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Connecting Enterprise Architecture and Project Portfolio Management:
A Review and a Model for IT Project Alignment

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ABSTRACT

Enterprise architecture (EA) and project portfolio management (PPM) are key areas when it comes to connecting enterprise strategy and information technology (IT) projects. Both management disciplines enhance business capabilities, integrate skilled resources, and govern affiliated processes and functions. A skillful comprehension of the links between these managerial areas is essential for effective IT planning. This article elaborates on the common grounds and structural attachment of EA and PPM, showing the substantiated relations between them and demonstrating their cohesiveness. From strategic planning to solution delivery, a conceptual model for IT project alignment integrates these IT management disciplines over two levels. EA ascertains the technical goals and constraints, whereas PPM determines the organizational goals and constraints. The results from both sides are combined to jointly propose, select, prioritize, and schedule IT projects. Roadmapping is a suitable approach to bring EA and PPM together.

KEYWORDS

Business–IT Alignment, Enterprise Architecture, IT Governance, IT Project Alignment, Project Portfolio Management, Roadmap

INTRODUCTION

Information technology (IT) increases a company's competitive advantage by lowering costs and/or by differentiating from rivals (Porter, 1985, pp. 166–172). Enterprises must build and constantly enhance their IT capabilities to survive in the marketplace. Since the late 1970s, the planning of IT capabilities has been strategically significant; indeed, IT planning strives to merge project planning with strategic business planning (Robson, 1997, pp. 100–101). Yet, the mechanisms regarding how IT is strategically aligned to business are still unclear in practice and are subject to numerous theoretical discussions, particularly the alignment of IT and business dominate diverse academic considerations that take various notions, such as fit, linkage, integration, or bridge (Ullah & Lai, 2013). Business-IT alignment is defined in many ways and has been discussed for three decades (Chan & Reich, 2007). This alignment phenomenon is still of growing relevance, and researchers have proposed a great deal of tools, methods, and techniques (Aversano, Grasso, & Tortorella, 2012, p. 162). However, the roles and functions in the enterprise IT area are confusing and inconsistent because there is no authoritative

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source that defines the knowledge across the whole enterprise (IEEE & ACM, 2018). This article illuminates enterprise architecture (EA) and project portfolio management (PPM) functions and according managerial roles that perform and coordinate strategic IT planning activities.

Definitions and standards for EA have been inconsistent for more than 35 years (Halawi, 2018, p. 1). EA is viewed, on the one hand, as an IT topic, and on the other hand, it is seen as a business model and strategy subject, particularly in the management literature (Syynimaa, 2018). The Open Group Architecture Framework (TOGAF) presents EA as a generic methodology, but the descriptions of EA skills clearly stress IT competencies (The Open Group, 2018, pp. 470–471). In real life, EA almost always includes IT (Walrad et al., 2014, p. 43). EA creates links between business architectures and IT architectures and verifies their integrity (Helfert, Doucek, & Maryska, 2013, p. 73); it also identifies business processes, applications, data, and technology (Strano & Rehmani, 2007, p. 392) and is a means for organizational change (Sousa et al., 2011). Indeed, EA supports executives regarding optimal strategy, providing the direction on what is needed to achieve the business goals.

PPM is embedded in the organization's overall strategy to accomplish objectives and realize the strategies of an enterprise (PMI, 2013, pp. 5–7). These objectives concern all the primary and support activities of an enterprise's value chain, including IT "since every value activity creates and uses information" (Porter, 1985, p. 168). PPM takes a holistic view, covering all organizational changes, and every organizational change affects IT. Effective PPM increases the business value from investments (PMI, 2013, p. 10). A portfolio represents the total investments for strategic change initiatives (Axelos, 2014, p. 2). PPM allocates budgets assets, and human resources to projects based on strategic analyses and choices. Projects denote investments (Axelos, 2014, p. 3) in strategic change initiatives to build or extend capabilities and assets to gain a competitive advantage.

Both EA and PPM enable a structured realization of IT solutions that effectively meet business requirements (Office of Management and Budget, 2013, p. 149). Both IT management disciplines enhance business capabilities, integrate skilled resources, and govern affiliated processes and functions. A skillful comprehension of the links between these managerial areas is essential for effective IT planning. The relatedness of these IT planning capabilities is highly significant, because both disciplines bear responsibility of value generation from IT solutions. However, too little attention has been on the connectivity of EA and PPM in theory and practice.

The purpose of the current conceptual paper is to explore the coherence of EA and PPM and their functional alignment to the business and to IT projects. More elaboration is needed to comprehend the dependencies between both IT planning functions and to set the appropriate organizational structures. The present paper answers the following research question: How do EA and PPM connect and align in strategic and tactical ways? The current paper investigates in the coherence of EA and PPM and extends the views on their strategic and tactical alignment.

This paper starts with a literature review on connectivity of EA and PPM and their alignment to the business. The review includes the nascent notion of IT project alignment. Then, the strategic and tactical levels of EA and PPM are theoretically illuminated. For both disciplines strategy concerns alignment, whereas tactical management affects governance. Connections between EA and PPM are elaborated; the concept of IT project alignment integrates EA and PPM by aid of the roadmapping technique. Finally, the key statements are summarized, and future directions of research are proposed. The present work contributes to the literature by a concept and a model that connect EA and PPM; practitioners may apply this model as a foundation for governance in their IT organization.

LITERATURE REVIEW

The Connectivity Between EA and PPM is Underestimated

EA and PPM have rarely been seen in connection. The work from Luftman and Brier (1999) described the strategic IT alignment process; here, architecture is one of the 12 strategic alignment components,

while project management is the means to implement strategies. However, the connections between architecture and project management have not been analyzed. O'Brien and Marakas (2011, pp. 491–492) noted three main elements of business IT planning: strategic development, resource management, and IT architecture. The planning process should mutually accommodate setting the objectives and prioritization, which both require business insights and feedback. General managers and chief information officers (CIOs) must manage strategy development to have the business and IT areas work together. However, the authors neither mentioned PPM nor EA.

Cuenca et al. (2014) presented a strategic alignment model that highlighted IT architecture but did not mention PPM. In the same way, Bhattacharya (2018) omitted PPM in his elaboration of the strategic alignment model that uses EA. Similarly, Zhang, Chen, and Liu (2019) suggested an approach for resource allocation and portfolio analysis that concentrates on EA methods but leaves out PPM.

In contrast, some authors reflect PPM in strategic planning/alignment but fail to include EA. Marcos, Mezcua, and Crespo (2007) presented a model that contains portfolio management, IT strategy planning, and alignment, but they did not consider architecture. Kumar, Ajjan, and Niu (2008) regarded applications, infrastructure, and projects as interrelated parts within IT portfolios. Architects were just allocated to the infrastructure sub-portfolio but not to the applications and project groups. Hansen and Kremmergard (2014) even separated IT architecture from IT PPM scope. In their mind, IT architects do not concentrate on the development of IT solutions, but on the operation of IT infrastructures. Benaija and Kjiri's (2014) proposition for strategic alignment of PPM left out the IT architecture; they did not consider IT at all. Kaiser, Arbi, and Ahlemann (2015) theorized project selection by PPM from cases in the construction industry without any architectural aspect. El Hannach, Marghoubi, and Dahchour (2016) disregarded EA in their project prioritization process. Bondel, Faber, and Matthes (2018) showed the business capability map as an EA tool for business-IT alignment. Portfolio management was displayed as a business capability on the top level, but links to EA were not demonstrated.

According to Gartner Inc., EA and PPM should build relationships and integrate because both disciplines benefit from each other (Bittler, 2012). Foorthuis et al. (2010) carried out an online survey and found that conformance of EA and projects provide benefits in view of project quality, risks, and business-IT alignment. Another survey from Shanks et al. (2018) also showed benefits to projects when using EA services for IT or business changes.

Few academic publications have recognized the relations between PPM and EA to realize these benefits. According to Quartel, Steen, and Lankhorst (2012, p. 193), EA is essential to identify and analyze the links within a portfolio. In their model, both EA and PPM relate to the business strategy and business requirements. Cameron (2005, p. 404) stated that the IT architecture team belongs to the bodies and stakeholders that manage the portfolio. The involvement of IT architects in PPM is also supported by Aier and Schelp (2010), who examined EA in six companies and reported that EA contributions in IT projects were long-term key success factors in all the cases. Simon, Fischbach, and Schoder (2013) discovered the importance of the PPM-EA connection; they identified some differences and similarities between EA and IT portfolio management from the literature and suggested integrating IT portfolio management into EA management. In their model, EA scope comprises IT and business, while PPM scope is IT only. The Body of Knowledge and Curriculum to Advance Systems Engineering (BKCASE; 2018, p. 641) connected EA and PPM by looking at resource allocations and budget decisions. These activities are founded on the recommendations from PPM and on the objectives from EA, and they must be brought into line. Investment decisions and the preceding evaluations need inputs from both roles, that is, portfolio managers and architects (Lankhorst & Quartel, 2010, p. 14). A technical value analysis from the EA side should be combined with a monetary value analysis from the PPM side. However, the literature is unclear, how EA contributes to decision-making on IT investments (van den Berg et al., 2019).

Even TOGAF (The Open Group, 2018), the leading reference for EA, does not provide distinct directions to PPM. TOGAF indicates a "structured direction" between EA and PPM and says that PPM

is a supplier of pieces that must fit into the EA puzzle (The Open Group, 2018, p. 62). Yet, TOGAF neither presented nor worked out the appropriate processes or methods for "structured puzzling."

Some recent papers indicated links between EA and PPM, but they did neither present sufficient theoretical arguments nor empirical data. Ugwu (2017) pointed out the complementary functions of EA and project management and the need for their alignment by bi-directional data exchange. Yet, the statements from Ugwu (2017) were not scientifically substantiated; his article only referred to the PMBOK (PMI, 2017) and seven online references, thereof two wiki websites and one blog. Sousa and Carvalho (2018) emphasized the need to align EA and PPM and to integrate information flows between both functions for project prioritization, project planning, and risk assessment. A research methodology was outlined, but data has not been presented yet. Schomburg and Barker (2019) compared the entities IT project management office (supporting portfolios and projects) and EA in the public sector. They concluded that these entities have different but complimentary views on IT projects and are critical to project success. Yet, their paper described perceptions and lacked valid research methods.

The Nascent Notion of IT Project Alignment

The literature has not clearly denoted "alignment" as a state, degree of fit, or process in a business/strategy context (Ullah & Lai, 2013). Yet, alignment theories in IT/IS research concentrate on the business-IT interface. The notion of IT project alignment is emerging; researchers have given different meanings to it, which are summarized as follows.

Juiz, Gómez, and Barceló (2012) presented a case where the strategic and tactical IT objectives were aligned to the business, with approved IT plans coming out as the result. However, the authors concentrated on objectives and processes but let down functions and organizational structures. The authors left the notion of IT project alignment unexplained, even though it was part of the title. Not to mention, their theoretical framework lacked proof; their paper only refers to seven sources.

Wolf, Beck, and Vykoukal (2010) delivered a model for IT project alignment that has diverse levels. The vertical direction connects the strategic level to tactical level, whereas the horizontal dimension refers to the external environment. Wolf et al. (2010) omitted IT architecture functions in their model. Bardhan, Krishnan, and Lin (2007) related IT project alignment to the ways information systems are used as tools to perform project management (e.g., file sharing, collaboration systems, planning applications, etc.).

Nilsson (2015, p. 29) observed IT project alignment in practice and showed the context among strategy, EA, PPM, and project management, associating 13 assumptions with this context. The relationships between EA and PPM were not examined; instead, a model was compared with previous research and a set of assumptions was discussed. Nilsson (2015) placed the IT project in the center surrounded by skilled stakeholders that all need to understand the project essentials. IT project alignment, in Nilsson's sense, is relationship management between the IT projects and the stakeholders.

The term "information system project alignment" was presented by Jenkin and Chan (2010), but their research addressed the compliance of project outcomes to project objectives and assumed that IT had already been strategically aligned. Beyond strategic IT alignment, Jenkin and Chan (2010) gave their alignment view on IT deliverables that must be in line with IT project goals; their research related to the tactical results from projects. The influence of IT architecture on project alignment was not examined but suggested for future research.

Previous research on IT project alignment has failed to address the strategic relationship between EA and PPM. The author uses the phrase IT project alignment to connect these functions in the model that is presented later (Figure 1).

The literature review has shown that the connections between EA and PPM and their alignment are essential but inconsistent in theory. In the following section, key aspects of both disciplines are illuminated on two levels: one strategic, one tactical. Thereafter, a model is presented that integrates EA and PPM for aligned IT planning.

THE STRATEGIC LEVEL: BUSINESS ALIGNMENT

Business-IT alignment contributes to value generation from IT investments (Henderson & Venkatraman, 1993), and the concept of business-IT alignment is one of the most examined topics in academia and real life (Ullah & Lai, 2013). EA is considered to be an effective methodology for business-IT alignment (Bhattacharya, 2018), which deals with the interrelationship of IT and business to attain strategic goals (Ullah & Lai, 2013) and to create business value (Mosthaf & Wagner, 2016). Early and influential research on strategic IT alignment perceived architecture as a substantial element for that purpose (Ross, 2003). Architects select, define, and integrate IT infrastructure components (e.g., hardware, software) that must align to organizational goals (Henderson & Venkatraman, 1993; Luftman & Brier, 1999). According to Wieringa, van Eck, and Krukkert (2005), business-IT alignment is an essential driving force for IT architecture. Zhang, Chen, and Luo (2018) found more than 40 academic publications for achieving business-IT alignment by applying EA methods. However, a general definition of business-IT alignment related to EA does not exist. In the context of these previous EA role descriptions, the author considers EA as a strategic function for both business and IT that connects these concepts together; here, EA is the key for business-IT alignment.

Business architecture designates the enterprises' operations in terms of its capabilities, organization, processes, tasks, and so forth (The Open Group, 2018, p. 78) to achieve a common understanding (Business Architecture Guild, 2017, p. 590). Business architecture describes the enterprise's current and future conditions and is "used to align the enterprise's strategic objectives and tactical demands" (Business Architecture Guild, 2017, p. 590; IIBA, 2015, p. 442). Thus, the business architecture is sender and receiver for business-IT alignment and constitutes a foundation for the enterprise architect.

The alignment of project management to business strategy is also a bidirectional relationship. In proper alignments, project management supports businesses that pursue cost leadership or differentiation strategies (Porter, 1980); in turn, this affects these businesses from a project feedback perspective (Milosevic & Srivannaboon, 2006). "PPM advances organizational capabilities" (PMI, 2014, p. 1). Projects align to the business by meeting organizational goals and by considering organizational constraints (Chaudhry, 2015). PPM should evaluate these constraints to make rational investment decisions. Indeed, "strategic decisions are based on a clear understanding of costs, risks, impacts on business as usual, and the strategic benefits to be realized" (Axelos, 2014, p. 2).

THE TACTICAL LEVEL: GOVERNANCE

EA Governs Solution Architecture

IT alignment appears to be multidimensional (Chan & Reich, 2007). However, the research on IT alignment has mainly addressed strategic topics, leaving out their integration in tactical directions; previous studies have underrated the meaning of tactical management (Wolf et al., 2010). The empirical research outcomes from Wolf et al. (2010) indicated the complementation of the strategic and tactical management levels. These management levels correspond to the two main IT architecture levels from Martin, Dmitrieva, and Akeroyd (2010, p. 6): the EA level and the project/solution level. Architectures must be designed so that they perfectly match each other on each of these levels (Wieringa et al., 2005). Enterprise architects link the strategy level to the tactical level by governing solution architects in supporting business-IT alignment (Ullah & Lai, 2013).

On the tactical level, solution architects support projects (Gellweiler, 2019) to implement the strategies and act from previously made strategic decisions and policies (Robson, 1997, p. 17). Enterprise architects control the efficiency and adequacy of the IT architecture (Helfert et al., 2013) and guide solution architects throughout projects. Frameworks, policies, and standards are the tools used to govern solution designs within projects. Governance by EA is crucial to guarantee architectural involvement in projects (Shanks et al., 2018, p. 147). Here, governance includes the introduction and

monitoring of the principles and standards for maintaining the consistency of architecture. These standards and policies provide guidance for decision-making in projects (Löhe & Legner, 2014, pp. 105–106), that is, they still allow for autonomy (Robson, 1997, p. 21).

PPM Governs Project Management

Besides the strategic level of business-IT alignment, PPM comprises the tactical level for governance and feedback. The tactical level concerns projects over their life cycle (Milosevic & Srivannaboon, 2006). Thus, PPM must bridge the business on the strategic level to projects on the tactical level. PPM should organize the information flows and make decisions between both levels.

Portfolio managers maintain a consistent delivery of changes (Axelos, 2014, p. 12), that is, PPM controls and monitors projects. Project governance within portfolio functions provides efficiency by giving a definition and application of the tailored frameworks, policies, guidelines, rules, templates, and so forth. Standardization, process homogeneity, planning consistency, and learning curve effects accelerate project management tasks and avoid the costs of failure. Concurrent projects may transparently be controlled, and their dependencies may be managed more efficiently.

Projects can be thought of as business change initiatives that compete for resources and monetary funds; these demands must be monitored and decided if deviations from the cost baselines occur as projects progress. Therefore, portfolio management must constantly gauge all running projects to resolve capacity conflicts regarding the achievement of strategic objectives. For the purpose of resource decision making and for efficiency reasons, projects must be governed from a higher level, that is, portfolio management, and, if needed, via programs as intermediate management level for controlling bundles of interrelated projects.

Portfolio management goes beyond strategic alignment and project/program governance. It also oversees the values that should be realized from the deliverables in use (PMI, 2013, pp. 7–8). In the case of IT, value is delivered from solutions that have gone into production. Thus, portfolio management not only controls IT project performance, but also evaluates the delivered IT solutions in the company's day-to-day operations to verify the achievement of strategic objectives and the fulfillment of business requirements. Therefore, portfolio management is a permanent function. It covers all the solutions from their emergence until their end of life.

TOWARDS A CONCEPTUAL MODEL INTEGRATING EA AND PPM

Technical and Organizational Goals and Constraints

For the design of enterprise networks, Wilkins (2011) distinguished organizational goals and constraints from technical goals and constraints; this differentiation helps in comprehending the complementation of analytical contributions from EA and PPM.

Technical goals, as suggested by Wilkins (2011, pp. 71–72), correspond to IT requirements. All technical goals—and, accordingly, the IT requirements—depend on the business architecture. Functional IT requirements are specified to develop new IT services that provide value. Non-functional IT requirements must be defined or reviewed along with any functional changes. Some examples are the scalability to prepare future expansions, service availability for business continuity, performance, manageability, security for data protection and accessibility (Cater-Steel, 2009, p. 129). EA must define the technical goals and analyze the company's limitations. Some examples of technical constraints include legacy equipment, solution life cycles, provider contracts, platform compatibility, interoperability (protocols, interfaces), or other technical dependencies such as bandwidth (Wilkins, 2011, p. 72). In short, EA strategically aligns IT to business by translating business architectures into technical goals and IT requirements. EA also takes any technical constraints into account. The implementation of strategically planned changes is carried out on a tactical level by solution architects governed by EA.

Organizational goals encompass all the strategic endeavors, such as geographical expansions, new product introductions, structural redesigns, acquisition of firms, location moves, outsourcings, changes in supplier or partner relationships, and so forth. These must be evaluated based on the requirements, scope, and added value, that is, a benefit realization perspective. PPM strives for optimal resource and budget allocations and preschedules projects to best accomplish the organization's goals (BKCASE, 2018, p. 628; Cooper, Edgett, & Kleinschmidt, 1999, p. 334). This requires a thorough project analysis from PPM while keeping in mind goal setting and value delivery. The selection and prioritization of projects depend on how these projects support strategic goals (Martinsuo & Lehtonen, 2007). The resources and budgets are allocated accordingly. Furthermore, PPM must schedule projects based on priorities, cash and resource availabilities, and project interdependencies. Organizational constraints impact project implementation. In the worst case, they can prevent projects from starting. The limiting factors here are budget, human resources, skills, assets, and risks. These must be analyzed, for example, by a capability analysis (PMI, 2013, p. 74) and must be preplanned. Furthermore, internal and external dependencies must be taken into account, such as supplier conditions, lead times, policies, contractual obligations, and logical dependencies from and to other projects. Laws and regulations are also aspects to be considered.

Table 1 depicts scopes of EA and PPM. Both functions strategically align to the business and control subordinate functions on the tactical level to maintain consistency for future changes. While EA concentrates on IT projects, PPM encompasses all major changes of the enterprise. Both sides analyze potential projects based on their needs. These analytical outputs need to be exchanged and discussed between EA and PPM to achieve a joint way forward.

Connecting EA and PPM

Decision-making approaches are imperfect, if analyses and judgments are made within EA and PPM silos and, if important aspects from the other silo remain unconsidered. EA lacks organizational views (Nilsson, 2015, p. 28), which are needed to capture the business-IT relations (Luftman & Brier, 1999), whereas PPM lacks the technical perspectives required to implement the IT strategies (Luftman & Brier, 1999). Plans from PPM need alignment with plans from EA. On the EA side, EA states strategically relevant IT change undertakings within the project portfolio (Ross, 2003, p. 43; Öri, Molnár, & Szabó, 2018, p. 727). On the PPM side, each project and organizational change affect IT, which must be taken into account by EA. For example, Langermeier and Bauer (2018) drafted an EA planning method for architectural compliance in projects in order to achieve EA goals; this method integrates project proposals into the domain architecture.

Requirements management is another concrete example that calls for collaboration of EA and PPM. According to Buckl (2011, p. 153), the requirements from IT and the business must

Table 1. Scope and focus of EA and PPM

	Enterprise Architecture (EA)	Project Portfolio Management (PPM)
Strategic scope	- Technical goals and constraints - Business-IT alignment - Technology life cycles	- Organizational goals and constraints - Project prioritization aligned with the business - Fund and resource allocation
Tactical scope	- Consistency of IT architecture - Monitoring and controlling of solution design - Definition of reusables, guidelines, principles,…	- Consistency of project delivery - Monitoring and controlling of programs/projects - Definition of frameworks, guidelines, principles,…
Project focus	- IT projects (infrastructure changes, application development,...)	- All projects (organizational restructuring, process reengineering, mergers, acquisitions, outsourcing, new sites, moves, new products,…)

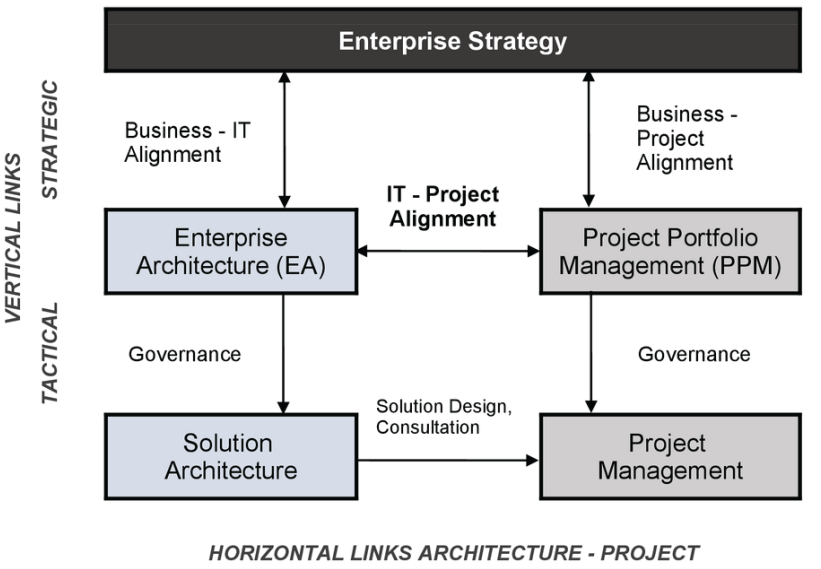
Source: Author

be identified, evaluated, and prioritized by EA. Yet, some project-related requirements cannot be described and managed by EA (Apelt et al., 2017). Requirements management should be integrated with processes, such as goal setting, business processes, project management, enterprise architecture, or solution design (Hiisilä, Kauppinen, & Kujala, 2016). Boness and Harrison (2015) suggested a method for requirements modeling and goal setting using the EA tool ArchiMate (The Open Group, 2017); it supports project managers in scope definition and stakeholder alignment. Werewka (2017) mapped project management concepts (PMI, 2017) to the EA language of ArchiMate (The Open Group, 2017) and suggested alignment of EA and project management notions for developing the governance.

The presented strategic alignment and tactical governance aspects reflect the structural similarities of EA and PPM. Both functions are permanent, are connected to enterprise strategy, and must analyze the business: enterprise architects focus on business architecture and IT, while portfolio managers concentrate on organizational objectives. The technical goals and constraints from EA must regularly be aligned with organizational goals and constraints. Then, project proposals can jointly be evaluated, selected, and prioritized. Interdependencies can be uncovered, and timelines for projects can be drawn. The author denotes this horizontal process between EA and PPM as IT project alignment, which ensures that the information and strategic plans between IT and other organizational endeavors match (Figure 1).

The results from IT project alignment are inputs to the tactical level, that is, to solution design and to project planning. Solution architects consult with project managers when designing and implementing solutions; they also report to enterprise architects to meet EA goals (Schekkerman, 2011, p. 6). Enterprise architects and portfolio managers serve as governance bodies for solution architects and project managers (Figure 1). Governance provides planning efficiency in both ways and allows for the control of resources and outcomes. Governance embraces all the solutions from project selection to the phase-out of solutions. Thus, portfolio managers and enterprise architects are permanent roles within an organization and control requirement fulfillment in projects, and here, subordinate tactical roles also closely cooperate in view of requirements analysis and solution design (Gellweiler, 2019). On demand, intermediate organizational levels can be incorporated in both vertical paths. These can be domain/segment architects or program managers, respectively.

Figure 1. The model of IT project alignment (Source: Author)



The suggested model for IT project alignment defines the overall alignment as designing and implementing IT solutions by projects that meet the requirements from strategic technical goals and from strategic organizational goals. Projects must fit into the strategic purpose. The tactical links in Figure 1 deal with efficiency, that is, time- and cost-efficient project implementation, or doing the projects "right." The governance of solution architects and project managers from EA and PPM, respectively, strives for consistency with strategy, efficiency of planning and execution, and achievement of project objectives. The upper, strategic links in Figure 1 refer to effectiveness by selecting and prioritizing the "right" projects. The roadmapping technique is presented for this aim.

Roadmapping as the Technique for IT Project Alignment

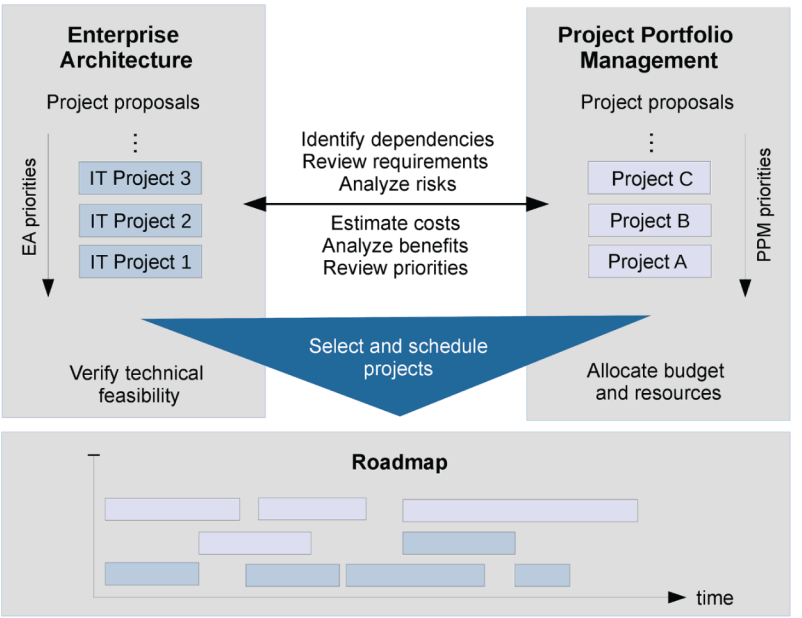
Roadmapping provides flexible and useful ways for project planning and architecture structure (Lee & Park, 2005, p. 576); it coordinates and improves the evaluation of IT projects regarding their relations to business requirements (McCarthy, 2003).

From an architectural perspective, roadmaps are based on strategic changes in the business architecture, and they present the current state and a direction to future architecture (IIBA, 2015, p. 420). Architects must "align with business architecture and roadmap" (Cater-Steel, 2009, p. 140). From a project point of view, roadmapping is a methodology that associates projects to strategy and determines the dependencies, risks, and gaps (Office of Management and Budget, 2013, p. 12). Here, a dependency analysis includes resources, finance, and quality. The roadmap also comprises strategic objectives, a cost-benefit analysis, prioritization analysis, milestones, and challenges (PMI, 2013, pp. 61–66); it integrates technologies and market strategies (Vishnevskiy, Karasev, & Meissner, 2016).

Roadmaps make planning transparent and raise awareness within the enterprise, enabling collaborative planning across organizational units (Office of Management and Budget, 2013, p. 12) and promoting communication between the planners (Office of Management and Budget, 2013, p. 94). Roadmaps are the results of a cooperative planning approach that combines planners from various areas (e.g., architects, program managers) to develop a cohesive plan for projects (Office of Management and Budget, 2013, p. 65). Roadmaps link technology to business and enable communication between functions. Building roadmaps combines EA and PPM views and integrates technology strategy and planned organizational initiatives (Phaal, Farrukh, & Probert, 2007, pp. 3–4). Sousa et al. (2011) presented the Serasa case, which strived for the integration of views from IT architecture, IT projects, and IT governance. Thereby, the roadmaps for long-term planning of projects and IT architecture can be linked. Indeed, roadmaps combine planning information from diverse sources, contain current and future architectures, and update project progressions. Strategic planning finishes with a roadmap and a project portfolio to achieve the architectural objectives (Langermeier & Bauer, 2018, p. 98).

Roadmapping is the proposed technique for the reconciliation of strategic plans from EA and PPM; roadmaps integrate each discipline's plans into a joint plan. The EA and PPM planners document data and draw plans to achieve a common understanding and analysis. Both areas develop their schedules, which need to be matched, although these are already aligned with the enterprise's strategy. The schedule from PPM contains parts that are not on the EA schedule (e.g., geographic expansion), whereas the EA schedule covers elements that are not covered in the PPM schedule (e.g., life cycle-driven system replacements). Technical goals and constraints must be discussed with organizational goals and the constraints from PPM. Thus, EA and PPM should create a collective plan. This joint schedule—referred to as a roadmap—covers all the pieces from both sides, harmonizes priorities, considers interdependencies, and places projects accordingly on a timeline. Roadmapping, that is, the process of alignment between EA and PPM, which the author calls IT project alignment, closes the strategic alignment loop between business-IT alignment from EA and business–project alignment from PPM. The main result—the roadmap—provides a common and reasoned master plan (Figure 2). The integrated roadmap may be approved by an authorized executive role or by a governance body (Office of Management and Budget, 2013, p. 94) and it needs to be constantly reviewed to respond to dynamic forces.

Figure 2. The process of IT project alignment (Source: Author)



By using this roadmapping idea, the author defines IT project alignment as the process of harmonizing strategic plans between EA and PPM into a collective roadmap to the meet organizational and technical requirements in projects that deliver IT solutions for value creation.

CONCLUSION

The current paper has given the reasons for the coherence of EA and PPM by detecting connections, structural similarities, and common grounds from both areas. Both functions are connected to business strategy when it comes to selecting and prioritizing projects. Thus, the EA scope is on IT, while PPM considers all the projects affecting the organization. Both functions also connect to the tactical level and provide governance through frameworks, policies, and principles to guide solution architects and project managers, respectively. The strategic links can enhance effectiveness (choosing the "right" projects at the "right" time), and the links to the project level improve efficiency (the "right" detailed planning and implementation).

The present article has detected the need to harmonize EA and PM plans and proposed a way for alignment between both strategic key functions. EA means business-IT alignment and includes long-term services, overall design, and structures from business architecture. EA also defines the technical goals and constraints (e.g., from legacy solution) and describes target and intermediate IT architectures. PPM concentrates on organizational goals (e.g., acquisitions, geographic expansions, etc.) and is central in investment decision making. Based on business priorities, resources and budgets are allocated to projects. Within the enterprise, all strategic change initiatives should match; plans from EA need to be brought into line with plans with PPM. The technical goals/constraints from EA and organizational goals/constraints from PPM need to be analyzed to determine gaps and interdependencies. Decisions on future investments can then be jointly taken. EA and PPM may choose and prioritize projects together and can roughly schedule them by applying the roadmap approach. This strategic process is referred to as an IT project alignment, which closes the strategic planning loop between business-IT alignment and portfolio planning.

Previous research underrated the necessity to link EA to PPM. Simon et al. (2013) detected cohesiveness but their interpretation of the scopes of EA and PPM were inadequate. The current article introduces an opposing viewpoint; it defines scope the other way; that is, EA concentrates on IT, whereas PPM serves the whole strategic change spectrum.

The present paper contributes to theory in three ways: first, by demonstrating the connectivity between EA and PPM; second, by reviewing and redefining the emerging notion of IT project alignment; and third, by presenting a two-dimensional alignment model that integrates EA and PPM. The propositions from the current work also provide ways for practical application. Enterprises may modify their organizational structures and processes to be in tune with the IT project alignment model. Also, the ideas from the current paper can be used as a blueprint for regular alignment between EA and PPM. For example, EA and PPM stakeholders may periodically carry out planning meetings to jointly update the roadmap.

The suggestions from the present conceptual paper are, in some ways, limited because they are found on theory without collected data from practice. Future qualitative research is recommended. First, case studies would be beneficial because little is known about the EA-PPM connection in the industries. The case studies can be used for testing the concept of IT project alignment (Myers, 2013, p. 75). Multiple case studies on the cooperation between EA and PPM can be carried out in enterprises by interviewing enterprise architects, portfolio managers, CIOs, and general managers. In addition, analyses on existing documents within enterprises, such as internal guidelines or planning handbooks, would help in exploring this topic. The applicability of IT project alignment can be verified by participatory action research (Whyte, 1991) to examine the phenomenon in real-life settings. Finally, agile methods for the displayed EA-PPM linkages are recommended topics for upcoming research; several articles on EA and agile portfolio/project management showed ideas and findings for further elaboration (Canat et al., 2018, Hanschke, Ernsting, & Kuchen, 2015; Horlach, Schirmer, & Drews, 2019; Werewka & Spiechowicz, 2017).

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