research currently focuses on guiding how to adopt single agile IT governance practices such as budgeting (e.g., Bogsnes 2009), portfolio management (e.g., Hoffmann et al. 2017) or enterprise architecture management (e.g., Uludağ et al. 2019). Others analyse cross-practice guidance for an agile mind-set, structures, and processes on the organizational level, but limit themselves to combining specific agile methods (Scaled Agile 2020) or solely proclaiming the combination of agility and IT governance capabilities as crucial (Qumer 2007; Luna et al. 2010, 2014, 2019). Insights on the self-management of agile teams as one fundamental agile value (Beck et al. 2001) are also increasing, but they are not linked to agility as the aspired outcome and the overarching governance system (Moe et al. 2019). Finally, governance in bimodal IT organizations – which is one alternative operationalization of scaling agile values within the IT function by creating a separate agile IT unit (Horlach et al. 2017) – is gaining popularity (Jöhnk et al. 2019; Kiselev and Winter 2020), but also does not explicitly reflect the influence of agility. As a result, insights on how agility shapes key aspects of IT governance such as decision areas and responsibility structures are scarce. Thus, the following question guides our analysis:

RQ: How does organizational agility re-shape IT governance?

To provide an answer, we draw on data from a cross-industry study with 40 participants from various IT organizational levels and multiple experienced consultants. For structuring our findings, we draw on Weill and Ross' (2004) IT governance approach. It belongs to one of the most cited approaches on the areas on what to govern of IT and they do not presume a concrete decision structure and responsibilities as, for instance, COBIT (ISACA 2018) does. However, in order to not miss out on crucial findings through a narrow theoretical view that is limited by the existing approach, we conduct an abductive qualitative analysis with theory-inductive coding informed by IT governance and agility research and open coding inspired by the grounded theory approach (Strauss and Corbin, 1991).

17.2 Conceptual Foundations

IT governance is one cornerstone of IS research due to its criticality for the success of IT organizations by ensuring the desirable behaviour of IT for enabling the business objectives (De Haes and van Grembergen 2004). As effective governance does not happen by accident, the board of directors, the executives and the IT management are responsible for setting up an IT governance framework that directs the IT delivery and operations by defining standards and principles (Weill and Ross 2004). Thus, IT governance includes setting and evaluating the accountability framework, which defines the decision-making responsibilities (Weill and Ross 2004), predominantly along the lines of (de)centralization of authority and clarifying the duties of business and IT functions. In general, the decision-making authority may be centralized, decentralized, and/or federal (Sambamurthy and Zmud 1999; Brown and Grant 2005). While a centralized IT governance bundles all decision-making authority and targets profitability, efficiency in operations, and control, a decentralized IT governance calls for more customer orientation, responsiveness and innovativeness by distributing decision rights to individual units (Sambamurthy and Zmud 1999). In turn, federal or hybrid IT governance aims to balance centralization and decentralization to combine the benefits of both (Weill and Ross, 2004). In addition, the accountability framework includes the IT governance scope. Following Weill and Ross (2004), the scope includes five main decision areas: While IT principles define the strategic role of IT with its funding and connection to business principles, business application needs set the individual functional requirements for purchased or internally developed IT applications. The area of prioritization and investment decisions then concretizes the standards and determine how much and where to invest in IT. In turn, the areas of infrastructure strategies and IT architecture define the technological basis for the standardization of realized IT services and other technological choices.

Agility – i.e. the ability for embracing volatility in markets by sensing changes and opportunities and responding to them with ease, speed and dexterity (e.g., Sherehyi et al. 2007) – affects how to steer the IT use and capabilities within an organization (Denning 2017; Tiwana and Kim 2015; Urbach et al. 2019). As IT is seen as a major ingredient in today's strategic moves with digital products, services and/or business models (Melarkode et al. 2004), agility requires organizations to be able to cater to changes in the market in a rapid way by swiftly shifting and redirecting strategies, capabilities, knowledge, and processes (Denning 2016; Liang et al. 2017) for flexibly selecting, acquiring, configuring, and implementing IT (Chakravarthy et al. 2013). Yet, those shifts need to be pursued in a controlled way (Tiwana and Kim 2015) in order to prevent new impediments for agility like a new complex IT architecture with scattered and disparate IT infrastructure (van Oosterhout et al. 2006) or unresolved issues when handling the omnipresent duality of traditional enterprise 'heavyweight' IT targeting at efficiency, reliability and stability and lightweight agile IT for speed (Bygstad 2017; Haffke et al. 2017). As consequence, organizations need an accountability framework with controls, processes and structures (Qumer 2007; Vejseli et al. 2018) that shall emphasize speed and flexibility in IT use and steering (Vejseli et al. 2019, 2020, Jöhnk et al. 2019). Research on governance in bimodal IT organizations or scaling agile frameworks may help in this regard by providing insights on potential operationalisations with sets on structural, process and relational mechanisms from case companies (Jöhnk et al. 2019, Kiselev and Winter 2020) or providing a blueprint for one-size-fits-all solutions (Scaled Agile 2020; Disciplined Agile 2020), but do not link the findings to organizational agility as aspired outcome of such organizations. Further proposed coordinated combinations of agile and IT governance capabilities (Luna et al. 2014, 2019) are also only partially applicable, as they do not reflect how to realize this IT governance framework for enabling IT embracing the continuity in changes (van Oosterhout et al. 2006; Overby et al. 2006; Tallon and Pinsonneault 2011).

Instead, research increasingly discusses implications of agility for individual IT governance decision areas, with an emphasis on the functional ones such as portfolio management and budgeting. The approaches range from single tasks such as continuous planning (Suomalainen et al. 2015) to general design principles (Hope and Fraser 2003; Hoffmann et al. 2017; Horlach et al. 2019) that emphasize pace and adaptation in functional planning. As 'digital' intertwines business and IT logic, how to handle business IT alignment becomes an even bigger key element for enabling agility (Tiwana and Kim 2015; Horlach et al. 2018). Increasingly, the same requirements are also enforced in the technological IT governance decision areas via enterprise architecture management (Tiwana and Konsynski 2010; Drews et al. 2017; Uludağ et al. 2019; Horlach et al. 2020) and IT principles with strategic planning (Bharadwaj et al. 2013; Matt et al. 2015), which are traditionally more stable. Yet, while the respective insights highlight the individual IT governance decision areas in depth, the underlying requirements across the areas are scarce. Only Horlach et al. (2020) and Ross et al. (2019) provide initial insights on a systemic view on an agile IT governance framework by either calling for integrating IT governance processes or by showing a set of building blocks of digital transformation that include, e.g., an operational backbone and an accountability framework that need to be governed in an interconnected way for agility. Neither paper, however, does address how agility as an aspired outcome affects IT governance specifically with respect to its decision areas and responsibility structures. Thus, companies still struggle to find insights or guidance on how to govern the modes for agility within a bimodal IT setup (Haffke et al. 2017), or how to sustain a transformation towards agility with a (large) scaled agile setting (Jöhnk et al. 2017; Gerster et al. 2020).

17.3 Research Methodology

For gaining an understanding on how agility re-shapes IT governance, we proceed in two steps. First, we empirically derive four principles with implications for Weill and Ross' (2004) IT governance approach and its components (e.g., the five decision areas). Second, we take a step beyond our four principles to gain an understanding on how agility re-shapes IT governance decision-making as a whole. Both insights serve as pre-theoretical knowledge as a result of theorizing (Weick 1989, 1995) and sense-making (Drechsler and Hevner 2018) of the findings to inspire and guide individual decisions and actions. Thus, we aim to enrich the understanding of IT governance for organizational agility rather than offering an IT governance tool that strictly prescribes a course of action (Nicolai and Seidl 2010). We gain our understanding from the insights of a cross-industry qualitative study with 40 participants from various organizational levels and backgrounds in two countries on two continents. Table 35 provides an overview of all participants.

The first data collection phase primarily targeted the perspective of the managerial and strategic level of the IT organization and consisted of a cross-industry study with IT executives (CIO or CDO) in a single country from seven private and public firms. The participants had three criteria to fulfil: 1) their organization is undergoing a transformation towards organizational agility, 2) the participants hold a position with in-depth insights on the (agile) organizational system, and 3) they are willing to partake in open information sharing among the researchers and organizations. For understanding each agile organizational setup and how they strategize and manage in detail, we first conducted individual semi-structured interviews with the participants. Each interview session took ca. 60 minutes and was audio-recorded and transcribed. We also conducted three single day focus group workshops (Krueger and Casey 2014) with the same participants in spring and summer of 2018 and in winter of 2019 for raising broader insights on the setups and sensing shared patterns by comparisons. The participants discussed in various sessions the nature of their setup and (strategic) processes, the reasons for their approach, and the consequences for the IT organization.

Table 35: Participants in the Empirical Study.

	#	Position	Industry	Number of employees
Focus Group	FG-1	CIO	Banking	50.000-100.000
	FG-2	CIO	Utilities	5.000-25.000
	FG-3	CIO	Insurance	0-5.000
	FG-4	CIO	Insurance	0-5.000
	FG-5	CIO	Retail	50.000-100.000
	FG-6	CDO	Government	5.000-25.000
	FG-7	CDO	Utilities	0-5.000
Interviews Country A	I-1	Project Management Officer	Energy	5.000-25.000
	I-2	Project Management Officer	Government	0-5.000
	I-3	Chief Product Owner	Telco	5.000-25.000
	I-4	Program Manager	Telco	5.000-25.000
	I-5	Program Manager	Telco	5.000-25.000
	I-6	Enterprise Architect	Banking	0-5.000
	I-7	Enterprise Architect	Banking	0-5.000
	I-8	Enterprise Architect	Telco	5.000-25.000
	I-9	CEO Tool Vendor 1	Transport, Health, Energy	Diverse
	I-10	CEO Tool Vendor 2	Banking, Government	Diverse
	I-11	CEO Tool Vendor 3	Insurance, Energy, Telco	Diverse
	I-12	Consultant	Telco, Government, Banking	Diverse
	I-13	Consultant	NGO, IT, Banking	Diverse
	I-14	Consultant	Energy, Banking	Diverse

	I-15	Consultant	Government, Banking, IT	Diverse
	I-16	Consultant	Insurance, Government, Utilities	Diverse
	I-17	Consultant	Utilities, IT, Retail	Diverse
Interviews Country B	I-18	Product Owner	Retail	50.000-100.000
	I-19	Product Owner	Retail	0-5.000
	I-20	Team Architect	Retail	50.000-100.000
	I-21	Project Management Officer	Utilities	0-5.000
	I-22	Chief Product Owner	Retail	50.000-100.000
	I-23	Program Manager	Utilities	5.000-25.000
	I-24	Program Manager	Utilities	5.000-25.000
	I-25	Enterprise Architect	Retail	50.000-100.000
	I-26	Enterprise Architect	Retail	25.000-50.000
	I-27	Consultant	Automotive, Insurance, Banking	Diverse
	I-28	Consultant	IT, Retail	Diverse
	I-29	Consultant	Retail, Automotive	Diverse
	I-30	Consultant	IT, Retail	Diverse
	I-31	Consultant	Retail, Banking	Diverse
	I-32	Consultant	Automotive, Banking	Diverse
	I-33	Consultant	Banking, Government	Diverse

The second data collection phase targeted the operational and managerial level at the ‘lower’ levels, which mainly involved roles within agile teams or roles for inter-team coordination. For the detailed exploration of operational insights on organizational agility and the implications for the IT organization, we conducted semi-structured interviews with 33 participants across two countries. Similar to the interviews in the first phase, we asked the participants to describe their or their key clients’ agile setup and the implications for the IT organization. The interview sessions lasted 45-75 minutes and were audio-recorded and transcribed. For our analysis, we integrated all transcripts into the qualitative analysis tool MAXQDA. Inspired by the grounded theory coding process of open-axial-selective coding (Strauss and Corbin 1991), we conducted an abductive qualitative analysis (see Table 36).

Table 36: Exemplary Analysis Process of Empirical Data.

Quote	Code	Code Area	Aggregated Code Area	Consolidated Core Area
“*You need to see the touchpoint of internal capabilities to external processes, as processes do not end at organizational borders. [..] In these times, the process belongs to the customer.*”	IT Principle: Clarify nature of concrete customer participation in value creation and touchpoints	Knowledge of customer for shaping the right touch-points	Customer concern leads continuously governing the right touchpoints and solutions	Continuous concentration on ecosystem
“*I always say that I don’t know yet if my maxim [to the customer concern] is true in 3 or 4 years. I build current solutions with my current knowledge based on current problems. [..]I have to find my maxim to go along with uncertainty.*”	IT Principle: Cope with uncertainty in solutions by finding and (re)evaluating underlying customer concern	Customer concerns as stable refe-rence point for finding solutions		

As a-priori codes for structuring the IT governance systems in the case organizations, we used Weill and Ross' (2004) IT governance decision areas. For concepts not covered by them, we assigned open codes like e.g. 'guilds for enterprise-wide exchange of innovation ideas' by using descriptive labels with words from the material where possible. Via constant comparison among the codes (e.g., 'IT architecture: cross-team meeting group' and 'IT architecture: consulting architects'), we derived the outline of each decision area and its operationalization based on the codes' common character (e.g. required collaboration across teams for faster delivery). We repeated the constant comparison across the code areas until the underlying shape of the IT governance system across the individual decision area as aggregated code area emerged. The final step then involved the same process for identifying the fundamental principles that guide the design of the IT governance system when striving for organizational agility.

17.4 Principles for Re-Shaping IT Governance for Agility

In the following, we discuss the four principles we identified that give guidance for organizations in their agile journey on how to re-shape their IT governance approach (see Table 37). In addition, we illustrate their design within the IT governance system and the concrete operationalization by the case organizations with individual practices. We also show how the insights are related to existing agility literature. Moreover, we outline those of the five main traditional IT governance decision areas for each principle that it affects the most.

Our data also reveals that firms follow different paths for agility's operationalization. Based on three archetypes on how firms seek agility that we uncovered in previous research (blinded for review), our findings may be applicable for 1) part(s) of the IT organization, 2) a separate digital unit following the bimodal IT approach, and/or 3) for the whole enterprise. Yet, all three have the same goal of moving towards agility in common for enabling their digital transformation, and the same applies to the challenges that are to overcome. Thus, our findings are intended as underlying logical patterns to guide digital and agile transformations by providing a more tailored management approach for creating digital-intensive services, independent from an individual structural setup. Thus, our propositions do not represent structural recommendations or a framework in any form although we will present exemplary mechanisms for showing how firms realized the identified logical patterns.

Table 37: Principles for Re-Shaping IT Governance for Organizational Agility.

Principles for Re-shaping IT Governance	Design of IT Governance System	Applied Practices	Relation to Research on Organizational Agility
Governance around the ecosystem - End-to-end ecosystem value contribution - Balance of internal aspired position and external changes - Ecosystem architecting	- Ecosystem concerns, particularly customer value contribution, as overall strategic angle - Focus on solving aspired part of value creation by team - Different origins of budgets, but assigned to ecosystem concern and teams' purpose - Architecture around ecosystem concerns	- Customer-oriented vision (I-3, I-31) - Roadmapping along business priorities (FG-1, I-33) - Purpose setting (FG-5, I-1) - Architecture as competency (I-15, I-23)	- Enable flexibility in strategic moves (Overby et al. 2006) - Adaptivity of portfolio process (Hoffmann et al. 2017) - Reevaluate business needs in short cycles (Hoffmann et al. 2017, Horlach et al. 2019)
Digital business governance - Embedding of digital capabilities within business strategies for new strategic moves - Social and increasingly structural business IT fusion in value contribution	- Ecosystem concerns shared strategic angle - Business and IT needs fused within strategic goals - Platforms new central digital operational backbone for digital service realization - Operationalization of IT principles for single strategic move within team	- Strategic goals (I-22, I-27) - Combined IT and business architectural view (I-7, I-25) - Team funding (FG-2, I-1) - Cross functionality (FG-6, I-9) - BizDevOps Team (FG-1, I-12) - Shared functions (I-8, I-30)	- Reflection of IT as business enabler (Melarkode 2004) - Embedding of digital concerns (Bharadwaj et al. 2013) - Flexible and adaptable budget allocation (Horlach et al. 2019) - IT infrastructure enabling swift shifts (van Oosterhout et al. 2006)
Reciprocity in governance - Top-down guidelines and autonomous concrete design - Consideration of teams' discoveries in overall planning	- Demand management encapsulated in team - Teams commit to architectural vision as guardrails - Architects and groups across organization for coordinated, 'standardized' understanding - Decentral IT infrastructure choices as much as possible	- Product vision (I-18, I-22) - Cloud strategy (FG-4, I-20) - Community of Practice (I-17, I-29) - Architecture as a service (I-11, I-25)	- Ensure team autonomy (Moe et al. 2019) - Flexibility in IT architecture with loose coupling (Chakravarthy et al. 2013) - Handling of duality of heavy- and lightweight IT (Bygstad 2017)
Continuous Governance (Governing) - Fluid business and IT resource allocation and prioritization - Continuous Learning with governing duality of thematic flexibility along guidelines and continuous capability reconfiguration	- Governance means directing organizational changes - Continuous discovery of ecosystem needs by teams and flow back into overall strategic direction - Constant thematic changes leads to changing required capabilities - Resource allocation independent from budget	- Continuous responsibility by team (FG-3, I-19) - Consistent flow of value (I-14, I-16) - Internal value stream (I-2, I-13) - Capability mapping (I-7, I-28)	- Flexible and adaptable resource allocation (Horlach et al. 2019) - Reconfiguration of internal processes, structures and capabilities (e.g., Denning 2017) - Secure organization as network of accountable teams, not centralized functions (Bogsnes 2009)

17.4.1 Governance around the Ecosystem

The first fundamental principle for enabling agility with IT governance is continuous governance around the ecosystem in order to be able to rapidly react to and anticipate required changes, understand on how to respond to them, and facilitate solutions quickly. As agility calls for focusing on providing value for the ecosystem at any time – especially for customers as they are the key value providers for enterprises – the corresponding outside-in mind-set becomes the focal point to help the company choose the 'right' strategic moves at all times. Hence, instead of merely using the customer as source of ideas and as a tester (Sambamurthy et al. 2003) in the small, ecosystem centricity in governance decision-making recognizes today's shift of power towards the customers (Bogsnes 2009; Denning 2016) in the large. The ecosystem focus results in centering the IT governance system – from the strategic level down to the individual – on providing this value, enclosed by the aspired corporate position in the ecosystem value creation based on identified relevant ecosystem concerns. In other words, agility changes the answer to the question 'Who is the customer?' in (parts of) the organization – for both business and IT. In addition, this unifies their understanding with a common aspired outcome instead of aligning internal separate business and IT goals. This is captured in the customer-oriented vision, as I-14 states: "[We need] one big purpose, which includes the culture and gets rid of a mission statement. We don't need those, but have a very clear vision statement, which can be accompanied by a purpose statement." The vision is developed by top management from business and IT in a shared governance process. Thus, governing how IT is used within the business according to IT principles is now merged with business goal setting within the vision. For being more actionable, the top management breaks down the vision by setting strategic goals with deadlines and dependencies within roadmaps. The goals flexibilize the strategic moves by not predefining solutions, so that individual teams or intermediate domains can shape and govern these solutions with greater autonomy. Thus, the traditional IT governance decision-making authority is decentralized as much as possible by being encapsulated within the teams. In turn, top-down decisions involve selecting the relevant ecosystem concerns and deciding on the intended longer term contributions through vision and strategic goals. Yet, governing also involves the ongoing (re)evaluation and possible adjustments of the relevance of external concerns, the internal direction and their fit due to the existing ecosystem changing or plans to enter another one for reaching new customers. This is mainly top management's responsibility, but informed by teams as customers' 'ear' via the principle of reciprocity in governance.

Ecosystem governance also involves 'architecting' the organization around the (business and IT) ecosystem for embedding this mind-set. Similar to the vision, the companies use the understanding of the ecosystem with the respective customer value(s), the ecosystem concerns and how everything corresponds with internal value propositions for 'structuring' their organization for a common reference point and resulting commitment despite changing strategic moves. This is mainly realized by organizing teams – either logically or structurally – by their purpose around the relevant concerns. For a team, the purpose serves as the single value proposition for the targeted ecosystem concern and is the only “clear perspective on what it is that they as an individual and they as a team, empowered and almost self-leading” (I-14) are striving for. Thus, the purpose serves to anchor the IT principles (one of the five traditional IT governance decision areas), but within each single team. This also governs the resulting choices on the service(s), the business functionalities and the corresponding IT architecture. Thus, the purpose is more stable than the strategic goals, as the latter are used for shaping the concrete strategic moves as response to the aspired vision. As a result, teams plan their work by reflecting whether and how their own aspired outcome realizes the strategic goals and vice versa. As teams have an external focus instead of working towards more internal strategic goals, this enables uncovering new potentially valuable and/or essential concerns not yet covered by the strategic direction.

Overall, the teams’ purposes then embody the path along the different ecosystem concerns for understanding the strategic moves and the respective business and IT implications. Thus, the teams are responsible for understanding and governing the ‘ecosystem architecture’ of their own path, including the traditional IT governance decision areas business application needs, the IT architecture and the IT infrastructure strategies. For enabling an overall overview and understanding of this potentially complex architecture, traditionally IT-focused enterprise architecture management is now seen as an embedded key component “for getting rid of [..] those horizontal segmentations and allow the whole focus” (I-14) – both as a competency within the overall governance, currently still with dedicated architects, and the individual governance within each team, often supported by guiding architects or with team members already fulfilling the competency. Thus, architecting around the business ecosystem and the subsequent gap-spotting via internal maps helps shaping the understanding and seeing required actions (Horlach et al. 2020). In other words, a good architecture and architecting processes are key prerequisites for governing around the ecosystem, as they guide the deconstruction of the complexity within the firm and the ecosystem.

17.4.2 Digital Business Governance

While the ecosystem view links the company to its surrounding ecosystem for faster sense and response processes, the ecosystem view does not prevent internal frictions (e.g., prolonged hand-over processes) which inhibit an overall fast response. One of the main frictions, especially concerning digital transformation, is aligning business and IT in order to create the (individual and overall) seamless customer or partner experience. As digital capabilities are becoming key for this goal with strategic moves, IT governance in agile contexts is increasingly oriented towards a digital business governance with converging business and IT decision-making. This applies to the strategic level with fusing the strategic planning under the common goal of customer value and resulting concerns with a shared ‘north star’ IT and business vision and strategic goals – for instance via a digital business strategy (Bharadwaj et al. 2013; Matt et al. 2015) – and the resulting common overall investment and prioritization decisions. In addition, although budgets often are still in place for different parts of the organization such as IT and marketing, they are unified via assigning them to a single team. As a result, budgeting is stabilized by delinking the budgets from strategic goals in order to create a further common commitment for solving a specific ecosystem concern. Without this, it would further cause a “paradox, [as] [the teams] didn't have benefits to show until they were able to deliver the next stage of an MVP, but they weren't funded unless they can show benefits. So they were always trying to chase their funding and not sure whether they're going to get through.” (I-7) Digital business governance also applies ‘in the small’ with linking business and IT capabilities around the single purpose, so that deriving business application needs, IT investment and IT infrastructure decisions (three of the five traditional IT governance decision areas) are encapsulated within these teams. For an informed decision-making, the teams’ capabilities should cover both business and IT and include, for instance, marketing, UX, or IT engineers – or, more general, everyone who “should be responsible [for the] delivery of particular pieces of technology, but […] also be focused on delivering changes to the business processes and supporting these things as well” (I-11). Some organization also link those capabilities in a structural way by setting up cross-functional or BizDevOps teams. All those mechanisms aim at a continuous exchange of perspectives across functional lines while enabling (solution) flexibility that, in turn, shall solve the call for an integrated understanding and commitment (Tiwana and Kim 2015). Those are further mediated by coordinating the encapsulated business and IT needs among the teams in case of dependencies. This is particularly crucial in relation to shared functions like security, networking, or legal, that are usually still separated in specialized teams due to yet nascent competencies within the teams or economies of scale.

The consequent integrated business-IT governance, in line with the call of Horlach et al. (2019) for integrating portfolio management with other strategic management processes for enabling agility, leads to a converged 'system' of visioning across the functional and (IT) architectural perspectives and the corresponding planning, prioritization and (re)evaluation throughout the organization. While increasing the agility level in specific IT governance decision areas are still required (e.g., Hoffmann et al. 2017; Uludağ et al. 2019), we also see integrating the views of functional and architectural planning to see all the business IT dependencies, which supports recognizing internal gaps between business and IT capabilities. In this regard, architecting again stands out as an integral competency throughout the organization to lead to an enterprise-wide, integrated, and holistic consideration of business and IT aspects. At the moment, IT and enterprise architecture functions still tend to be rooted very much in IT matters. Therefore, the focus here is to be widened beyond the IT architecture (as one of the traditional IT governance decision areas) in order to achieve an effective agile enterprise or ecosystem-wide architecture management function (Drews et al. 2017; Horlach et al. 2020).

17.4.3 Reciprocity in Governance

Next to minimizing the friction between business and IT, agility also emphasizes that speed in delivery includes the time of delivering each single service to the end customer in order to provide value in the small. As this may take time in complex systems, parts of all IT governance decision areas are encapsulated within a single ecosystem concern and funding the corresponding capabilities. As the IT governance decision areas in the small can only be efficient when the individuals are empowered for taking responsibility by the IT governance in the large, the third principle for enabling agility is reciprocity in governance. Reciprocity means continuously governing the balance between autonomy for fast moves and alignment for the 'right' moves (Ross et al. 2019). As described beforehand, reciprocity is primarily established by freedom within guardrails, which include aligning the teams to their aspired outcome, strategic goals and establishing a baseline for their work with architectural guidelines such as a cloud-first strategy. However, the local, yet simultaneously global mind-set also affects those guidelines, as teams are increasingly (partly) responsible for "the [architectural] vision that has been developed together, which resulted in a commitment from everyone and that has ideally been developed by oneself" (I-19). For having a 'democratic' process within the organization, such decision-making is often handled with supporting architects for spanning the overview and group-based decisions along communities of practice, which include everyone from a dedicated function, or interest groups. Architectural roles are also used for facilitating the link between top and operations.

Reciprocity also includes the openness to new strategic moves. As the increasing volatility results in internal uncertainty on both the executive and operational level, the teams as the customers' 'ear" may be more informed than the executives, at least for their individual part of the ecosystem. Reciprocity in decision-making thus helps minimizing individual risks (e.g., Bogsnes 2009; Hoffmann et al. 2017) with enabling continuous service innovation (Beck et al. 2001) based on the in-depth knowledge. This then helps clarifying and shaping (parts of) the overall future journey of the company with optimizing their value proposition – not only limited to the concern they are working on. Hence, instead of being a traditional top-down approach (ISACA 2018), innovation is everyone's responsibility due to the distributed knowledge. Similar to Horlach et al. (2019), we find that those innovations, together with existing customers' insights on required changes, flow back into the strategic level for analysing possible adjustments to the vision based on identified changing concerns: "There are two possibilities to deal with new things. On the one hand, I could say: okay, let's do it, but include that in your own planning […]. The other option is that I adjust my north star architecture and say: You're right and that is a cool idea. Let's open that to everyone. That is the loop to do." (I-27) Thus, we see that IT governance within the individual team as well as across teams shift towards the continuous elicitation and discovery of the right services for the ecosystem concerns at any time, instead of being limited to the IT investment prioritisation (as one of the five traditional IT governance decision areas). In turn, such a shift may also contribute to tackling the overall ecosystem concern landscape by continuously seeking new potentials for strategic moves based on changed customer preferences.

17.4.4 Continuous Governance (Governing)

Finally, the three previous principles that link parts of the governance system by aligning ecosystem and organization, business and IT, and local and overall interests are 'governed' themselves by a fourth one: governing as the continuous organizational ability to learn and adapt to new contexts as a result. This leads to IT governance for agility becoming a rapid and systemic enabling of capability (re)configurations. While this partly already applies to traditional IT governance through resource allocation to projects, directional changes are now inextricably linked to a continuous transformation of the organization itself, as the responsibilities for the IT governance decision areas are decentralized as much as possible along the encapsulated IT and business capabilities. Thus, stabilizing through the business processes and IT architecture is still present, but only along the different ecosystem concerns. Moreover, agility actively seeks a continuous transformation instead of seeing changes being the exception rather than the norm. Thus, the continuous state of (re)organizing the teams and/or the teams (re)organizing themselves to address changing ecosystem concerns results in moving purposes and possible restructurings due to capability issues. This challenges (IT) governance's responsibility to find a solution for enabling flexibility while avoiding constant restructuring, as this would lead to lower productivity of teams due to familiarizing in ever-changing contexts.

Governing can almost be understood as meta-capability, as it combines the continuous systemic (re)organizing of the affected organizational capabilities and interminable (re)allocating resources, reflected with value(s), ecosystem concerns and purpose, while simultaneously enabling a thematic reallocation, both regarding the functional content and the technological choice, with the customer-oriented vision, strategic goals and resulting work as determined by the teams. Governing therefore affects all of the five established IT governance decision areas but on a higher level. Governing answers the question of "How can I continuously ensure responding to the specific customer [and other ecosystem] concerns?" (I-2) and finds a way to bundle the capabilities in the best possible way for realizing the value proposition. This extends the traditional agile adjustment by changing the single work packages via backlogs (Scaled Agile 2020). Enabling such a duopoly of organizational and thematic flexibility involves the continuous surveillance and adaptation of the whole governance system, including the strategic level, instead of having a stable strategy with flexible portfolio planning and beyond (Hoffmann et al. 2017).

As a result, this calls for a meta-analysis across the first three principles in short interconnected multi-level feedback cycles (Suomalainen et al. 2015) by continuously surveilling the actions, analysing the gap among the individual, aggregated, and collective value proposition and customer value creation in order to be able to make large-scale decisions on how to (re)organize resources and content. In addition, the organization continuously (re)evaluates along this cycle, which concerns need standardization via a common way of working, and where a divergence in delivery and structure should be favoured (e.g., if the accountability for backbone information systems or platforms such as ERP should be centralized or not). Organizations increasingly use business capabilities or value streams for this purpose, as those represent the overall view on the gap between the customer value(s) and the resulting ecosystem concerns and teams' purpose on one hand and the internal vision, strategic moves and required capabilities on the other, following the question on "How can we strengthen our strengths and eliminate our weaknesses [for the ecosystem]?" (FG-5). This leads to organizations bundling all capabilities around the customer-oriented vision and enables them to cut across traditional business and IT lines, IT architectural borders and organizational levels, as they allocate the involved enterprise resources, capabilities, and the flow of information and materials for realizing the customer value. Both business and IT are therefore both directly and peripherally involved in the value creation.

As the insights on the internal requirements for the individual customers' perspective resides within the teams, the meta-analysis is a multi-level process throughout the organization. Hence, the value stream or business capability view enables "a layer outside of the line organization und cross-functional in its structure for solving topics in a faster way. […] [The capability owner and representatives are] allowed to induce requirements and assign teams. Currently, that is done via the line organization […], but they will be more active and independent." (I-22). This is helpful for creating this overall view on the business and IT capability landscape without being 'hindered' by functions and hierarchies. Furthermore, as business capabilities or value streams act as the intermediate between the external value creation and the internal strategic value contribution, they serve as reference point for governing by seeing the implications of thematic flexibility of new strategic goals on the organizational reconfiguration and vice versa. The responsibility for continuously checking the 'trinity' of external value creation, the internal strategic value contribution, and the operationalization with business and IT capabilities should lie preferably with the top management. Yet, due to the reciprocity in governance, the identified changes by the teams as the customers' ear need to be taken seriously when considering organizational and/or thematic adjustments. As a result, top management "is much more involved in the content of the teams" (FG-5) in order to estimate the consequences for the organization and sensing required overall moves.

Taken together, the four principles we identified highlight that the traditional notion of IT governance is moving towards 'Ecosystem Co-Evolution Governing' (see Figure 17) and merging with governance on the organizational level, so that the organization can continuously mutually adjust with the surrounding business ecosystem by meeting (parts of) its value creation with the strategic moves and possibly also influence or even shape the ecosystem in return.

Thus, we achieve a new understanding of IT governance for agility as the responsibility of everyone in an organization to continuously ensure the fit between IT and business, between functional and technical systems, and between value propositions and ecosystem concerns by rapidly sensing changes, acting on them, and bringing forth decisions in case of dependencies.

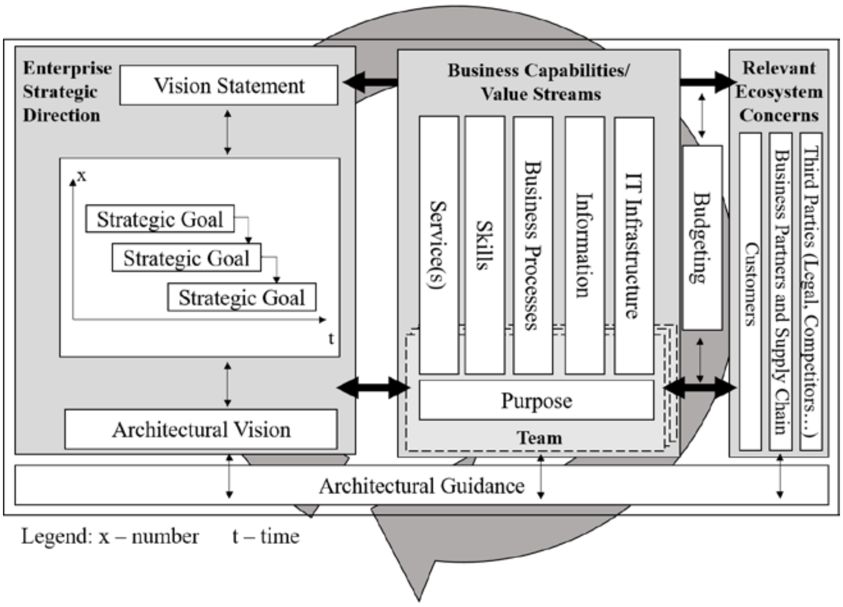

Figure 17: Ecosystem Co-Evolution Governing.

17.5 Discussion and Conclusion

Based on the insights of an empirical analysis of 40 participants from various organizational contexts and functions as well as experienced consultants on agility and IT governance, we contribute four fundamental principles for IT governance when striving for agility. Based on these, we also propose an evolution of the 'IT governance' term towards 'Ecosystem Co-Evolution Governing'.

With these findings, we make the following contributions to the IT governance discourse. First, we expand the scope of the traditional IT governance perspective by encompassing not only the (digital) business side, but also the ecosystem surrounding the business along with the ecosystem actors' (especially the customers') concerns. Second, we show that agile governance involves continuously (re)evaluating this knowledge throughout the organization by thoughtful integrated business and IT decision-making for adjusting the fit of the value propositions to these concerns, often decentralized for the individual concern for faster responses. As business and IT knowledge is encapsulated within capabilities, agile IT governance has a wider focus than traditional IT governance, as the dedicated IT focus may disperse in some organizational setups due to strategic and structural convergence. Finally, IT governance for agility emphasizes the overall fundamental shift from IT governance as mechanism for stability towards being a mechanism for fluidity via continuous governing, concerning both capabilities and content for accelerating the organizational ability to respond with existing or induce new strategic moves. In turn, this shift towards governing 'meta-governs' by facilitating (or even enforcing) the continuous (re)fitting and (re)organizing between the ecosystem and the organization, within its different lines of business and IT and local and global interests.

The findings also contribute to a deeper understanding of IT governance research by clarifying how agility affects the components of Weill and Ross' (2004) established IT governance approach. We highlighted the major implications for the five established decision areas among the discussion of each of the four principles. We therefore see that the IT governance decision areas are still valid, but are changing in their scope with converging thinking with respect to the ecosystem, business, and IT governance. With respect to the responsibility structures, the integration or fusion of traditional IT and business perspectives removes the need to distinguish between IT governance archetypes such as federal, feudal etc. The resulting ideal type for a suitable responsibility structure in the agile context – as outlined throughout our discussion of the four principles – can be characterized as federal between top management and a number of semi-autonomous teams or units with a heavy emphasis on decentralization. In practice, such 'pure' forms of organizing governance may not be feasible, however. Here, the established responsibility structures provide proven terminology to characterize the actual locus (or loci) of decision-making as well as future directions for adapting them further.

In addition, our findings include a proposal for the underlying changes of IT governance in order to enable a 'new' agile IT governance system. The terms and concepts that we introduce can inform IT governance research, as they explicate the character of proposed general agile and IT governance capabilities (Luna et al. 2014, 2019) while simultaneously providing overarching guidelines for selecting suiting agile processes, structures and relational mechanisms (Vejseli et al. 2018, 2019, 2020) for enabling agility. The identified principles further clarify the role of the individual governance practices like budgeting (e.g., Bogsnes 2009), portfolio (e.g., Hoffman et al. 2017), or enterprise architecture management (e.g., Uludağ et al. 2019) by spanning an overarching frame for their application. As a result, our insights on explicating the intended outcome of the practices via the principles helps guiding their interlinkage for enabling agility in the large.

The novel perspective on IT governance also contributes to the discourse on agility. Research on agility already largely emphasizes IT's needed integrated role for embracing the continuity in changes with proactive and reactive fast strategic moves (van Oosterhout et al. 2006; Overby et al. 2006; Tallon and Pinsonneault 2011) via a strong business IT relationship (Horlach et al. 2019), continuous planning (Suomalainen et al. 2015) while enforcing self-management of the teams (Moe et al. 2019) for speed and adaptation. Yet, the findings extend those insights and existing frameworks for scaling agility towards the organizational level (Scaled Agile 2020; Disciplined Agile 2020) by revealing that governing IT for the ability of continuous adaptivity (Beck et al. 2001) not only involves continuous thematic re-configurability, but needs an IT governance system that handles a parallel continuous systemic (re)organizing of the affected organizational capabilities. In addition, the principles further contribute with delineating the primarily conceptual findings of agility research with actionable solutions in form of corresponding practices. This will presumably also guide the nascent research stream of scaling agility and its initial structures for agile IT setups such as bimodal IT (Haffke et al. 2017), or (large) scaled agile settings (Jöhnk et al. 2017; Gerster et al. 2020) by providing a frame in which applied structural, procedural and relational mechanisms (Jöhnk et al. 2019) can be analysed for identifying how to govern those settings for overall agility.

The four underlying principles of 1) an ecosystem perspective, 2) digital business and 3) reciprocal governance between the local and the global level and 4) the resulting continuous adaptation are also relevant for practitioners. Although the individual factors are not novel per se – for instance, Weill and Ross (2004) themselves already emphasized business-IT decision-making, as the IT governance decision areas are not isolated – their combination reveal the multi-faceted nature of IT governance in the light of organizational agility. This is relevant for practitioners, as they must choose a specific agile IT governance strategy for their own organizational agile transformation, driven by the desired outcome and the desired speed of this outcome. As the agile IT governance strategy is therefore linked to the organizational context, a one-size fits all solution like proposed in most scaling agile frameworks (Disciplined Agile 2020; Scaled Agile 2020) might not suitable for an organization, but requires to be tailored to the individual demand. Here, our principles can inform the decision-making by providing guidance on the underlying factors for consideration – for instance, to select or tailor a framework for agile IT governance or for evaluating the current organizational and IT governance set-up.

However, we did not propose specific roles and responsibilities for agile IT governance (or ecosystem co-evolution governing). This restriction in scope is one main limitations of the paper, as we provide rather limited actionable findings. Hence, we call for more and in-depth analyses and evaluations of individual mechanisms and their combination for patterns of decision structures and distribution of responsibilities for a sustainably effective agile governance framework. As the ideal combination of practices is presumably context-sensitive, more differentiated inquiries within our three identified agility archetypes – IT organization, digital unit and enterprise-wide – and across are required. For instance, the individual current and envisioned extent of agility within an organization presumably affects the ability for agility for each of the three archetypes. There may also be (non)favorable styles or patterns on how to implement, combine, and adapt each decision area and the underlying factors within each archetype. Along these lines, dimensions of differentiation or contingency factors may be further areas of interest for shaping effective governance implementations. This presumably also supports solving the question on how to identify and re-evaluate the most suitable tailoring of the IT governance system and when change is due or not.

The other major limitation of our paper is that we build our results on knowledge gained in an empirical study of 40 participants from two countries, limiting the validity and generalizability of our research. Although we included various roles involved in organizations striving for agility or consulting such companies, we did not cover all perspectives of business and IT in organizations by far. In particular, this includes business and IT support functions that are mainly indirectly affected by the changing ecosystem concerns and the resulting organizational adjustments. As these functions are also rarely in the focus of research on agility, we recommend further studies on analysing their effective organization and how they are embedded in the overall IT governance approach to prevent new frictions. Integrating these additional views – together with the yet missing perspective of senior business management and executives – is one of our research goals for future findings that are as holistic as possible while longitudinally studying the analysed organizations in their agile transformation.

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18 Appendix B: Eidesstattliche Erklärung/ Declaration on Oath

Hiermit erkläre ich,

Bettina Horlach, geboren am 25. Juni 1985 in Rostock,

an Eides statt, dass ich die vorliegende Dissertationsschrift

„*Shaping the IT Function for the Digital Age – Re-Designing and Re-Conceptualizing IT Governance Decision Areas and Business IT Alignment for Organizational Agility*"

selbst verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt habe.

I hereby declare, on oath, that I have written the present dissertation by my own and have not used other than the acknowledged resources and aids.

Hamburg, den 04.06.2021

(City, Date) **(Signature)**