The Contribution of Enterprise Architecture to the Achievement of Organizational Goals: Establishing the Enterprise Architecture Benefits Framework

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THE CONTRIBUTION OF ENTERPRISE ARCHITECTURE TO THE ACHIEVEMENT OF ORGANIZATIONAL GOALS: ESTABLISHING THE ENTERPRISE ARCHITECTURE BENEFITS FRAMEWORK

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Abstract. *Currently, there is no scientifically grounded, comprehensive framework of Enterprise Architecture (EA) benefits that establishes the contribution of EA towards the achievement of organizational goals. In other words, there exists no single comprehensive view of the ways an architectural practice might add value to an organization. The aforementioned problem introduces several implications for both researchers and practitioners: i) ambiguity of the role and value of EA, ii) inability to effectively establish the business case for EA, and iii) inability to develop standardized and reusable EA effectiveness metrics.*

In the context of this research project, we embarked on an exploration of the ways EA has been attested to contribute to the realization of business goals. To this end, a theoretical framework for describing EA benefits was designed: the Enterprise Architecture Benefits Framework (EABF). Practitioners can utilize the EABF for establishing the business case for EA based on scientifically grounded reasoning, for charting both as-is and to-be situations concerning the effects of EA on organizational structures, and for developing highly specific EA effectiveness metrics that can be readily integrated to existing organizational performance measurement systems.

To achieve this, a systematic review of the relevant literature on EA effectiveness was first conducted with the goal of discovering potential EA benefits. Except for the EA benefit's own intrinsic value, they served as input to the second step, the design of the EABF. An assessment of the available frameworks in the literature, against the framework's established design requirements, led to the adoption of Kaplan and Norton's Strategy Maps framework as the base for the EABF.

The results of the systematic review produced rich evidence concerning the ways EA has been found to contribute to organizational goals and at the same time revealed the current state of the domain literature as being strongly IT-oriented, short of relevant research, and frequently superficially researched and reported. However, we acknowledge that the study might not have addressed the entire span of existing literature for a number of reasons (e.g. the language of the retrieved publications). Additionally, we acknowledge that although a rigorous method for designing the EABF was followed—which included multiple evaluation activities—an empirical evaluation of the design is still pending and is a next step outside the context of this research.

Keywords: Enterprise architecture, benefits, effectiveness, enterprise architecture benefits framework, structured literature review

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1 Introduction

Currently, there is no scientifically grounded, comprehensive framework of Enterprise Architecture (EA) benefits that establishes the contribution of EA towards the achievement of organizational goals. In other words, there exists no single comprehensive view of the ways an architectural practice might add value to an organization.

The aforementioned issue introduces several implications. First, the role and value of EA appears ambiguous among researchers and practitioners. As a consequence, this leads to the second implication, which is the inability to establish effectively the business case for EA and the third implication, which is the inability to develop sets of standardized and reusable technical EA effectiveness metrics.

The main part of this introductory chapter concerns an elaboration on these implications. It is deemed appropriate, though, that first EA and the main problem are put into context in order to provide the reader with the necessary subject-matter background as well as some essential definitions. The final part of this chapter presents the overall structure of the document.

1.1 What is Enterprise Architecture?

1.1.1 The Origins of Architecture

The word **architecture** derives from the Greek *αρχιτεκτονική* – arkhetaektoneke, which etymologically stems from *αρχή* – arkhe (principle) and *τέχνη/τεκτονική* – taekhne/taektonike (construction/creation). A common misconception is that architecture derives from the Greek *αρχιτέκτων* – arkhitaekton, (architect) which etymologically derives from *αρχι* – arkhe (master) and *τέκτων* – taekton (builder).

Encyclopædia Britannica Online defines architecture as the "[a]rt and technique of designing and building" [1]. Such a broad definition is necessary in order to capture the meaning and purpose of architecture, as there is no universally acceptable definition of what it encompasses [2].

Hoogervorst informs us that the various definitions of architecture generally converge at two basic approaches: one sees architecture as being a *prescriptive* concept and the other as a *descriptive* concept [3]. Descriptive means that architecture is used as a tool to describe already existing constructs, whereas prescriptive means that architecture is seen as the blueprint or guideline(s) of how constructs should be created.

Although the first known architectural treatise is *De Architectura* by Vitruvius [4], a Roman architect of the 1 century BC, architecture itself represents an even older human endeavor that initially stemmed from the basic need for shelter. Through time it progressed into being a distinct, very important scientific field that jointly acquired the status of an art-form as means and resources available to man became abundant.

In time, the term architecture was adopted by various other newly-found scientific disciplines (e.g. naval architecture, computer architecture, enterprise architecture) that made use of the word for a broader definition that relates to the original Greek meaning—which boils down to that descriptive set of principles to be used/that have been used for the creation of an artifact. The term architecture is also used today to describe the *product* of architectural work.

1.1.2 Enterprise Architecture

As an analogy to construction architecture–or simply, Architecture–the term EA was coined in order to describe the scientific discipline that concerns itself with the principles that govern the complex constructs of modern business organizations or simply, enterprises.

The term was established by what is known to be the landmark publication for EA, and consequently a highly influential work, by John Zachman at IBM in the 80's [5]. The extensions and elaborations on this work in the early 90's [6] and later on [7] are widely known as the *EA Framework* or *Zachman's Framework*. Zachman himself used Architecture in juxtaposition with EA in order to establish the rationale behind his framework and describe its usage.

1.1.2.1 *Enterprise Architecture Domains*

When asked to define what EA is, Zachman claimed that the addressing question was erroneously stated since there is not one EA, but what appears to be a set of them [5], spanning different contexts, perspectives, and granularity levels. From then on, different researchers have produced various categorizations to accommodate the identified architectural domains (also found as *layers* in the literature). As an example we provide the following categorizations.

Winter & Fischer [8] found the most common differentiations proposed by various EA frameworks to fall into five domains: *business* (enterprise organization), *process* (service development, creation and distribution organization), *integration* (IS components organization), *software* (software artifacts organization), and *technology/infrastructure* architecture.

Hoogervorst [3] proposes four architectural domains, namely *business* (principles and standards that guide business engineering), *organizational* (guides organizational engineering), *information* (guides information management), and *technology* architecture and provides with four respective frameworks the ability to operationalize each domain in practice. It is interesting to note that Hoogervorst's organizational architecture includes what Winter & Fischer explicitly differentiate as process architecture.

It soon becomes apparent that the different EA domain categorizations simply reflect different subject-matter perspectives, each one appropriate in its own respect. For this reason, in the context of this research, we will employ what Wagter et al. propose in turn [9], that, most often the different architectural domains can be grouped into three general ones: *business*, *information* and *technical* architecture. Figure 1 shows what each of the aforementioned grouped domains include.

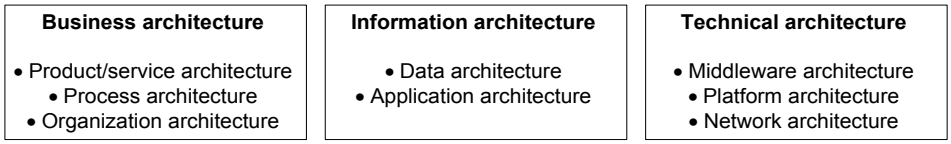


Figure 1 Enterprise Architecture domains [9].

1.1.2.2 *Defining Enterprise Architecture*

Being still a young discipline [10, 11, 12], even the precise definition of EA remains in the field of controversy [9]. Although a multitude of different definitions exist, we will briefly present some indicative ones below.

In 2000, IEEE published the IEEE 1471 recommended practice which has since served as the base for various subsequent definitions for EA. IEEE 1471 is not a standard for EA, but a set of guidelines for describing an architecture, which is defined therein as *"[…] the fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principle guiding its design and evolution"* [13].

Lankhorst constructively builds on the IEEE 1471 recommended practice to define EA as *"a coherent whole of principles, methods, and models that are used in the design and realization of an enterprise's organizational structure, business processes, information systems, and infrastructure"* [14].

Wagter et al., in a similar manner, defined EA as *"the consistent set of rules and models that guides the design and implementation of processes, organizational structures, information, applications and the technical infrastructure within an organization"* [9].

Ross et al. provide a similar, but more focused perspective on EA by defining that EA is *"[…] the organizing logic for business processes and IT infrastructure, reflecting the integration and standardization requirements of the company's operating model. The enterprise architecture provides a long-term view of a company's processes, systems, and technologies so that individual projects can build capabilities - not just fulfill immediate needs"* [15]. The authors define the "operating model" as *"[…] the necessary level of business process integration and standardization for delivering goods and services to customers"* [15].

Although the precise definition of EA is an ongoing debate, it is logical to expect that as the EA discipline matures, one precise EA definition will be adopted. At this point, the authors agree with the perspective of Berg & Steenbergen that it is not so important which definition an organization adopts, but how that definition serves the purposes of the organization [16]. Indeed, considering on one hand the wide spectrum of possible architectural endeavors that fall under the general umbrella of EA and on the other the diverse needs of different organizations, it seems plausible to ascertain that *"[a]ny given organization, in choosing a definition, should indicate as concretely as possible the nature and the scope of the architecture"* [16].

In this respect, and for the specific purposes of the research undertaken in the context of this project, the authors choose to conform to the general guidelines of the IEEE 1471 recommended practice and adopt as their perspective the aforementioned definition given by Wagter et al. in [9]. The choice is motivated partly by the fact that this definition recognizes EA as a *management tool* that fosters and directs the change processes within an organization [9] and partly on the broad nature of the definition that enables us to look at all of EA's constituent elements (i.e. principles, norms, guidelines, standards, and models), spanning different architectural domains (i.e. business, information, technical), from different abstraction levels.

1.2 What is the problem with Enterprise Architecture?

EA has generally evolved into a well-accepted discipline [12] and its importance is considered to be growing [10]. Curiously enough, to date, there exists no single comprehensive view of the ways EA might add value to an organization. This carries several implications that are examined in the following sections.

1.2.1 Enhancing the understanding of Enterprise Architecture

The absence of a scientifically grounded, comprehensive framework of EA benefits inhibits the establishment of a common understanding, among practitioners and researchers alike, of the potential of EA as a discipline and how EA may lead to the desired organizational outcomes [17].As a consequence, comparisons to other, already established business governance instruments become difficult and ambiguity is introduced over the specific value proposition of EA.

1.2.2 Establishing the Business Case for Enterprise Architecture

An integral part of any business case is demonstrating the business value of the project at hand. The business value can be demonstrated using either various financial measures (*cost-justification*) or by establishing the connection between the proposed project and the achievement of certain business goals (*contribution justification*). Traditionally, business cases are constructed using cost-justification in an attempt to measure the expected financial gain from the implementation of the project; IT investment business cases being no exception [18].

Increasingly, traditional cost-justification methods are found to be inappropriate for measuring the contribution of IS/IT investments in general [19]. More specifically, quantifying the value of EA is considered to be a challenge [11, 14] and research strictly focusing on financial benefits is considered to represent a very limited view [12].

The alternative is to make use of contribution-justification. In this respect though, the absence of a comprehensive, scientifically grounded framework of potential EA benefits inhibits establishing the business case for EA. Interestingly enough, Slot, Dedene and Maes [20] find it surprising that to a large extent, the business case for the current EA activities that take place in the business and IT world is non-existent.

1.2.3 Developing effective Enterprise Architecture contribution metrics

The absence of a scientifically grounded, comprehensive framework of EA benefits inhibits the establishment of a set of standardized and reusable technical EA effectiveness metrics since the entire breadth of the indirect effects of EA is not known.

1.3 Document Structure

This first Section introduced the reader to the main problem, as well as attempted to put the domain of EA under a certain perspective, which was adopted for the entirety of this research project. Section 2 positions the research problem, defines the objectives and the implications of this research, establishes the relevant research questions, and finally presents the research methods that were utilized for answering the research questions and meeting the objective of this research.

Sections 3 and 4 both present and elaborate on how the research undertaken conformed to the research methods utilized for producing the results, as well as present and elaborate on the results themselves. More specifically, Section 3 describes how the Structured Literature Review (SLR) [21] was undertaken and what were its results. Section 4 describes how the Designing Cycle [22] was utilized for designing the main artifact of this research project, the Enterprise Architecture Benefits Framework (EABF), and elaborates on the EABF, its constituent parts, and its applicability.

Section 5 presents a constructive discussion and an elaborate reflection on the overall research findings from the application of the research methods in Sections 3 and 4. In the same Section we

include various suggestions and proposals for future research. Section 6 concludes by presenting a summary of the research results, the research questions and their answers.

The appendices of this document contain most of the results of the various research activities, organized roughly per research step. Appendix A contains the SLR Protocol that was constructed in the context of the first part of this research, the SLR. The SLR Protocol contains the guidelines for conducting the systematic review. Appendix B contains the SLR Report, also constructed in the context of the first part of this research. The SLR Report contains the results of the systematic review. Appendix C contains information relating to the EABF.

Following the appendices, and concluding the document, is the References Section where the reader will find the works cited throughout this document.

2 Research Approach

2.1 Research Problem Definition

As has been elaborated in the introductory Section 1.2, the main research problem can be defined as:

Currently, there is no scientifically grounded, comprehensive framework of EA benefits that establishes the contribution of EA towards the achievement of organizational goals. In other words, there exists no single comprehensive view of the ways an architectural practice might add value to an organization.

Throughout the subsections of Section 1.2, we have established the exact implications of the aforementioned research problem definition, in terms of three specific problems. In brief, these are:

1. The role and value of EA appears ambiguous among researchers and practitioners.
2. Apparent inability to effectively establish the business case for EA.
3. Apparent inability to develop sets of standardized and reusable technical EA effectiveness metrics.

2.2 Research Scope & Objectives

2.2.1 Research Objective

The objective of this research was the establishment of a theoretical framework of EA benefits (EABF) that will enable a better understanding of EA applicability and its potential contribution towards the achievement of business goals.

2.2.2 Research Question

The two formal research questions that were answered in the course of this research are:

RQ 1. *What are the benefits of Enterprise Architecture?*

RQ 2. *What is the Enterprise Architecture benefits' role in the achievement of business goals?*

2.3 Research Implications

The proposed theoretical framework of EA benefits is expected to have the following implications for both practitioners and researchers:

- Enhance the understanding of how EA may lead to the desired organizational outcomes [17].
- Provide the necessary transparency on the direct and indirect contribution of EA towards the achievement of specific organizational goals, so as to establish the Business Case for it.
- Provide the theoretical base of benefits on which other theoretical propositions can be developed and tested.
- Guiding the development of effective, context-aware, accounting, performance or other EA metrics related to the desirable organizational outcomes.

In the consecutive subsections an elaboration follows on the aforementioned implications that motivate the ways each one of them is relevant to the industry, the academia or both.

2.3.1 Scientific Relevance

EA is considered to be a relatively young discipline [10, 11, 12]. From the early 1990's, when Zachman published his highly influential EA framework [5, 6, 7], it was not until the beginning of the 2000's when EA became an emerging field in prominent academic publications.

In 2000, IEEE established the IEEE 1471:2000 recommendation "for architectural description of software-intensive systems" [13]. In 2003, Ross [23] presented EA as the guideline towards IT and business strategy alignment. The same year, the United States Government Accountability Office [24] presented a framework to be used for the assessment and improvement of EA and EA governance. In 2005, Lankhorst [14] tried to define the problem domain of EA, relate it to already established business governance instruments and presented several methods and techniques for creating integrated architectural descriptions. In 2006, Ross et al. [15] acknowledged the strategic importance of EA and presented a four-stage maturity model. In 2007, Boh & Yellin [25] claimed finding positive effects on enterprise-wide IT resources management from the use of EA standards.

In accordance with the claim that EA is in its infancy, numerous other prominent theories, frameworks, methods, and techniques are currently clashing for prevalence both among the academia and practitioners. Amidst this natural—and beneficial for the development of the field—collision of ideas, practitioners report a variety of potential benefits that an EA initiative might provide an organization [17]. These benefits appear however to be inconsistently scientifically grounded [17].

The concept and the practice alike of EA are considered to be wide-ranging, spanning various scientific and professional disciplines. As such, the effect of EA on business goals is found in reality to be rather indirect [12].

Although the (mostly practitioner-oriented) literature -on the whole- displays an abundance of potential EA benefits, these are mostly inconsistently scientifically grounded [17]. Even in those cases that the EA benefits are consistently and scientifically grounded, they are usually presented as being under the direct influence of the architectural practice (Figure 2 (a)), completely lacking any justification as far as the cause and effect relationships between them, the EA practice and the ultimate business goals are concerned.

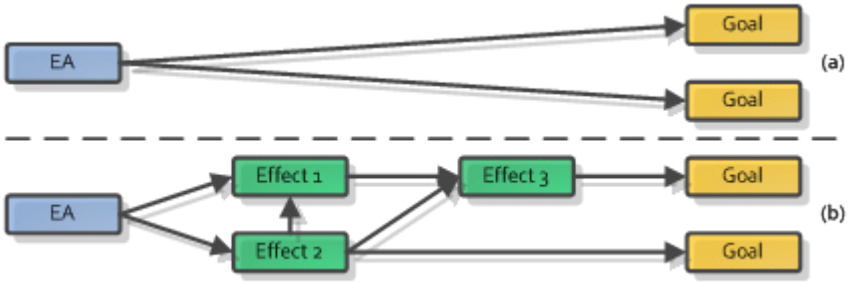


Figure 2 Different cause and effect justifications. Drawing based on the Architecture Effectiveness Model (AEM) [12].

In the publications of Ross & Weill [26]–and more extensively reappearing in Ross et al. [15]–we have been able to locate the only relevant research where architectural benefits are properly

scientifically grounded and in addition provision was taken in identifying some level of the cause and effect relationships between them, the EA practice and the ultimate business goals. A preliminary research though on the potential benefits of EA revealed that the list of benefits presented in [26] is not in any way comprehensive.

A second criticism is that the cause and effect relationships presented have not been supplied along with the relevant data that would allow us to back-trace how they concluded on these specific relations. A last criticism relates to the way three types of EA benefits are presented: technology-related, business-related and strategic business impacts. Although they identify several intrinsic cause and effects relationships for each of the technology-related and business-related benefits, they miss informing us which are those cause and effect relationships between the technology-related, business-related and strategic business impacts. In other words, they do not inform us how the aforementioned technology and business-related benefits contribute both one to another and to the achievement of the strategic business benefits. Of course, the aforementioned criticisms appear to be—partly at least—justifiable since the research presented in [15, 26] is primarily concerned with how these benefits are attained as organizations mature their business processes and IT capabilities.

Steenbergen & Brinkkemper [12] conducted several relevant exploratory case studies and found that in reality, the nature and complexity of the cause and effect relationships occurring between multiple differencing benefits is far more complicated (Figure 2 (b)).

The establishment of a theoretical framework of potential organizational benefits of EA is not only relevant scientifically per se, but also in several other ways. It is expected to enhance the understanding of academics on the potential benefits of EA and how these may lead to desired organizational outcomes [17]. Additionally, it is expected to serve as a theoretical foundation for examining and testing more complicated theoretical propositions related to the value of EA [17]. For example, several contextual dimensions of EA benefits can be researched in relation to specific EA practices and organizational characteristics [17].

2.3.2 Business Relevance

The construction of a comprehensive framework of EA benefits is also socially relevant for several reasons:

Admittedly, and as established in Section 2.3.1 (i.e. partly because EA is a young, evolving discipline), there is a lack of common definition among practitioners that range from the basic understanding of the nature of EA itself (e.g. confusion with IT architecture) to the potential benefits of EA. In practice, usually this results in the creation of a per-vendor marketing-hype (e.g. SOA). As mentioned in Section 2.2.1, the final artifact of this research is not expected to significantly enhance the common definition of EA per se, but will enhance the understanding of practitioners over the potential benefits of EA and promote a common understanding of the EA discipline value proposition.

Second, also an implication of the previous effect, the framework will enable the establishment of the Business Case for EA. Contribution-justification demands enhanced understanding and total visibility of the ways in which EA directly or indirectly contributes to the achievement of certain business goals. Simply put, currently, such understanding and visibility is not possible because no scientifically sound, systematic effort has being made to not only classify the benefits of EA, but also

establish the relationships between them and how they contribute on their part to the achievement of business goals. Practitioners will thus be able to reason in a scientifically grounded way about how EA might contribute to the achievement of certain business goals.

Third, the insight and depth provided by this research will enable practitioners to define more effective and highly-targeted metrics for assessing the effectiveness of EA. Ideally, these metrics will be chosen from a standard list of metrics, scientifically grounded and developed specifically for the established benefits of EA from this research.

2.4 Research Process

The overall research process that was followed during this research project has been modeled by adapting the Information Systems Framework elements as proposed by Hevner et al. [27] and then overlaying the specific process steps of this research. The resulting research diagram is presented in Figure 3 and represents the core planning on how this research project consulted the existing knowledge base (Figure 3-2), built (Figure 3-3) and evaluated (Figure 3-4) the artifact that added to the knowledge base (Figure 3-5) the necessary elements to tackle the existing environmental issues (Figure 3-1) that have been the triggers for this research project. It is important to stress at this point that the entire research project does not qualify as design-science research. More specifically, only the second part of this research project, the design of the EABF artifact, qualifies as such. Nevertheless, we found the concept of the IS Framework elements to be very helpful in charting the overall research process.

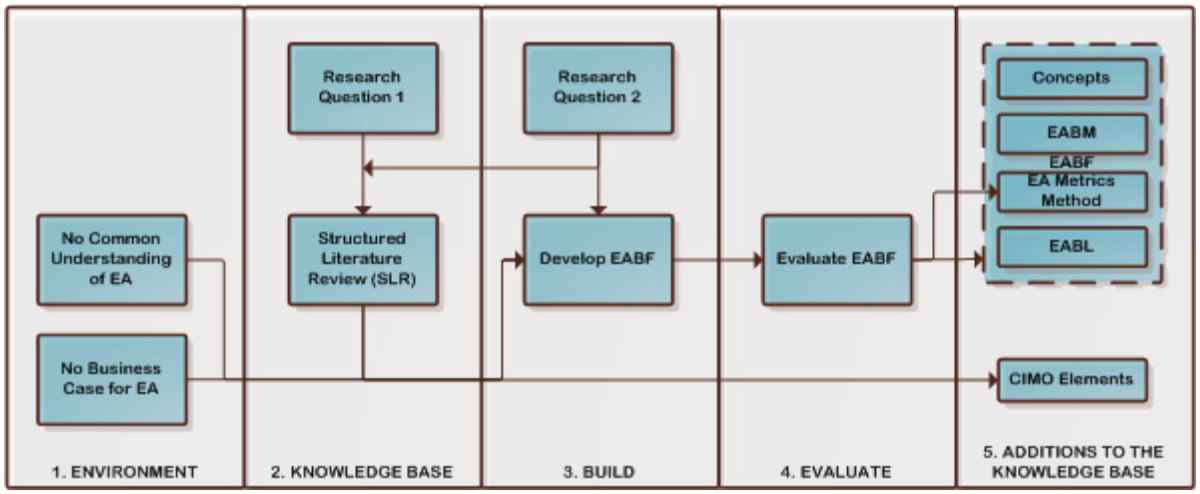


Figure 3 Overall Research Process

2.5 Research Methods

In this section we motivate and document the various research methods employed in the context of this research. In Section 2.5.1 we describe the research method that was undertaken for conducting the systematic literature review and data synthesis that produced the list of EA Benefits. In Section 2.5.2 we describe the research method that was utilized for designing the Enterprise Architecture Benefits Framework (EABF) artifact.

2.5.1 Systematic Review Research Method

The first step for constructing the EABF was synthesizing the list of EA Benefits with data from the relevant literature concerning the field of EA architecture, including surveys, etc. Below we analyze

how this research process was handled in order to ensure that the final EA Benefits list was constructed in a transparent, traceable and replicable way.

Tranfield et al. [21] develop a methodology for conducting Structured Literature Reviews (SLR) pertinent to the management research domain by transposing relevant, established and highly influential methodologies from the medical research domain, like the ones described in the *"Cochrane Handbook for Systematic Reviews of Interventions"* [28] by *The Cochrane Collaboration* and the *"Systematic Reviews: CRD's guidance for undertaking reviews in health care"* [29] by York University's *Center for Research & Dissemination* (CRD).

Armitage & Keeble-Allen studied the application of the aforementioned methodology of Tranfield et al. in respect to research projects undertaken by graduate students. While in general they find the approach of Tranfield et al. to be highly relevant and necessary as a qualitative literature review methodology–especially in the management discipline–, their research findings suggest that for such projects particularly, it is inappropriate because of the new set of conceptual, methodological and data collection demands that the specific research paradigm imposes. For this reason they developed the Rapid Structured Literature Review (RSLR), a "light" version of SLR, specifically designed for smaller-scale research projects and propose its usage over SLR specifically for graduate projects [30].

Armitage & Keeble-Allen further report though, that those graduate student researchers that make use of such a rigorous and structured approach appear to benefit from an important additional bottom-line contribution to the overall insight and knowledge acquired from the domain under question. Having full knowledge of the additional work load that was needed for conducting a SLR instead of a RSLR, and for this last reason, the authors opted following the SLR methodology proposed by Tranfield et al. [21].

To this extent, a SLR method was developed for scanning through and locating potential EA benefits in the relevant EA scientific literature. The aforementioned methodology provided us with the overall guidelines for conducting the systematic review and the rationale for the necessary method adaptations to the management domain. However, it was deemed necessary to consult the initial sources (mainly [29]) for certain aspects that required deeper subject-matter knowledge and clarification than that provided in Tranfield et al. [21].

2.5.1.1 *The Structured Literature Review (SLR)*

According to Tranfield et al. [21], an SLR comprises of three main Stages with nine subsequent Phases (Figure 4). In the subsequent sections we present and elaborate on those Phases that are relevant to this research.

2.5.1.1.1 Phase 1—Review Proposal Preparation

Prepare a review proposal that describes the need for conducting the literature review.

2.5.1.1.2 Phase 2—Review Protocol Development

Start Phase 2 with forming a *review panel* consisting of several experts in the EA field. The review panel is responsible for settling any disputes that might arise over the inclusion or exclusion of studies and for providing general direction during the course of the review.

Continue by conducting "scoping studies" in an effort to put the problem into context and uncover similar or alternative studies done in the field. Include any such studies found in the scoping study.

Last but not least, construct the *review protocol*, which serves as the overall research plan that will be followed for conducting the systematic review. By describing the steps to be taken in the review protocol, we are taking measures that ensure the objectivity of the review. Departing from Tranfield et al., the review protocol is selectively constructed as a synthesis of the guidelines presented in CDR's [29] and Cochrane Collaboration's [28]. According to the views of Tranfield et al., the review protocol should not compromise the creative abilities of the researcher. Management reviews are considered to be an explorative/creative process, so the review protocol ought not to be rigid whilst ensuring an unbiased research outcome [21].

2.5.1.1.3 Phase 3—Research Identification

By utilizing the review protocol, the first step in conducting the systematic review, is to establish the search strategy (e.g. keywords, search terms, Boolean operators) that will be applied on the various information sources (e.g. journals, bibliographic databases, studies, surveys, conference proceedings, etc).

2.5.1.1.4 Phase 4—Studies Selection

The second step concerns locating the candidate studies that fulfill the criteria established in the review protocol. Tranfield et al. inform us that this phase usually proceeds iteratively: the researcher reviews and identifies the relevant studies or excludes the irrelevant ones with increasing scrutiny [21]. Every decision made for the inclusion or exclusion of certain studies has to be well documented. Enhancing the Tranfield et al. SLR method, we adopted (and slightly modified) the Cochrane Handbook's [28] four-step process (Phases 4.1–4.4) for selecting studies that conform to the selection criteria.

Phase 4.1—Search results merging and duplicate records removal

Merge initial search results and delete duplicate records. Document the initial search results.

Phase 4.2—Obviously irrelevant records removal

Perform initial examination of titles and abstracts and remove obviously irrelevant reports. Document excluded records together with the reason for their removal (exclusion).

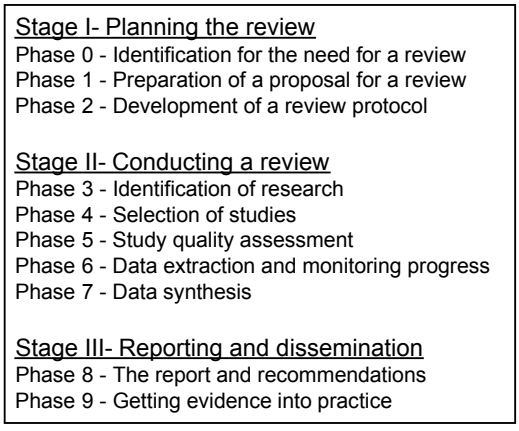
Phase 4.3—Potentially relevant records full text retrieval

Retrieve the full text of the potentially relevant records remaining after the previous step. This includes locating full text records under currently available repositories (according to the researchers' institutional library accounts) as well as retrieving or purchasing full text records as needed.

Phase 4.4—Link together multiple reports of the same study

Link together multiple reports of the same study in order to resolve (potentially) duplicate or overleaping results.

Figure 4 Stages of a Systematic Review [26]



2.5.1.1.5 Phase 5—Studies Quality Assessment

The third step is a highly controversial one, since it involves subjective judgment as the basis for evaluating the quality of qualitative research. Tranfield et al. make a point by questioning the fit of traditional systematic reviews (using standard criteria in studies that employ quantitative methods) for assessing qualitative research and propose that quality conclusions regarding qualitative studies are instead more appropriate when thoroughly documented, explicating the researcher's own conception of "good" and "bad" quality. Enhancing the Tranfield et al. SLR method, we adopted (and slightly modified) the Cochrane Handbook's [28] three-step process (Phases 5.1–4.3) for qualitatively assessing studies that conform to the selection criteria.

Phase 5.1— Full-text eligibility criteria compliance examination

Examine full-text reports for compliance of studies with eligibility criteria and evaluation criteria.

Phase 5.2—Eligibility clarification & further information requests

Correspond with investigators, where appropriate, to clarify study eligibility (it may be appropriate to request further information, such as missing results, at the same time).

Phase 5.3—Finalize study inclusion

Make final decisions on study inclusion and proceed to data collection. Resolve disagreements with the aid of the Review Panel.

2.5.1.1.6 Phase 6—Data extraction

In the next step, and after applying the established quality assessment criteria on the pool of studies, extract the necessary data onto the data-extraction forms (or data-collection forms). A data-extraction form is a custom data repository that includes the relevant studies selected for assessment during the review. According to the Cochrane Collaboration Handbook [28], they serve several purposes, most important of which is to maintain a historical record of all study-related decisions taken during the review. The data-extraction forms will be created along the guidelines of the Cochrane Collaboration Handbook [28].

2.5.1.1.7 Phase 7—Data Synthesis

In Phase 7 apply a methodology for synthesizing the findings. The research synthesis method selected for summarizing, integrating and cumulating [21] the findings of the SLR is that of *design-oriented research synthesis,* proposed by Denyer *et al.* [31]; which is in essence an extension of Pawson's *realist synthesis* method [32]. The design-oriented research synthesis method is used in order to develop *design propositions* (or *technological rules* [33]) in the lines of the Context Intervention Mechanism Outcome logic or simply *CIMO-logic* [31].

For Aken, a technological rule is a fragment of general knowledge (or general solution) that in a specific field of application links an intervention or an artefact with some expected outcome or performance [34]. Denyer et al. similarly see a design proposition as offering a general template for creating solutions for a specific class of problems [31].

Table 1 The components of Design Propositions (adapted from [31])

Component	Explanation
Context (C)	The given (problematic) context in which a specific intervention *I* will produce an outcome *O*.
Interventions (I)	An intervention type (or artefact) to be used for solving a specific problem.
Mechanisms (M)	The mechanism that in a certain context *C* is triggered by the intervention *I*. A generative mechanism answers the question "why does this intervention (in this context) produce this outcome?" [34].
Outcome (O)	The outcome of the intervention in its various aspects, such as performance improvement, cost reduction or low error rates.

A design proposition made up of CIMO-logic components (Table 1) is formed in principle as follows: for some problematic Context(s), use some specific Intervention(s) that will invoke some generative Mechanism(s) that in turn will deliver the desired Outcome(s). Design propositions thus not only inform on what to do in a specific situation in order to create a specific effect but more importantly, they offer some insight on why it happens [31].

It is important to stress at this point that the CIMO-logic does not prescribe the specific form of a design proposition, but rather forms its underlying logic. As Denyer at al. point out, design propositions "[...] in organization and management studies are seldom reduced to algorithms and can take the form of an article, a report, a training manual or a whole book" [31]. What is more, a design proposition may be comprised of multiple CIMO-logic component variables (*C*, *I*, *M*, *O*), combined in various ways, spanning multiple scope detail levels and appearing in possibly nested structures [31].

2.5.1.1.8 Phase 8—Review Report Development

In Phase 8, produce the final report which consists of two parts. The first describes the field as it was found to be with the SLR. Provide enough detail for the various variables categories that were gathered with the aid of the extraction forms and provide with broad statistics an account of the entire field. The second part relates to reporting on major themes identified during the review. For example, the researcher will provide data on any research themes where shared consensus is identified, key research findings are seen, and important research questions posed.

2.5.1.1.9 Phase 9—Disseminate Review Results

Disseminate and put into practice the results of the review.

2.5.2 EABF Design Research Method

The research methodology that was followed for the design, construction and evaluation of the EABF artifact is the design-science method proposed by Verschuren and Hartog [22]. The authors propose the *Designing Cycle* as a generic design-oriented research methodology (Section 2.5.2.1) and introduce and elaborate extensively on several evaluation methodologies (Section 2.5.2.2) to be applied either in tandem with the aforementioned research methodology or separately as needed. The overall concept of the methods, evaluation criteria and guidelines introduced by Verschuren and Hartog refers to the application of a structured, rigorous research method with explicitly defined evaluation rules and design criteria for designing an artifact.

2.5.2.1 *The Designing Cycle*

Central to the designing process, as seen by Verschuren and Hartog, is the *Designing Cycle* (Figure 5). The Designing Cycle describes the generic stages of the designing process and consists of six stages, whose main concepts, outputs and evaluation methods we briefly present below.

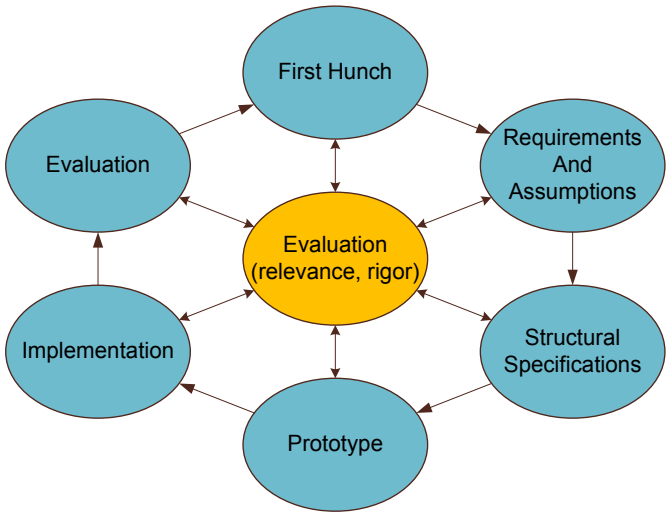


Figure 5 The Designing Cycle of Verschuren and Hartog [22] (adopted from [35])

1. ***First Hunch*** - The designing process begins with the realization of the need for or the conception of a new artifact (material or immaterial). The main output of this first stage is the set of Goals ([G]) that the realization of the novel artifact will achieve.
2. ***Requirements & Assumptions*** - The second stage concerns itself with specifying the sets of *requirements* ([R]) and *assumptions* ([A]) relevant to the goal(s). The requirements generally describe what should be fulfilled within the context set by the goal(s). The assumptions generally describe the designer-set qualities, capabilities or characteristics the future users, context and functions must exhibit in order to effectively utilize the artifact. Both requirements and assumptions are classified in three distinct categories. Requirements are classified under a) *functional requirements* ([R_f]) that describe what are the functions the designed artifact should be able to or enable to perform and those functions the artifact should fulfill, b) *user requirements* ([R_u]) that reflect the demands of the users of the system and c) *context requirements* ([R_c]) that reflect the demands of the context (e.g. political, economical or social environment) surrounding the artifact. Assumptions are similarly classified under *functional assumptions* ([A_f]), *user assumptions* ([A_u]) and *context assumptions* ([A_c]).
3. ***Structural Specifications*** - In the third stage, requirements and assumptions are used to derive the actual *structural specifications* ([S]) of the artifact. Structural specifications entail a somewhat detailed description of the intended structure of the artifact in terms of its different aspects, elements and characteristics. The final product of all the first three planning stages is a document that contains a detailed first draft of the design.
4. ***Prototype*** - In the fourth stage, a prototype is realized or materialized according to the detailed design. In this stage it is important to explicitly indicate how the structural specifications have been implemented by the prototype artifact.
5. ***Implementation*** - In the fifth stage, the prototype is put into practice in order to test its proper functioning before the next stage.

6. ***Evaluation*** - In the sixth and last stage of the Designing Cycle, the prototype is tested in order to assess the extent to which its short and long-term utilization generates effects that both fit the design goals and satisfy the expectations of the designer and the various stakeholders.

2.5.2.2 *Evaluation Types*

In [22], the authors elaborate on various evaluation types. A distinction is made between three different evaluation types for different Design Cycle stages (Table 2), namely *plan*, *process* and *product evaluation*. Plan evaluation concerns evaluating the quality of an artifact's design on paper. Process evaluation concerns evaluating the constructive activities and means used in realizing the plan. Product evaluation concerns identifying the designing process results, their value, as well as the artifact's short and long-term effects. As the authors note though, process and product evaluation may be used to any of the stages 1-6.

Table 2 Evaluation types of Design Cycle Stages

Design Cycle Stage	Evaluation Type
1. First Hunch	Plan
2. Requirements & Assumptions	
3. Structural Specifications	
4. Prototype	Process
5. Implementation	
6. Evaluation	Product

Additionally, the authors elaborate on evaluation serving different purposes. A first distinction is made between *summative* and *formative evaluation*. An evaluation is said to be summative when it is performed after the artifact is constructed and formative when it amends/improves the artifact or its design. A second distinction is made between *ex ante* and *ex post* evaluation. An evaluation is said to be ex ante when it takes place before an activity, in a feed-forward manner that will increase the designer's confidence on the result and ex post when it takes place after the activity has concluded in order to either provide feedback or decide on the continuation of the designing process. A third and final distinction is made between *goal based* and *goal free* evaluation. An evaluation is said to be goal based when it judges an artifact or its design against the design goals and goal free when it judges an artifact or its design against general professional criteria.

3 Enterprise Architecture Benefits

This first part of the research conducted, concerned a synthesis of the potential benefits of EA appearing in the existing knowledge base. In other words, the aim of this first, explorative in nature, research sub-step was to discover from within the existing knowledge base those ways an EA practice might contribute to the achievement of business goals, as seen by both researchers and practitioners of the field. Although the goals of this undertaking are indeed self-containing since the results are important to both academics and practitioners per se, in the context of the overarching research project they form only its first part and function as input to the second. The second part refers to the creation of the EABF framework, which in essence is a visual-oriented way of describing, documenting and making sense of the EA Benefits and their Relationships, as well as establishing EA measures of effectiveness.

In the sub-Sections that follow, we first provide in Section 3.1 a detailed account of how we utilized the adjusted SLR method for performing systematic reviews by Tranfield et al. [21]. The description of the method itself was presented in Section 2.5.1. Additionally, we provide the results of the various research activities, together with the activities through which they were generated. Important results are provided separately in sub-Section 3.2 and additional results in Appendix B, for presentation reasons: most of the results refer to long-spanning tabular data. The attempted synthesis of the results of the SLR is presented in Section 3.3.

3.1 Conformance to the SLR Method

In this section we describe how the literature review undertaken conformed to the adjusted SLR method of Tranfield et al. [21] (Section 2.5.1.1). To this end, in the following subsections we map the various research activities performed during the review on the nine phases of the SLR method and report on their results.

3.1.1 Phase 1—Review Proposal Preparation

After identifying the need for a structured literature review, a small scoping study was conducted in order to acquire a broad idea of the available literature, the relevant search engines, appropriate keywords, etc. A review proposal was produced and subsequently confirmed by one of the research advisors for this project. A Review Panel was assembled with the aim of resolving disputes. The members of the Review Panel were experienced researchers and practitioners in the field of EA.

3.1.2 Phase 2—Review Protocol Development

A review protocol was selectively developed along the guidelines for protocol construction presented in CRD [29] and Cochrane Collaboration [28]. The complete SLR Protocol is provided in Appendix A of this document. The main objectives of the SLR Protocol construction was to establish the relevant background for the literature review by identifying and justifying the research topic (A.1.1), to establish the rationale and importance of conducting the literature review (A.1.2), to set a formal objective that would guide the entire process (A.2), and lay down the methods/guidelines that would be used for conducting the review (A.3).

3.1.3 Phase 3—Research Identification

Building on the SLR Protocol guidelines, we defined a list of search engines and a list of relevant keywords that were used for searching them. The following academic-oriented search engines (Table 3) were used in order to track the relevant literature contributions. Some are freely available to the

public while some require a subscription, which was available to the researchers as part of their institution's library[1] subscriptions.

Table 3 Search Engines. Column [Last Search] specifies the date of the last search performed for each of the Search Engines.

Search Engine	URL	Last Search
CiteSeerX	http://citeseerx.ist.psu.edu/	08/10/2010
IEEE Computer Society Digital Library	http://www.computer.org/portal/web/csdl	08/10/2010
Science Citation Index (SCI)	http://www.isiknowledge.com/	08/10/2010
EBSCO	http://search.ebscohost.com/	08/10/2010
Elsevier/Science Direct	http://www.sciencedirect.com/	08/10/2010
Emerald	http://www.emeraldinsight.com	08/10/2010
ACM (The ACM Guide)	http://portal.acm.org/guide.cfm	08/10/2010

Table 4 Search Keywords

Keywords
("enterprise architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("it architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("information technology architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("business architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("organizational architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)

Table 5 Electronic Search Results per Search Engine.

Search Engine	Results	% of Total Results
Science Citation Index (SCI)	187	30.5
The ACM Guide	161	26.3
IEEE Computer Society Digital Library	128	20.9
CiteSeerX	50	8.2
Emerald	37	6.0
Elsevier/Science Direct	33	5.4
EBSCO	17	2.8
Total	**613**	**100.0**

In each of the aforementioned search engines, the keywords in Table 4 were generally searched for in the abstract of contributions. Capitalized *AND*, *OR* are Boolean operators. Phrases in quotes are treated by the search engines as inseparable, exact matches. During the electronic search, there were 35 searches performed for all Search Engines. In total there were 613 results retrieved (Table 5). A detailed account of the searches is provided in Appendix B.6.3, Table 57.

[1] Utrecht University Library (http://www.uu.nl/en/library/Pages/default.aspx).

In addition to the electronic searches, other contributions were identified through alternative sources and were subsequently included in the review. In the context of the researchers' personal collection of studies and in the context of the scoping study performed earlier in the process of this SLR, *19* relevant contributions were identified. Additionally, during the review process, an additional *18* relevant studies were located by examining the references of the contributions. All these studies found through other types of searches (Table 6) were incorporated into the list of results of the electronic searches as "manually added contributions" and "back-references" respectively.

Table 6 Manually-added Contributions

Addition Type	Contributions
Manually added contributions	[3, 10, 12, 14, 17, 26, 36-48]
Back-references	[49-66]

3.1.4 Phase 4—Studies Selection

During the SLR phases 4.1 and 4.2, 543 contributions were found to be either duplicates or obviously irrelevant, judging by the titles and abstract. In the end of phase 4.2 there were 70 potentially eligible contributions remaining. In Phase 4.3, the full text of all the potentially relevant records remaining after the previous step was retrieved. This included locating full text records under currently available repositories (according to the researchers' institutional library accounts) as well as purchasing full text records or retrieving them through other means (e.g. contacting authors). Finally, in Phase 4.4 multiple reports of the same study were linked together in order to resolve (potentially) duplicate or overleaping results.

3.1.5 Phase 5—Studies Quality Assessment

In assessing the quality of the contributions located from the electronic searches, as well as those located through other means, two types of criteria for considering studies for this review were developed. The first relates to an evaluation of the eligibility of the study type (Section 3.1.5.1) and reflects the initial decisions made in the SLR Protocol on the nature and focus of the SLR. The second relates to an evaluation of a study's inner quality aspects (Section 3.1.5.2). Subsequently, in Phase 5.1 full-texts of contributions were examined for compliance with the eligibility criteria and evaluation criteria. In Phase 5.2 the contributions' authors were contacted, where appropriate, to clarify study eligibility. Final decisions on study inclusion were made in Phase 5.3 where a Review Panel member was consulted. In the sub-sections that follow, we begin by presenting and motivating both evaluation criteria types and we proceed by presenting and elaborating on the results of the evaluation: the included and excluded contributions.

3.1.5.1 *Eligible types of studies criterion*

This SLR focused on all quantitative, qualitative (ethnomethodology, grounded theory, phenomenology etc.) and mixed-method contributions to the knowledge base. In other words, an inter-disciplinary approach on primary data was adopted in order to capture the broadest possible definitions of EA benefits that appear in the literature. As such, we defined the eligible types of core contributions to be the following:

i. Academic journal articles
ii. Practitioner-oriented journal articles

iii. Conference proceedings
iv. Workshop proceedings
v. Research reports/briefings
vi. Organizational literature
vii. Government & organizational statistics, including surveys
viii. Dissertations, theses
ix. Books
x. Book Chapters

The eligible types of contributions cover not only scholarly (peer reviewed) research but also include *grey literature* (i.e. literature that has not been formally published). This did not pose any threat to the validity of the literature review results as the individual quality of each of the contributions was established within the context of the synthesis of this literature review (Section 3.1.5.2). In addition, inclusion of grey literature to systematic reviews is even considered to be advantageous in order to help minimize publication bias effects [67, 68]. Especially in the context of systematic reviews that undertake meta-analysis, researchers are encouraged to include grey literature that meets some predefined inclusion criteria [69].

3.1.5.2 *Studies evaluation criteria*

An attempt to research the relevant literature on evaluation criteria for quantitative, qualitative and mixed-method studies unavoidably drags one in, in what is widely known in the academia as a paradigm war between not only quantitative versus qualitative research proponents but also among the qualitative research advocates as well.

There is an ongoing debate concerning not only what should be the criteria to judge qualitative research, but more importantly, if qualitative research ought to be judged in the first place [70, 71] . As Walsh & Downe inform us, this is an issue that has been quite often avoided by some researchers in the past with the rationale that being all-inclusive is more important than the individual rigor of the studies in question [72].

Sandelowski effectively frames the whole issue on the diverse nature of qualitative research and on the lack of consensus both on its conforming rules and its comparability to quantitative research [73]. The latter sparks another debate, whether qualitative research can and should be assessed using the same criteria with qualitative research [71]. Although there are multiple views on the subject, we chose to understand the issue using the simplifying binary classification scheme proposed by Murphy *et al*. that makes a distinction between *post-positivism* [70] and–as Mays & Pope explicate–*anti-realism* [71].

Anti-realists advocate the use of different evaluation criteria. Post-positivism is associated with those researchers that advocate the use of the same broad criteria for evaluating all research [70]. For this research, we adopt a post-positivism standpoint and more specifically, we constructively embrace the *subtle-realism* philosophy [74] which advocates that,

> *"quality in qualitative research can be assessed with the same broad concepts of validity and relevance used for quantitative research, but these need to be operationalised differently to take into account the distinctive goals of qualitative research" [71].*

According to Hammersley, *relevance* is a quality a study displays, when it is investigating issues of significance and either makes an original contribution to the existing knowledge base or tests what we already know [74]. In other words,

> *"[…] to be relevant, research must in some way contribute to the accumulation of knowledge" [70].*

Validity reflects a common, recurring research evaluation criterion in the scientific literature. For Murphy, it is that extent to which you limit the likelihood of the occurrence of error [70]. Yin breaks down the concept of validity into *construct* (appropriateness of operationalization of the investigated concepts), *internal* (the extent to which effects causality is established) and *external validity* (establishment of the study's generalization context) [75].

Table 7 Assessment Screening Questions

ID	Assessment Question	Answer Possibility
S_1	Eligible contribution type	{TRUE|FALSE}
S_2	Relevant to synthesis	{Agree|Partially Agree|Disagree|Other}
S_3	Scientifically relevant	{Agree|Partially Agree|Disagree|Other}
S_4	Research aims clearly stated	{Agree|Partially Agree|Disagree|Other}
S_5	Methodology appropriate	{Agree|Partially Agree|Disagree|Other}
S_6	Include in synthesis	{Agree|Partially Agree|Disagree|Other}

Table 8 Qualitative Research Assessment Questions

Category	ID	Assessment Question	Answer Possibility
Research Design	QL_1	Research design appropriate	{Agree|Partially Agree|Disagree|Other}
Sampling	QL_2	Sampling strategy appropriate	{Agree|Partially Agree|Disagree|Other}
Data Collection	QL_3	Data collection addresses research issue	{Agree|Partially Agree|Disagree|Other}
Data Analysis	QL_4	Data analysis rigorous	{Agree|Partially Agree|Disagree|Other}
Findings	QL_5	Findings explicitly stated	{Agree|Partially Agree|Disagree|Other}
Research Value	QL_6	Findings are transferable	{Agree|Partially Agree|Disagree|Other}
Reflexivity	QL_7	Researcher bias recognized	{Agree|Partially Agree|Disagree|Other}

In the context of the criteria that were used for the literature evaluation, we operationalized the concepts of validity and relevance using insights from criteria checklists for qualitative and quantitative research from various sources. First, we defined screening questions (Table 7), applicable to all research methodology designs. The answers to these screening questions were critical in deciding on the appropriateness for further evaluation of a specific literature contribution and for inclusion in the data synthesis process. The concept of relevance specifically, was assessed by questions S_1 and S_2. Failure to positively answer any of the screening questions, resulted in automatic exclusion from the synthesis (S_6="No"). Question S_6 represents the final judgment of the reviewer towards the specific contribution. The questions were not necessarily answered in sequence.

In Table 8 we present the criteria against which qualitative research studies were evaluated for inclusion or exclusion. Questions QL_1 to QL_7, operationalize the concept of validity in the context of qualitative research. The criteria list is an adaptation of the criteria lists appearing in the Public Health Resource Unit's (PHRU) Critical Appraisal Skills Programme (CASP) [76], in [77] as well as in [71].

In Table 9 we present the criteria against which quantitative research studies were evaluated for inclusion or exclusion. Questions QN_1 to QN_6, operationalize the concept of validity in the context of quantitative research. The criteria list is an adaptation of the list appearing in the University of Salford Health Care Practice Research & Development Unit's (HCPRDU) "Evaluation Tool for Quantitative Research Studies" [78].

Table 9 Quantitative Research Assessment Questions

Category	ID	Assessment Question	Answer Possibility
Research Design	QN_1	Research design appropriate	{Agree|Partially Agree|Disagree|Other}
Sampling	QN_2	Sampling strategy appropriate	{Agree|Partially Agree|Disagree|Other}
Outcome Measurement	QN_3	Outcome measures useful/appropriate for practice	{Agree|Partially Agree|Disagree|Other}
Research Value	QN_4	Findings are transferable	{Agree|Partially Agree|Disagree|Other}
Ethics	QN_5	Ethical issues adequately addressed	{Agree|Partially Agree|Disagree|Other}

The evaluation criteria presented in Table 8 and Table 9 do not represent absolute checklists in the sense that a specific contribution was not evaluated solely on its "elegant" research design. As this research adopted a *realist synthesis* approach (see Section 2.5.1.1.7) for the data synthesis part of this review, the previously stated explicit evaluation criteria were used as *supplements* to the overall evaluation of a specific contribution and as an extension, to the cumulative qualitative evaluation of the existing literature in the domain of EA that aims to identify the potential benefits of EA.

In line with other researchers' views, every contribution was mainly judged based on its "fit for purpose" [79], whether it added anything important to our understanding of the phenomenon under review [80], and on its quality as it was established in relation to the rest of the contributions of the synthesis [81]. Thus, highly relevant and original contributions were included in the review even if they displayed certain quality issues.

To operationalize the above concept, evaluation criteria in Table 8 and Table 9 only *partially* shaped the reviewer's final decision towards the screening question S_5. In certain cases, the final decision for a contribution was based not only on the appropriate research assessment questions from either Table 8 or Table 9, but also on the overall judgment of the relevance and value of the contribution to the review.

3.1.5.3 *Included studies*

During Phase 5 of the SLR, 107 contributions in total (70 from electronic searches and 37 manual additions) have been examined for qualitative eligibility (see Table 10) according to their type

(specified in Section 3.1.5.1) and according to the evaluation criteria (specified in Section 3.1.5.2). From these 107 potential contributions, 93 have been subsequently excluded (Appendix B.6.4, Table 59), resulting in 14 eligible (accepted) contributions (Appendix B.6.4, Table 58) in total.

Table 10 Summary of All Contributions

ID	Contributions Sources Name	Count
SE	Contributions from Electronic Searches	70
M	Manually Added Contributions	19
BR	Manually Added Back-References	18
	Total Contributions for Full-text Eligibility Examination	107
	– Rejected Contributions	93
	Eligible (Accepted Contributions)	**14**

The accepted contributions' full-text eligibility review details and comments are provided separately for qualitative (Appendix B.6.4, Table 60) and quantitative (Appendix B.6.4, Table 61) research studies. From the 14 accepted contributions, 8 where qualitative research and 6 quantitative. The most common contribution types were conference proceedings, with journal articles and organizational statistics following (Figure 7). The most common contributions' research designs were those of survey (57%) and case study (29%) (Table 11).

Table 11 Accepted Contributions Research Designs Frequencies

Research Design	Frequency	(% of Total)
Survey	8	57%
Case study	4	29%
Action Research	2	14%
Total	**14**	**100%**

Table 12 Ratio of Accepted and Rejected Contributions per Source, over Total Contributions for Examination of Full-text Eligibility.

	SE	M	BR	Total
Accepted	6 (5.6%)	6 (5.6%)	2 (1.9%)	**14 (13.1%)**
Rejected	64 (59.8%)	13 (12.1%)	16 (15.0%)	**93 (86.9%)**
Total	**70 (65.4%)**	**19 (17.8%)**	**18 (16.8%)**	**107 (100.0%)**

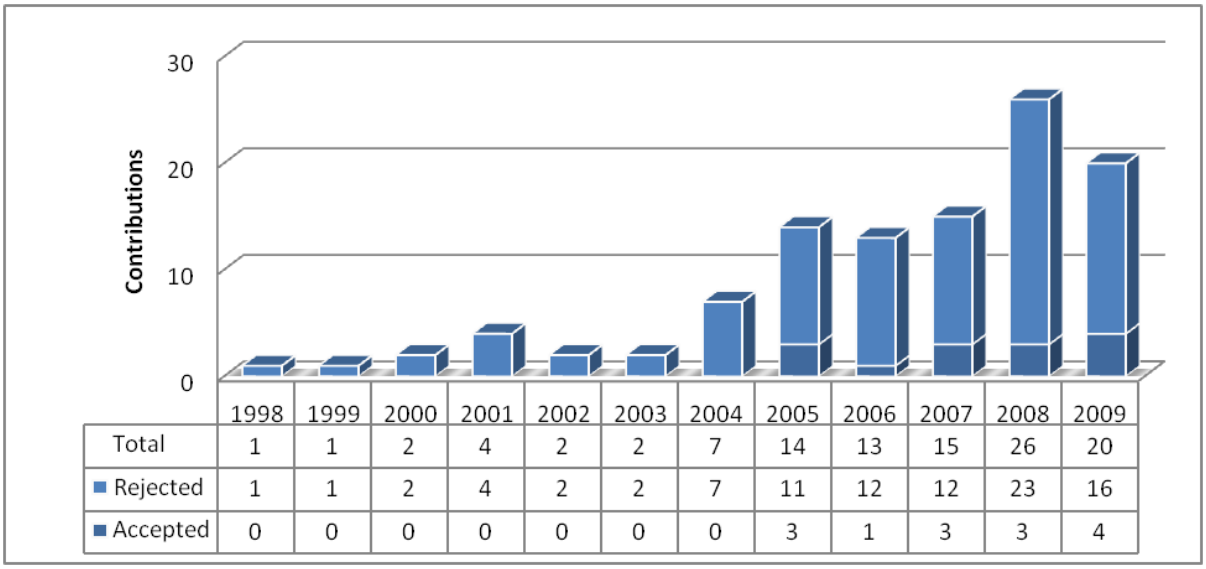
Table 13 Ratio of Accepted and Rejected Contributions per Source over Total Relevant to Synthesis Contributions (Screening Question S_2).

	SE	M	BR	Total
Accepted	6 (15.4%)	6 (15.4%)	2 (5.1%)	**14 (35.9%)**
Rejected	14 (35.9%)	8 (20.5%)	3 (7.7%)	**25 (64.1%)**
Total	**20 (51.3%)**	**14 (35.9%)**	**5 (12.8%)**	**39 (100.0%)**

Considering the number of the accepted contributions as a ratio of the initial 107 contributions, only 13.1% was finally accepted: 5.6% comes from search engines and 7.5% from manual (M+BR) additions (Table 12). Considering the number of the accepted contributions as a ratio of the 39 relevant to the synthesis contributions (i.e. from the initial 107, only those 39 that successfully passed Screening Question S_2), only 35.9% was subsequently accepted: 15.4% comes from search

engines and 20.5% from manual (M+BR) additions (Table 13). Although the number of accepted contributions originating from electronic searches (SE=6) is equal to that of contributions originating from manually added contributions (M=6) and greater than those originating from back-references (BR=2), the contributing ratio of accepted contributions for each source type over the total number of contributions that were deemed appropriate for full-text examination for each of the sources, is considerably larger for manually added contributions (32%) than that of contributions from back references (11%) and search engines (9%). The ratio of accepted contributions from search engines over the total number of the search engines' search results reveals a staggering 1.1%.

An overview of the total number of contributions that were considered as potentially relevant, as well as the subsequent number of accepted and rejected contributions per year, is supportive of the notion of the field of EA being a young, evolving domain (Figure 6).



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total	1	1	2	4	2	2	7	14	13	15	26	20
Rejected	1	1	2	4	2	2	7	11	12	12	23	16
Accepted	0	0	0	0	0	0	0	3	1	3	3	4

Figure 6 Frequencies of Accepted and Rejected Contributions per Year

3.1.5.4 *Excluded studies*

During the same Phase 5 of the SLR, 107 contributions in total (70 from electronic searches and 37 manual additions) have been examined for qualitative eligibility (see Table 10) according to their type (specified in Section 3.1.5.1) and according to the evaluation criteria (specified in Section 3.1.5.2). From these 107 potential contributions, 93 have been subsequently excluded (Appendix B.6.4, Table 59). The most commonly rejected contribution type is that of conference proceedings with journals, books and workshops following (Figure 7). Because the process of judging the contributions against the screening questions would immediately stop as a contribution would fail, there was only one consistently assessed screening question, relating to the contribution type eligibility (S_1); that screening question found 87 out of the total 93 contributions to have valid contribution types (Table 14).

The 93 contributions are distinguished in two major groups: first, 74 contributions that were found to be of potential relevance during Phase 4 of the SLR, were disqualified following a closer examination of their full-text against the screening questions (Table 7); second, 19 contributions that passed successfully the initial screening, but subsequently failed to qualify against the qualitative (Table 8) or quantitative (Table 9) research assessment questions. A detailed account of all rejected

contributions, along with a reason for exclusion for all those contributions that passed the initial screening and have been qualitatively or quantitatively evaluated, is given in Appendix B.6.4, Table 62.

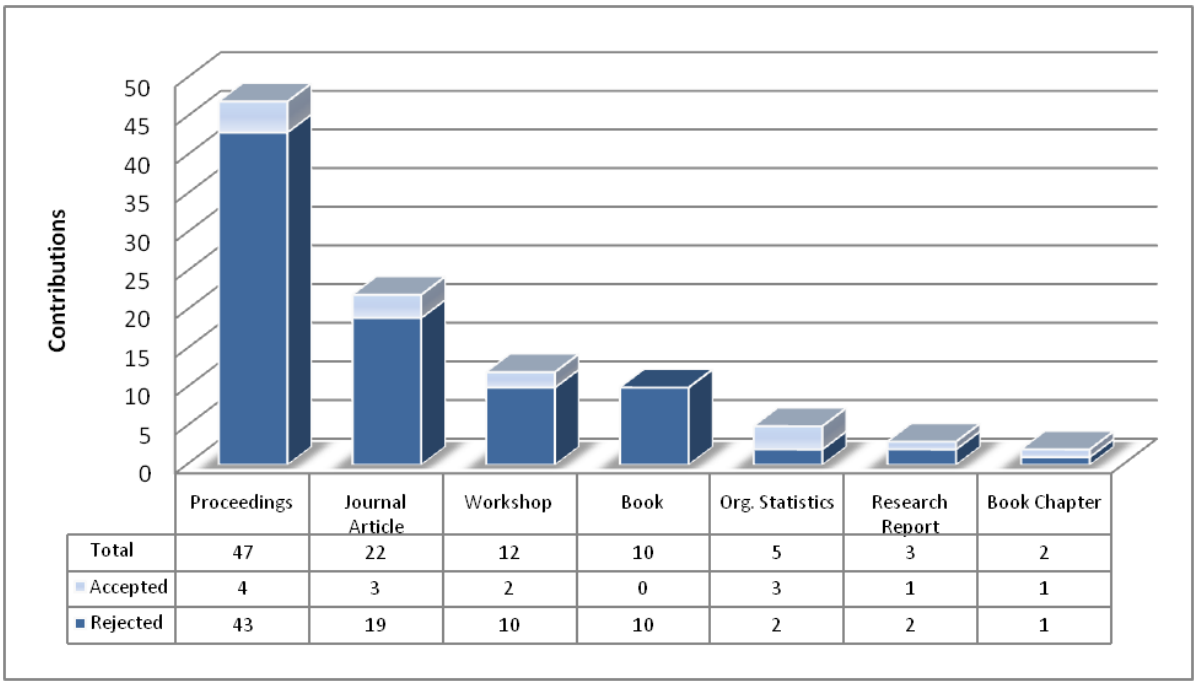


Figure 7 Frequencies of Accepted and Rejected Contributions with valid Contribution Types , by Contribution Type

Table 14 Frequencies of Rejected Contributions with Invalid Contribution Types

Contribution Type	Frequency
Magazine (Peer Reviewed)	1
Other	1
Periodical (Edited)	1
Poster	1
Proceedings Introduction	1
Seminar Paper	1

3.1.6 Phase 6—Data Extraction & Management

Using CIMO-logic, the accepted contributions were processed in order to extract design propositions. In other words, contributions were scanned for CIMO-logic components (CIMO Elements) and possible interrelationships between them. For Outcome Elements specifically, and to allow for greater analyzability, effort was made to extract and decode them using the conceptual schema for the definition of Goals in the Goal-Question-Metric (GQM) method [82]. In the GQM, a Goal is specified along three coordinates (i.e. *issue*, *object*, and *viewpoint*) and a *purpose*. Following this line of thought, we defined that an Outcome has to consist of at least the Object that the Outcome refers to. The remaining coordinates (Issue, Viewpoint) and the Purpose may all exist or not. Using Extended Backus-Naur Form notation (EBNF) [83], the encoding scheme we adopted for Outcomes was:

$$Outcome = [Issue], Object, [Purpose], [Viewpoint] \quad (1)$$

Due to its focus, in the context of this structured literature review we define one Intervention Element, the EA. Context Elements are thus some contexts for which the Intervention (EA) has been found to be appropriate. Mechanism Elements provide an answer to how or why EA produces or contributes, directly or indirectly, to certain Outcome Elements. It turned out though that in the literature that was processed, design propositions were found that describe only IO-logic (Intervention Outcome, i.e. "if A then do B"). Such occurrences were nevertheless expected, as they have been already acknowledged by researchers like Denyer et al., in that popular management literature usually concerns itself with IO-logic, completely ignoring the outcomes' contextual dependencies and generative mechanisms [31].

The 14 eligible contributions that were processed with CIMO-logic had their data extracted into the appropriate electronic extraction forms created in the MS Access environment (Appendix B.6.2, Figure 36). The forms allowed for extracting instances of CIMO-logic component variables (see Section 2.5.1.1.7, Table 1) present in the contributions and gave the ability to trace back each CIMO-logic component variable to their respective contribution (Appendix B.6.2, Figure 35). Data was extracted by the principal researcher only. No disagreements occurred, so the Review Panel was not called for resolving any disputes at this stage.

In total, there were 163 CIMO Elements and 181 CIMO Elements Relationships extracted (Table 16, column [Frequency]). Context, Intervention and Mechanism Elements were extracted as they were found in their respective contributions (e.g. in surveys) or as they were understood by the researchers (e.g. in case-studies). Individual Elements are provided in Appendix B.6.5: Contexts in Table 64, Interventions in Table 65, Mechanisms in Table 66, and Outcomes in Table 67; while CIMO Elements Relationships are provided in Table 68. To enhance both the understanding but also the traceability of the decisions made, we provide an alternative visual representation of the findings per Contribution in Section 3.2. All Intervention Elements that have been found refer to EA. The reason why EA is referred to multiple times as well as being a different Element is to maintain a separate account of the CIMO Elements Relationships found between *different* contributions. Additionally, there were instances where EA was referred upon multiple times as well as being a different Element within the scope of the *same* contribution. This occurred because there were instances where within the same contribution multiple unrelated design propositions where found that involved, one way or another, the EA as Intervention (e.g. Figure 8, "A", where both I1 and I2 semantically stand for EA).

Table 15 CIMO Elements Frequencies by Contribution.

Contribution ID	C	I	M	O	Total
6	15	1	1	-	**17**
19	1	2	-	18	**21**
27	-	1	-	28	**29**
2811	-	1	-	5	**6**
2817	1	1	-	9	**11**
2999	1	1	-	6	**8**
3039	1	1	-	4	**6**
3095	1	1	1	4	**7**
3131	1	1	1	6	**9**
3160	1	2	-	13	**16**
3161	-	1	-	13	**14**
3177	7	1	-	-	**8**
3185	1	1	-	3	**5**
3191	1	1	-	4	**6**
Total	**31**	**16**	**3**	**113**	**163**

Table 16 CIMO Elements Frequencies.

CIMO Element	Frequency	Merged Frequency
Context	31	29
Intervention (EA)	16	1
Mechanism	3	3
Outcome	113	100
Total	**163**	**133**

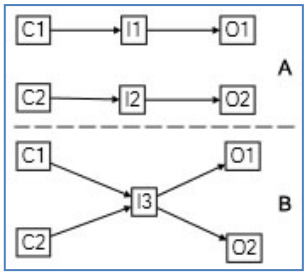


Figure 8 Merging of CIMO Elements and CIMO Elements Relationships

Merging the semantically common Intervention Element at this point for all design propositions, would have introduced transitive relationships between otherwise unrelated Elements (e.g. Figure 8, "B"). In this instance, it would mean that O2 is an outcome achieved by introducing intervention I3 in the context of C1, which is not true. For the purpose of simply registering the CIMO Elements and all their relationships, these transitive relationships were undesirable.

An account of the CIMO Elements that were registered for each contribution is given in Table 15. A careful examination of the elements' frequencies by contribution reveals that the vast majority of the CIMO Elements found concerns Outcomes (69%), then Contexts (19%), and almost no Mechanisms (2%). Of the 14 contributions, only 2 report on complete CIMO propositions (3095, 3131). 6 report on Outcomes that relate each to a specific context (19, 2817, 2999, 3039, 3185, and 3191) without any reference to Mechanisms. 1 reports on Contexts where a Mechanism has been found to provide Outcomes (6), without any reference to Outcomes. 5 report on Outcomes devoid of any Context or Mechanism (19, 27, 2811, 3160, and 3161). 2 report only of Contexts (3177, 3160). The contributions mentioned do not add up to 14 because we have taken them into account as separate, unrelated CIMO-logic propositions that appeared within the same contribution.

3.1.7 Phase 7—Data Synthesis

In the next step (first step for the synthesis), those CIMO Elements that were deemed to be semantically equivalent were merged in order to create a list of unique CIMO Elements for the purpose of this research. The merging decisions were not only based on the name or textual description of the CIMO Elements but also on the research context of their originating contribution. After the merge, there were in total 133 *Unique CIMO Elements* (Table 16, column [Merged Frequency]) and 168 *Unique CIMO Elements Relationships*. Individual *Unique Context* Elements are provided in Appendix B.6.6 in Table 69, *Unique Interventions* in Table 71, *Unique Mechanisms* in Table 70, and *Unique Outcomes* in Table 72; Unique CIMO Elements Relationships are provided in Table 73.

A very important effect of the merging of the CIMO Elements and CIMO Elements Relationships was the introduction of the transitivity property on certain relationships (e.g. Figure 8, "B") that were not originally found to have this property. To counter this effect, we defined that Unique CIMO Element Relationships are *not* transitive, unless otherwise explicitly stated. The scientifically established transitivity of relationships that occur as part of the research of the original contributions is not excluded of course, and can be found by referring to the CIMO Elements and CIMO Elements Relationships tables.

Next, defining a subset of the Unique CIMO Elements and their Relationships was sufficient: we defined the term *EA Benefits* as being semantically equivalent to the 100 Unique Outcome Elements included in Table 72 (Appendix B.6.6). Accordingly, we defined the term *EA Benefits Relationships* as representing that subset of the 65 Unique CIMO Elements Relationships in Table 73 (Appendix B.6.6) which refer to relationships among EA Benefits (or Unique Outcome Elements) only. These last two lists of EA Benefits and EA Benefits Relationships especially, represent the answer to the SLR goal, as it was established in Section B.2. Using the Unique CIMO Elements and Unique CIMO Relationships lists we proceeded with the actual synthesis of the findings of the SLR, the results of which are provided in Section 3.3.

3.1.8 Phase 8—Review Report Development

After finalizing the synthesis of the results of the SLR, the SLR Review Report was compiled. The SLR Review Report was created along the systematic review report guidelines put forth by the Cochrane Collaboration's Handbook [28]. As such, the SLR Review Report included all aspects of the methods utilized for conducting the review, elaborated on how these methods were subsequently utilized, reported on the results of the application of these methods, and scrupulously reflected in a discussion on the meaning and importance of the findings. The SLR Review Report is fully included in Appendix B. Additionally, parts of the report are being used in this and other Sections of this document.

3.1.9 Phase 9—Disseminate Review Results

In a first step for disseminating the review results, the SLR Review Report was supplied to the external advisor of this project in order to put the evidence into practice. In a second step, the conclusion of this document will make possible the dissemination of the information to the academic community. A final third step is planned, with the intended composition and potential publication of the research results to an academic conference's proceedings or journal.

3.2 CIMO Elements by Accepted Contribution

In this section we present a visual overview of the results of the processing performed using CIMO-logic for each of the accepted qualitative (Appendix B.6.4, Table 60) and quantitative (Appendix B.6.4, Table 61) research contributions during Phase 6 of the SLR. In the figures that follow (Figure 10 up to and including Figure 23), we use the notation described below (Figure 9), in order to describe the individual CIMO Elements (Appendix B.6.5: Table 64, Table 65, Table 66, and Table 67) and their CIMO Relationships (Appendix B.6.5, Table 68), as they were found in each of the accepted contributions. It is important to note that not all CIMO Relationships reflect cause and effect relationships. A Context Element pointing to the Intervention Element (EA) suggests that EA has been found to be of importance/use in the specific Context. When EA points to a Mechanism Element, the relationship suggests that EA has been found to invoke/realize the specific Mechanism. When EA or a Mechanism Element point to an Outcome Element, the relationship suggests indeed a cause and effect relationship between them; the Outcome Element being the result of the application/introduction of the EA or the Mechanism, under a specific Context (if given).

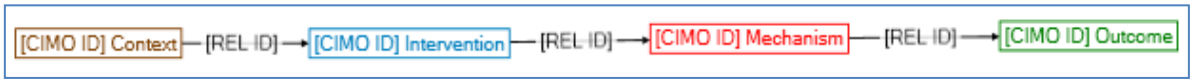


Figure 9 CIMO Elements drawing notation. [CIMO ID] is the ID Column in Table 64 for Content Elements, Table 65 for Intervention Elements, Table 66 for Mechanism Elements, and Table 67 for Outcome Elements. [REL ID] is the ID column

in Table 68. The colour used for the boxes outlines and the text is brown for the Context Elements, blue for the Intervention Elements, red for the Mechanism Elements, and green for the Outcome Elements.

3.2.1 CIMO Elements & Relationships for Contribution [10]

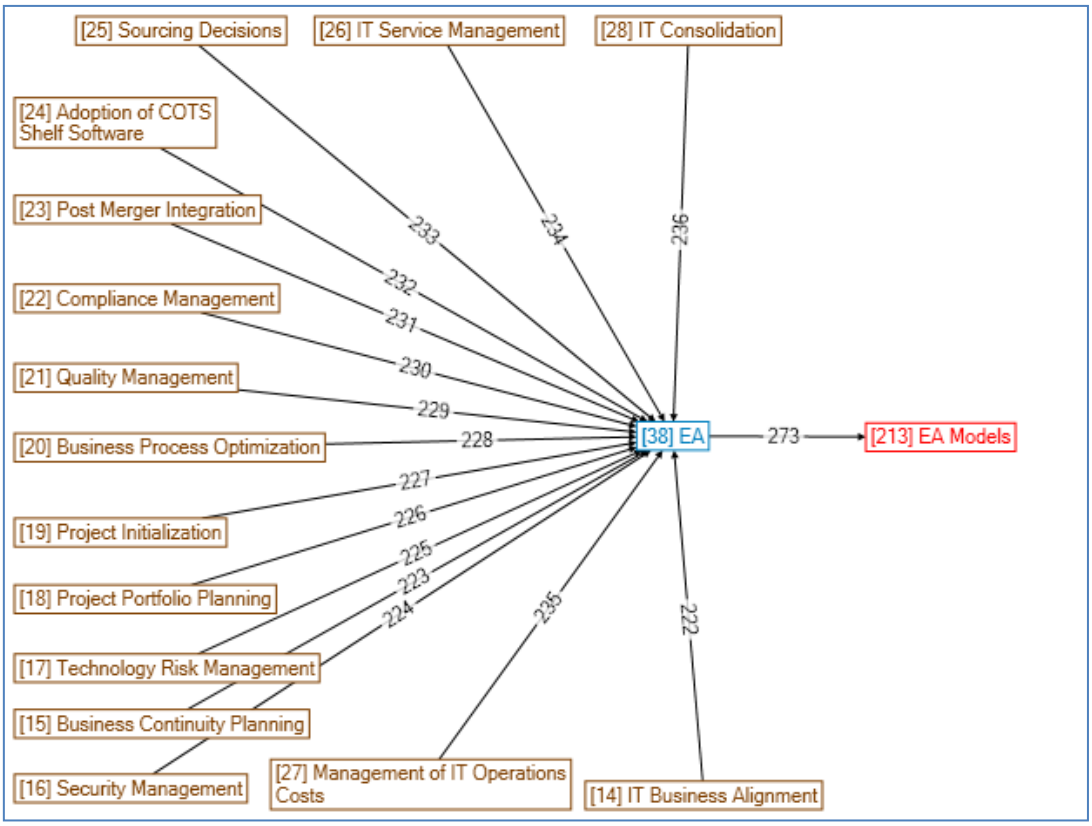


Figure 10 CIMO Elements and their CIMO Elements Relationships for Contribution [10].

3.2.2 CIMO Elements & Relationships for Contribution [46]

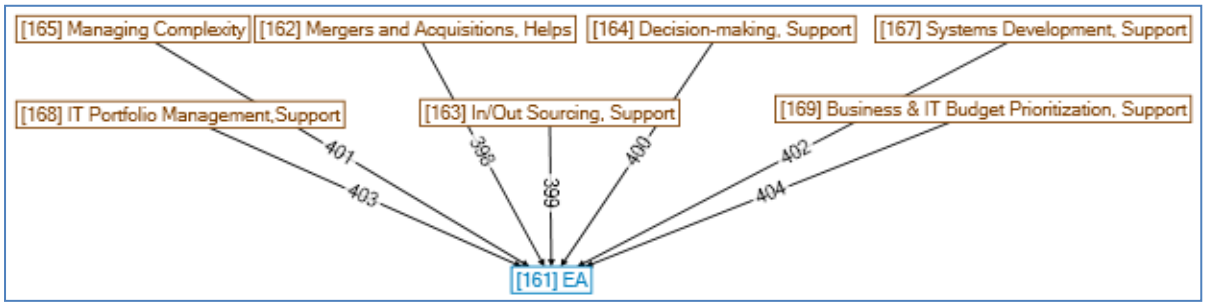


Figure 11 CIMO Elements and their CIMO Elements Relationships for Contribution [46].

3.2.3 CIMO Elements & Relationships for Contribution [17]

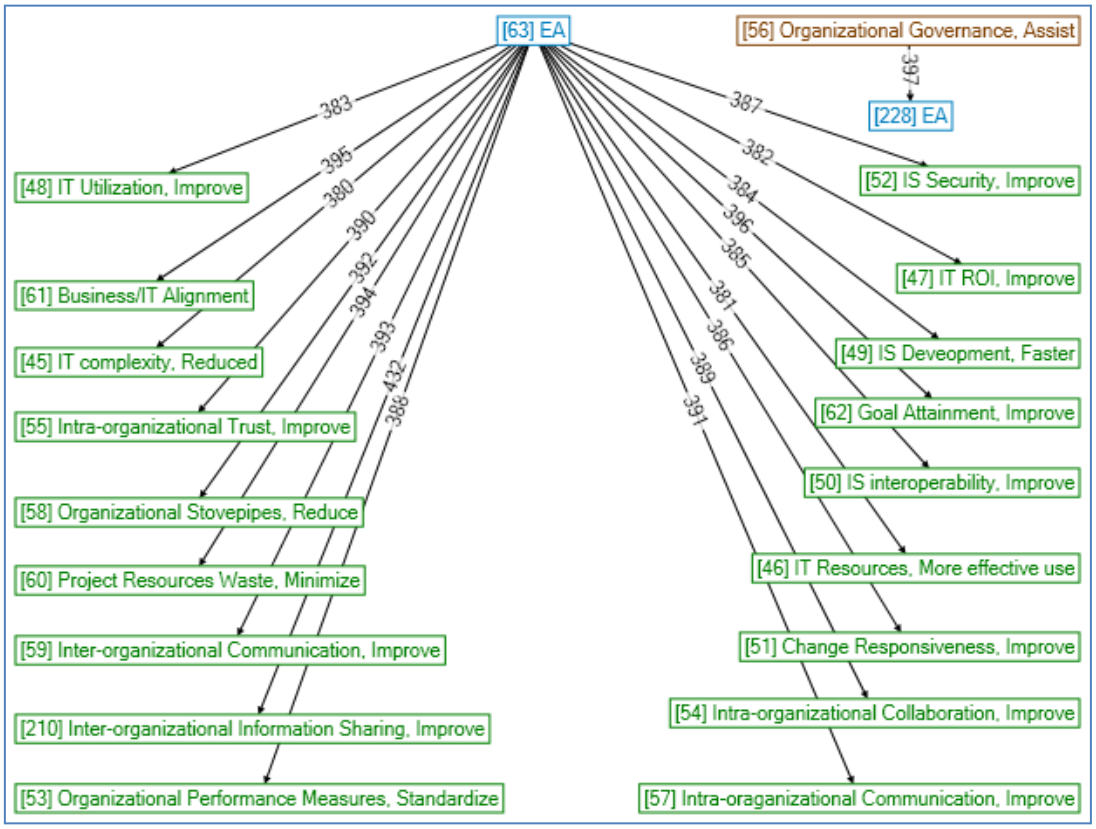


Figure 12 CIMO Elements and their CIMO Elements Relationships for Contribution [17].

3.2.4 CIMO Elements & Relationships for Contribution [84]

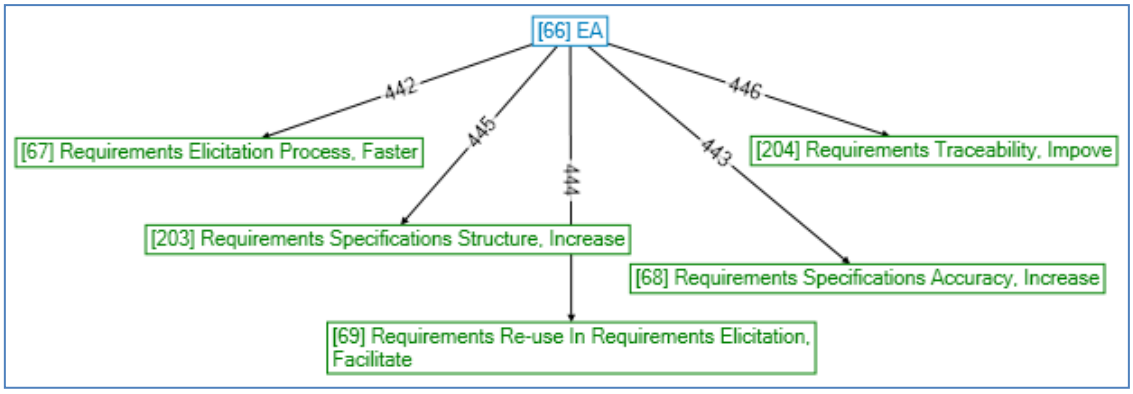


Figure 13 CIMO Elements and their CIMO Elements Relationships for Contribution [84].

3.2.5 CIMO Elements & Relationships for Contribution [26]

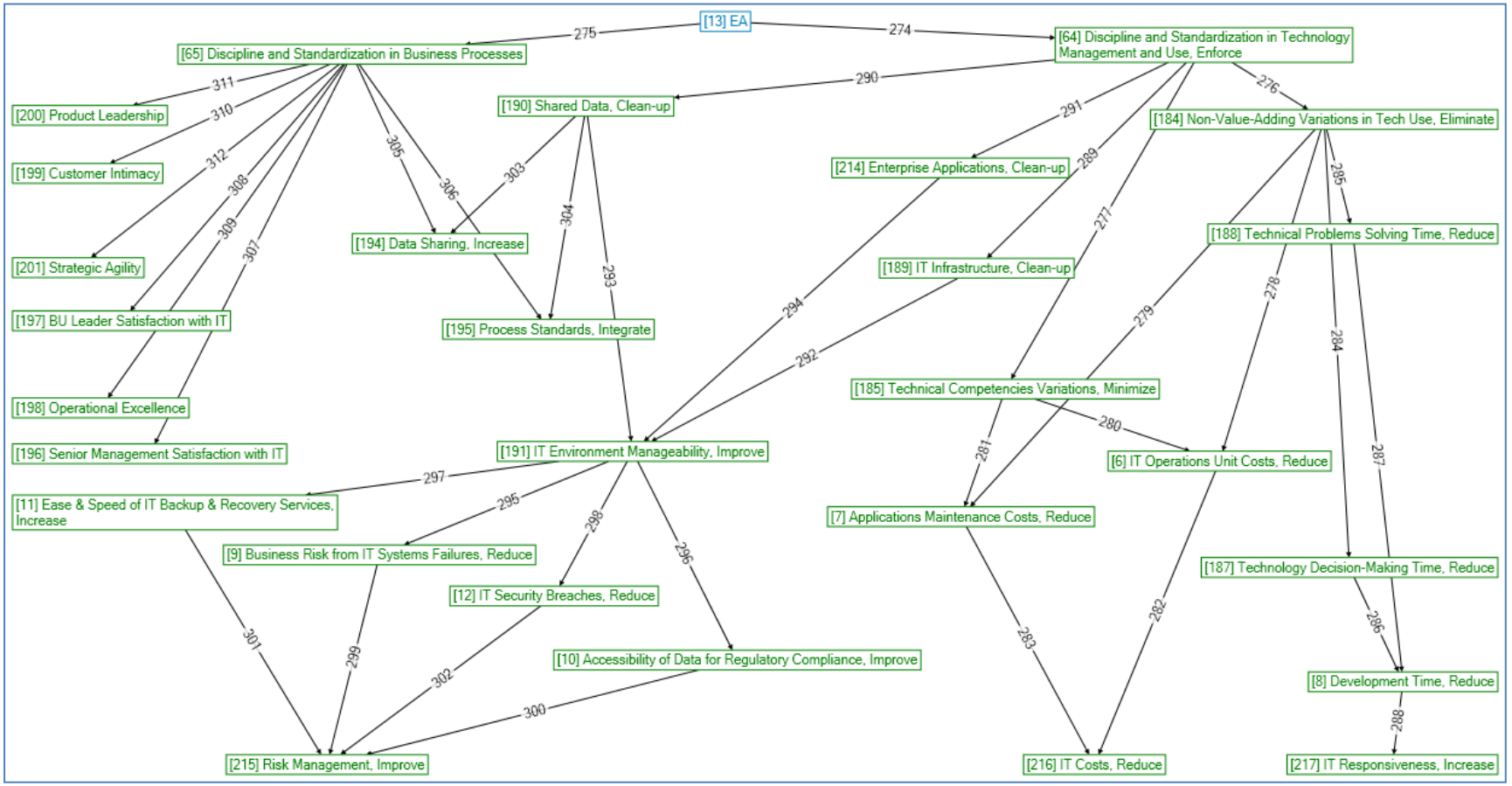


Figure 14 CIMO Elements and their CIMO Elements Relationships for Contribution [26].

3.2.6 CIMO Elements & Relationships for Contribution [85]

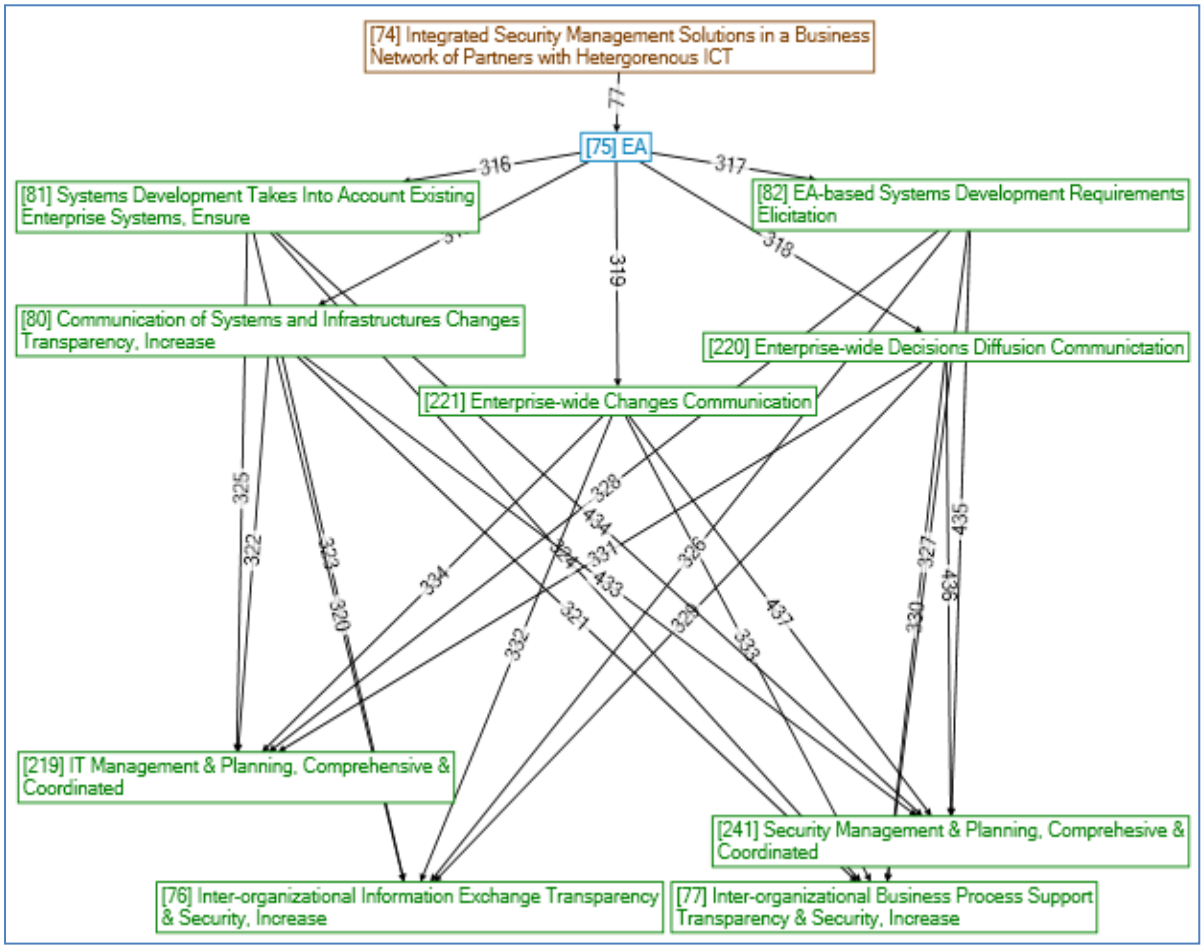


Figure 15 CIMO Elements and their CIMO Elements Relationships for Contribution [85].

3.2.7 CIMO Elements & Relationships for Contribution [86]

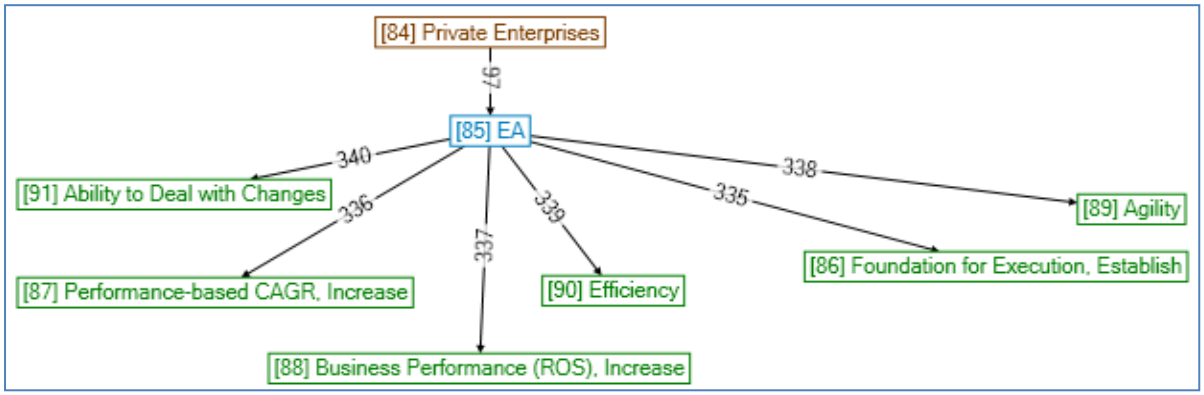


Figure 16 CIMO Elements and their CIMO Elements Relationships for Contribution [86].

3.2.8 CIMO Elements & Relationships for Contribution [87]

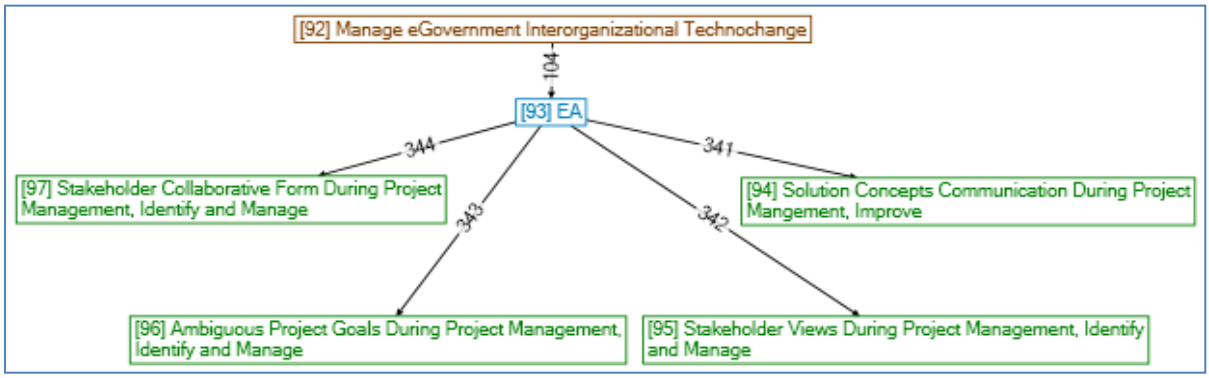


Figure 17 CIMO Elements and their CIMO Elements Relationships for Contribution [87].

3.2.9 CIMO Elements & Relationships for Contribution [25]

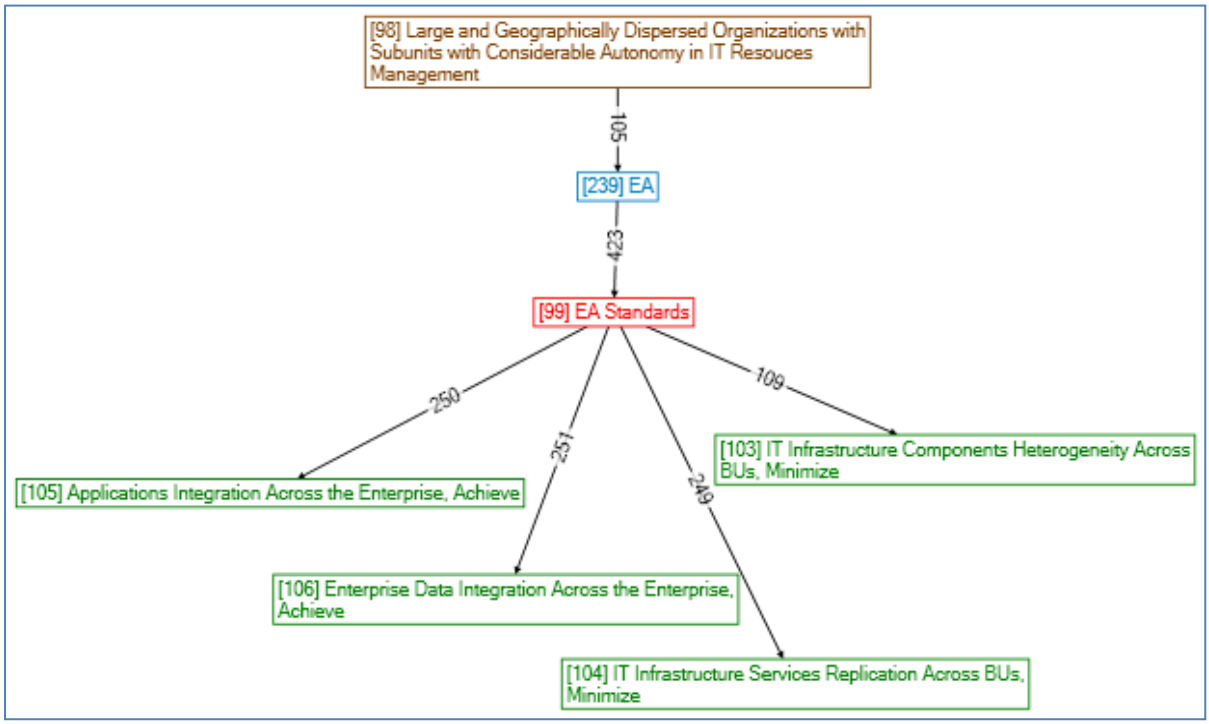


Figure 18 CIMO Elements and their CIMO Elements Relationships for Contribution [25].

3.2.10 CIMO Elements & Relationships for Contribution [88]

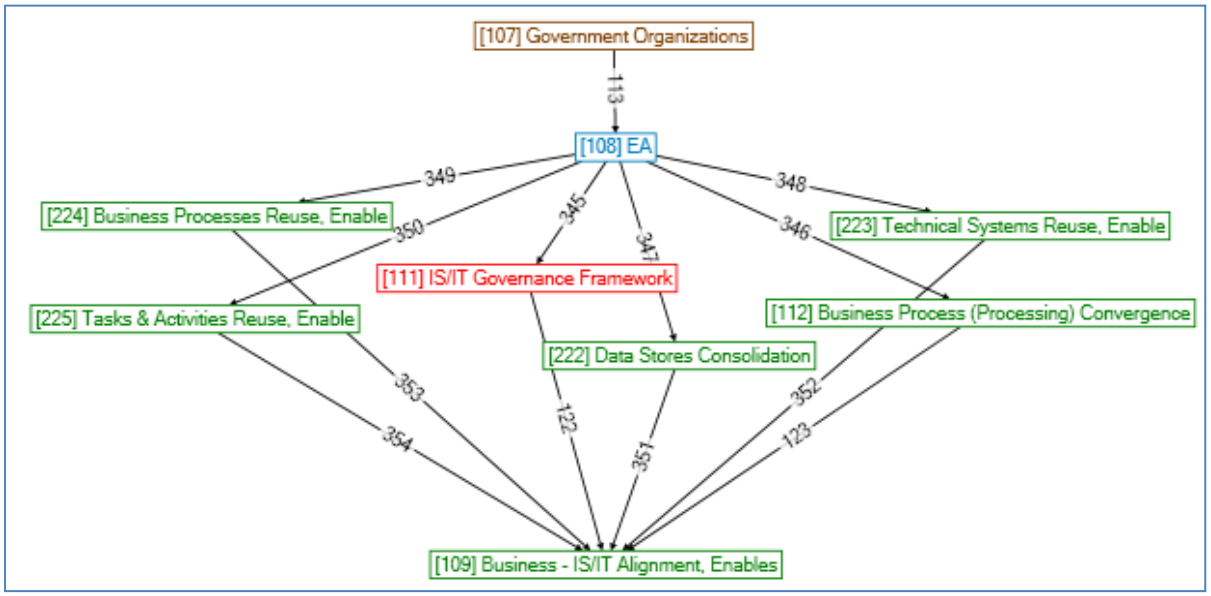


Figure 19 CIMO Elements and their CIMO Elements Relationships for Contribution [88].

3.2.11 CIMO Elements & Relationships for Contribution [40]

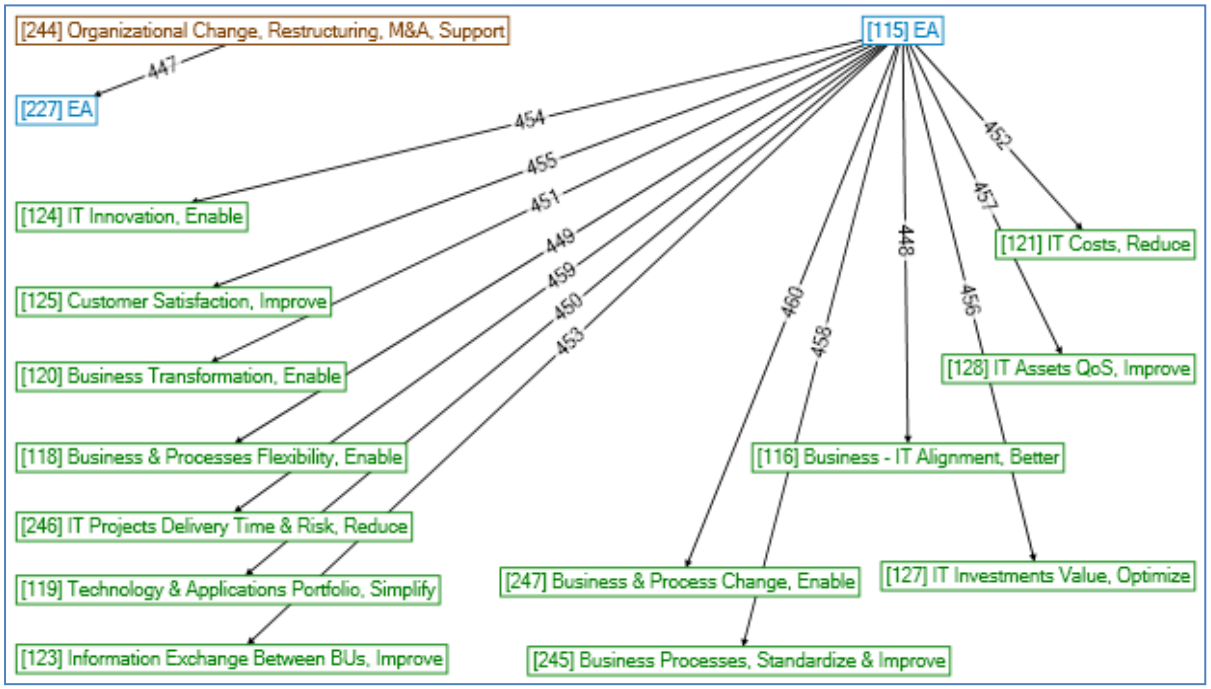


Figure 20 CIMO Elements and their CIMO Elements Relationships for Contribution [40].

3.2.12 CIMO Elements & Relationships for Contribution [41]

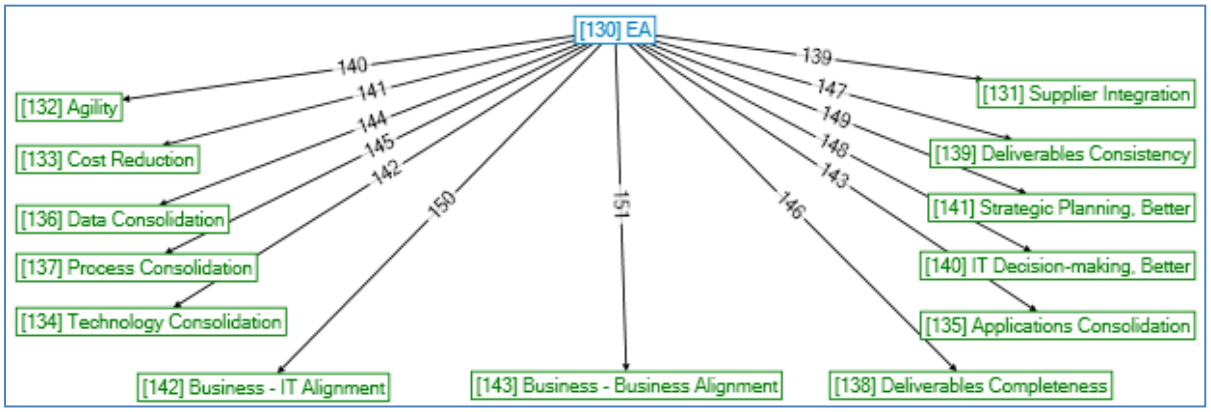


Figure 21 CIMO Elements and their CIMO Elements Relationships for Contribution [41].

3.2.13 CIMO Elements & Relationships for Contribution [50]

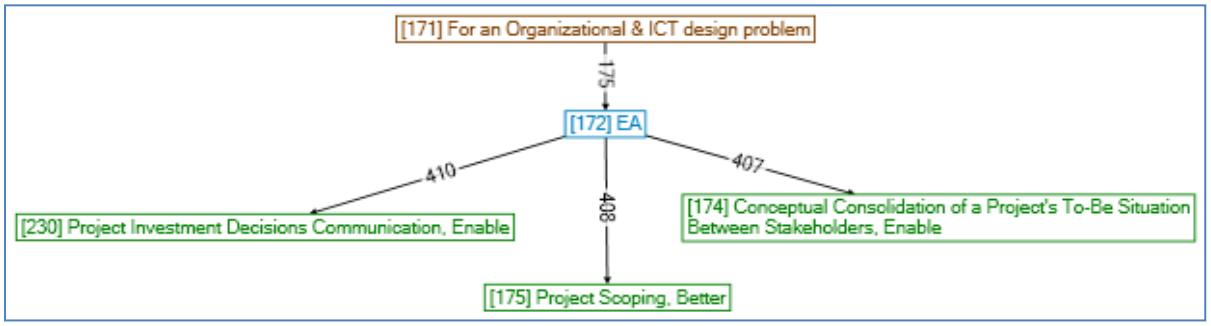


Figure 22 CIMO Elements and their CIMO Elements Relationships for Contribution [50].

3.2.14 CIMO Elements & Relationships for Contribution [54]

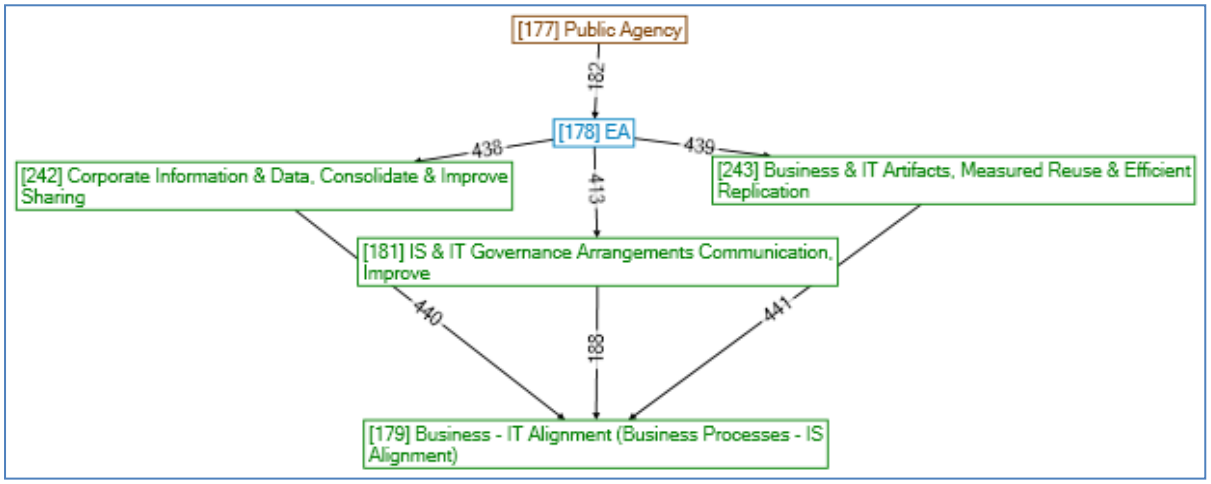


Figure 23 CIMO Elements and their CIMO Elements Relationships for Contribution [54].

3.3 Unique CIMO Elements Synthesis

An analysis of the Unique CIMO Elements that were identified and subsequently extracted from the 14 contributions in Phase 7 of the SLR (Section 3.1.7) revealed certain themes relating to the contexts of the EA utilization, as well as to the potential benefits of EA. No capable number of mechanisms was retrieved so as to proceed with a similar analysis. In the following sub-sections we present both context-related themes (Section 3.3.1) and outcomes-related themes (Section 3.3.2).

3.3.1 Context Elements Themes

As a convention in the following sub-sections, a parenthesis that refers to a Unique Context Element begins with a number that corresponds to the unique ID of a Unique Context Element in column [CIMO_UNIQUE ID] of Table 69 (Appendix B.6.6), followed by a comma and the reference number(s) that corresponds to the entry in the References section of this document and relates the Unique Context to its originating contribution(s).

Organizational Design

EA has been found to provide the necessary support in the context of organizational design problems. These problems might relate to the design of new organizational structures (137, [50]) or the re-design of existing ones, during mergers and acquisitions (13, [46]; 33, [10]), and during general organizational change and restructuring (92, [87]; 244, [40]).

Project Portfolio Management

EA has been found to provide support in the context of Project Portfolio Management, in cases like project portfolio planning (15, [10]), IT portfolio management (135, [46]), and in addition in related investment decisions. (165, [46])

Decision Making

EA has been found to aid in the context of general decision-making (131, [46]) activities, as well as in making decisions relating to Sourcing (14, [10]) and the adoption of COTS Software (34, [10]).

Regulatory Compliance

EA has been found to provide support in the context of regulatory compliance, be it general compliance management (32, [10]) or quality management (31, [10]).

Systems Development

EA has been found to be of help in the context of Systems Development, from the first phases during Project Initialization (e.g. project scoping) (29, [10]) to general Systems Development support (134, [46]).

Risk Management

EA has been proposed to aid in the context of Risk Management. Although there were cases identified were EA has been found to assist in Business Continuity Planning (26, [10]) most of the risk management scenarios identified were IT-related; ranging from Security Management (27, [10]), Technology Risk Management (28, [10]), and IT Service Management (35, [10]), to more specific cases of integrated Security Management solutions in business networks with heterogeneous ICT (59, [85]).

IT Costs Reduction

EA has also been found to be supportive in the context of reducing IT-related costs, either through IT Consolidation (e.g. by eliminating costly, redundant technological platforms) (37, [10]) or by better Management of IT Operations Costs (36, [10]).

3.3.2 Outcome Elements—EA Benefits Themes

As a convention in the following sub-sections, a parenthesis that refers to a Unique Outcome Element begins with a number that corresponds to the unique ID of a Unique Outcome Element in column [CIMO_UNIQUE ID] of Table 72 (Appendix B.6.6), followed by a comma and the reference number(s) that corresponds to the entry in the References section of this document and relates the Unique Outcome to its originating contribution.

Enhancing Organizational Processes & Process Standards

EA has been found to contribute to the achievement of a number of EA Outcomes that relate to an organization's processes and the processes' performance and standards. More specifically, EA has been found to contribute in enforcing discipline (5, [26]), standardization and improving business processes (161, [40]). What is more, EA not only contributes to the establishment of an organization's "foundation for execution" (86, [86]), but in addition enables the consolidation (113, [41]) and reuse (18, [88]) of business processes, and the integration of process standards (150, [26]). Additional findings relate to the EA enabling a greater degree of business and process change (163, [40]), flexibility (101, [40]), and agility (8, [26, 41, 86]).

Project Management

EA has been found to contribute to the achievement of a multitude of Outcomes relating to projects, most important of which appears to be the enhancement of communication and collaboration among the project stakeholders in a variety of contexts: from enabling the communication of project investment decisions (78, [50]), to enabling the conceptual consolidation of a project's "to-be" situation (164, [50]), and improving the communication of the solution-related concepts (92, [87]). Additionally, EA has been found to be helpful in the context of project management, in that it contributes to the identification and management of the various stakeholder views (93, [87]), of the ambiguous project goals (94, [87]), and of the appropriate collaborative form of the stakeholders (95, [87]). Finally, EA has been found to contribute to better project scoping (1, [50]), in minimizing project resources waste (51, [17]), and in enhancing the completeness (114, [41]) and consistency (115, [41]) of project deliverables.

Requirements Engineering

EA has been found to play an important role in the entire requirements engineering process, primarily because the requirements elicitation can be based on an organization's existing EA documentation (2, [85]), thus facilitating the reuse of requirements during the requirements elicitation (56, [84]) and subsequently increasing the speed of the requirements elicitation process (54, [84]). In addition, EA has been found to increase the accuracy (55, [84]) and structure (63, [84]) of requirements specifications, as well as to generally improve the requirements' traceability (64, [84]).

Enhancing Organizational Performance

EA has been linked with enhancing the performance of the organization, as reflected in increases in general lag indicators of organizational achievement like the performance-based CAGR, (87, [86])

and the Return On Sales (ROS)(88, [86]). Additionally, EA has been found to contribute to increased organizational efficiency (89, [86]) and the achievement of Operational Excellence (153, [26]).

Enhancing Intra- & Inter-Organizational Communication & Collaboration

EA has been found to contribute to the improvement of both intra- (3, [17, 40, 85]) and inter-organizational (50, [17]) communication. Additionally, EA has been found to contribute to the improvement of intra-organizational collaboration (46, [17]) and trust (47, [17]), as well as to the improvement of inter-organizational information sharing (69, [17]).

IS & IT

The vast majority (46%) of the discovered Outcomes refers or relates to (Computer) Information Systems (IS) and Information Technology (IT). Reflecting the broad subject-matter of the IS and IT domains themselves, the Outcomes that fall within this category can be further divided in sub-themes.

Enhancing IT Management and Decision-making

EA has been found to produce Outcomes that enhance or improve the IS/IT Management and decision-making process. More specifically EA has been found to enforce discipline and standardization in IT Management (and use) (53, [26]), to generally improve the manageability of the IT Environment (148, [26]) and to offer a comprehensive and coordinated way to perform IT Management and Planning (75, [85]). Additionally, that application of EA has been found to result in better IT decision-making (116, [41]) and to reduce both the technology decision-making time (144, [26]) and the time spent by managerial personnel in solving technical problems (145, [26]).

Increasing IT Value and Reducing IS & IT Costs

The application of EA has been found to increase the value of IT by improving the IT Return On Investment (ROI) (40, [17]) and optimizing the value of IT investments themselves (107, [40]). In addition, EA has been found to generally reduce the IT costs (7, [26, 40]). There are both direct and indirect ways this cost reduction is achieved. Direct ways include reductions in applications maintenance costs (120, [26]) and IT operations unit costs (156, [26]). Indirect ways include a reduction in the IS development time (12, [17, 26]), the more effective use of IT resources (39, [17]), the enablement for the reuse of technical systems (17, [88]), the improvement in IT utilization (41, [17]), the minimization of IT infrastructure services replication across Business Units (BUs) (98, [25]), and the measured reuse and efficient replication of business & IT artifacts (159, [54]).

IS & IT Consolidation, Integration & Homogeneity

In the general quest for cleanness and manageability in the organizational IT domain, EA has been found to play an important role in reducing IT complexity (38, [17]); minimizing heterogeneity (6, [25, 26, 40]) and variations in employees' technical competencies (143, [26]); and cleaning-up enterprise applications (72, [26]), shared data (147, [26]) and the IT infrastructure (146, [26]). Additionally, the application of EA has been found to contribute in consolidating technology (9, [41]), data (16, [41]), data stores (76, [88]), applications (112, [41]), and in general, consolidating and improving the sharing of corporate information and data (158, [54]). EA has been also found to contribute to the achievement of integration between enterprise applications (10, [25]) and data (11, [25]), as well as to improving the interoperability of IS (42, [17]). Finally, EA has been found to contribute to the convergence of business process processing (100, [88]).

IS & IT Openness & Responsiveness

EA has been found to contribute to a more open and responsive IS/IT domain. Openness is reflected in the improved accessibility of data for regulatory compliance (22, [26]), the increased data-sharing (149, [26]) the improved communication of the IS and IT Governance arrangements (141, [54]) and the increase in the transparency of the communication of IS and infrastructure changes (121, [85]). Responsiveness is reflected in the increase of IT responsiveness (74, [26]) and also the improvement of IT change responsiveness (43, [17]).

Enhancing IT Risk Management

EA has been found to contribute to the general improvement of IT-related risk management (73, [26]) and the reduction of the associated risks from IT Systems failures (21, [26]). More specifically, EA has been found to contribute to an increase in the ease and speed of IT backup and recovery services (23, [26]) and a reduction to the risk (as well as the time) related to the delivery of IT projects (162, [40]). Additionally, EA has been found to contribute to comprehensive and coordinated security management and planning (157, [85]), as well as to an improvement in the IS security (44, [17]) and to a possible reduction of the IT Security Breaches (24, [26]). Additionally, more specific outcomes are increasing the transparency and security of inter-organizational business process support (61, [85]) and information exchange (60, [85]).

4 Enterprise Architecture Benefits Framework

This second part of the research conducted, concerns the design of a framework (the Enterprise Architecture Benefits Framework or EABF) that would enable practitioners and researchers alike to describe, make sense of and communicate those ways EA contributes to the achievement of organizational goals, as well as to define EA measures of effectiveness. Similarly to the first part of this research—the discovery of the potential benefits of EA in the relevant literature—the goals of this second undertaking are also self-containing in that the creation of the EABF is relevant to both academics and practitioners per se (as established in Section 2.3). In the context of the overarching research project though, the EABF is seen as the prism through which we look to make sense of the EA Benefits/Outcome Elements discovered in the first part of the research. Although these results of the first part have been effectively analyzed (Section 3.3), we find the analysis capabilities enabled by the EABF, although complementary, to be of great importance.

In the sub-Sections that follow, we first provide in Section 4.1 a detailed account of how we conformed to the Design Cycle of Verschuren and Hartog [22] while designing the EABF. The description of the Design Cycle itself was presented in Section 2.5.2.1. In Section 4.2 we provide an extensive definition of the EABF and its constituent parts and in Section 4.3 we showcase its usage by providing a fictional, yet practice-oriented and reality-inspired, example Use-case of the EABF.

4.1 Conformance to Design Cycle

In this section we describe how the research undertaken conformed to the Design Cycle of Verschuren and Hartog [22] (Section 2.5.2.1). To this end, in the following subsections we map the various research activities performed during this research onto the six stages of the Design Cycle.

4.1.1 First Hunch

Using the overarching research project's Research Questions (Section 2.2) and Objectives (Section 2.2.1), we defined the Design Goal ([G1, G2, G3]) the EABF artifact should realize (Table 17).

Table 17 EABF Design Goals

Code	Description	Priority
G1	Make explicit to practitioners and researchers alike, the scientifically grounded potential contribution of Enterprise Architecture towards the achievement of organizational goals.	1
G2	Be extensible.	2
G3	Guide the development of EA effectiveness metrics.	3

Since the specified Goal flows from the already established Research Question of the overarching project, the authors deem as unnecessary to scientifically re-establish it here. The reader is instead invited to check Section 2.3.1.

At the end of stage one, a plan evaluation was performed on the Goal against two criteria: clearness and feasibility. A logic test on the Goal determined that it satisfactorily reflects in a clear way the intentions of the designers. In addition to logic, undertakings (e.g. [11, 12, 19]) with goals broadly relevant to the Goal were taken as being supportive towards the overall feasibility of the Goal, and it was thus determined that such an artifact is feasible.

4.1.2 Requirements & Assumptions

Borrowing from the common practice in the systems and software engineering domains, we began requirements elicitation with an identification and description of the intended end-users of the EABF, the *practitioners* and *researchers* in the domain of EA. The end-user identification results (Table 18) were based on personal experience, logical reasoning, as well as discussions with peer researchers and practitioners in the field.

Practitioners are generally expected to have a moderate to deep knowledge of the EA domain. In assessing the level of knowledge of various practitioners, we took into account two factors. First, not all practitioners are expected to be professionally trained enterprise architects. Practice shows that, especially in organizations that adopt a do-it-yourself approach, mostly IT personnel with relevant, but not always highly specific knowledge, are assigned to some of the responsibilities of an architect during EA project initiatives. As an example, the 2008/2009 Infosys Survey shows that some 13% of the surveyed organizations' EA Teams are only part-time manned by line of business architects [40]. Second, we took into account the relevant immaturity of the EA domain, as it has been already established in previous sections. This means that some practitioners can be expected to have incomplete knowledge of the entire domain. Practitioners are found to have a relatively small time-frame in their disposal for carrying out their professional tasks. Also, it is expected that they will need a wide variety of information detail levels (from low to high) when it comes to identifying the contribution of EA to certain business goals, according to the task at hand (e.g. building the business case, designing effectiveness metrics, etc) and according to the target audience of the undertaking (e.g. non-technical vs. technical).

Researchers, on the other hand, are expected to continuously need high levels of detail and possess a consistently high level of domain knowledge. Compared to practitioners though, they are usually expected to face somewhat more moderate time constraints.

Table 18 EABF End-User Needs

User	EA Domain Knowledge Depth	Detail Level Needed	Time Available
Practitioner	Moderate to High	Low to High	Low
Researcher	High	High	Moderate

Within the frame specified by the Goal (Section 4.1.1), the overarching research's objectives (Section 2.2.1) and the end-user characteristics and needs (Table 18), the sets of requirements ([R]) and assumptions ([A]) were formulated. During the formulation, similar research [35] was taken into account and peer researchers' review was utilized as refinement means. Requirements and assumptions are given in Table 19 and Table 20 respectively.

Table 19 EABF Design Requirements

Code	Description	Motivation
R_f1	The EABF must enable relating the ways EA contributes to an organization's achievement of certain organizational goals.	Flowing directly from ***G1***, means that the artifact has to provide for relating EA contribution and organizational goals in an explicit and readily apparent manner.
R_f2	The EABF must allow for future extensions in terms of the contribution of EA to the achievement of certain organizational goals.	As EA is still a young domain, It is reasonable to expect more research to be carried out on the contribution of EA. The EABF must be open in such a way so as to accommodate future additions.
R_f3	The EABF must allow for backtracking from the EA contributions to their original research study context.	To achieve consensus on the EABF's soundness from the scientific, as well as the professional communities, the EABF must be open to scientific scrutiny.
R_f4	The EABF must enable the development of EA effectiveness metrics.	It is important for the EABF to provide the necessary methods for measuring the contribution of EA over time, making thus explicit the actual contribution of EA.
R_u1	The EABF must enable transparent reasoning from the direct or indirect contributions of EA to the achievement of organizational goals.	As current research has been found to provide rather abstract, if at all, justifications of the direct and indirect contributions of EA, the EABF must provide particularly clear associations between them.
R_u2	The EABF must enable sufficient detail on the line of reasoning from EA to the organizational goals.	Some types of users are expected to need a great level of detail on specifying the contribution of EA.
R_u3	The EABF must provide an overview on the line of reasoning from EA to the organizational goals.	Some types of users are expected to need a bird's-eye view on how EA contributes to organizational goals.
R_c1	The EABF must allow for integrating with existing business effectiveness measurement instruments.	The EABF will provide methods for defining effectiveness metrics. It is important to ensure that integration of these methods and their measurements, with other established effectiveness measurement instruments is possible, so as to motivate organizational acceptance.
R_c2	The EABF must allow for accommodating all possible scientifically grounded potential contributions of EA.	The EABF will in essence be a categorization/visualization method for EA Benefits. As such it is important to ensure that it will be able to accommodate a varied collection of EA Benefits from the knowledge base.

Table 20 EABF Design Assumptions

Code	Description	Motivation
A_u1	The End-User has at a minimum a moderate level of knowledge pertaining to the EA domain.	To provide with rich information the End-Users, the EABF will require they uphold a sufficient level of knowledge for the EA domain. If not, the End-User has to be educated to achieve the necessary level of familiarity with the EA domain.
A_u2	The End-User is able to articulate the business objectives of his/her organization.	To provide information on the contribution of EA to specific organizational goals and appropriate measures for it, the EABF will require that the End-User is able to ascertain the organizational goals of interest. If not, the End-User must be educated in the use of appropriate methods for defining such organizational goals of interest.
A_c1	The End-User is able to articulate the appropriate focus/scope for EA Benefits for his/her organization.	To provide information on the contribution of EA to specific organizational goals that span different organizational domains and focus on different detail levels, the EABF will require that the End-User is able to determine the desired organizational domain focus and level of detail. If not, the End-User must be educated in the use of appropriate methods for determining the desired focus/scope for EA Benefits.

After the sets of requirements ([R]) and assumptions ([A]) were established, relevant literature was researched with the goal of locating existing artifacts that might be applicable and could potentially be utilized for meeting the EABF Design Goals, either in their current state or by adapting/extending them. Of all the frameworks/methods considered, the most promising ones were Zachman's EA Framework (ZF) [5-7], the ZF's derivative Enterprise Unified Process (EUP) extension for the ZF [89], the BSC Strategy Maps (BSC SM) framework [90, 91], the BSC SM derivative Enterprise Architecture Scorecard Framework (EASF) [11], and the Architecture Effectiveness Model (AEM) [12] (which distantly echoes, but is not a derivative of the BSC SM). To this end, the aforementioned frameworks were assessed against the requirements ([R]) of the EABF Design (Table 21).

Table 21 Assessment of Frameworks against the EABF Design Requirements

	Requirements								
Framework	**R_f1**	**R_f2**	**R_f3**	**R_f4**	**R_u1**	**R_u2**	**R_u3**	**R_c1**	**R_c2**
ZF	✓	✓	–	–	×	×	×	–	✓
EUP	✓	✓	–	–	×	×	×	–	✓
BSC SM	✓	✓	–	✓	✓	✓	✓	✓	✓
EASF	?	✓	–	✓	?	×	?	✓	✓
AEM	✓	✓	–	✓	✓	✓	×	✓	✓

✓ = possible, × = not possible, – = not readily possible but could be probably added, ? = not clear.

The assessment was conducted by reviewing the relevant literature for each of the frameworks. After acquiring a clear understanding of the capabilities and pros and cons of each framework, the researchers attempted to answer how and whether they would individually fulfill the Requirements ([R]) of the EABF Design. More specifically, for each of the Requirements it was attempted to specify whether each of the frameworks could provide the ability to either fulfill them or not, and if this were not possible out-of-the-box, than to see if it was still highly probable to add to or extend the

frameworks. This turned out to be a highly iterative process, since to give an answer for most of the juxtaposing individual Requirements and frameworks, it was necessary to investigate and integrate different parts of the individual literature sources relevant to each framework, as well as parts of different literature sources altogether.

The results of the assessment show that the BSC SM framework and its derivatives clearly fit better the purpose of this project. As it became evident during the assessment, this happens because the ZF and its derivatives, although they do cover a wide breadth of organizational perspectives and do enable relating different elements of those perspectives, they lack the expressive capability of describing explicitly and flexibly–in terms of detail abstraction–the relationships between those elements.

The assessment thus led us to the decision of adopting the BSC/SM framework in order to base upon the construction of the EABF. More specifically, the fit between the BSC SM specification and the EABF Requirements is given in Table 22. That decision though, was not only justified by the results of the assessment, where the BSC SM framework appeared to be more versatile for our purpose. We considered the recurring uses of the BSC SM framework in the literature as the base for relevant undertakings (e.g. [19, 48]) (in addition to the ones considered as contenders in our assessment) to be a reinforcing factor for our decision.

Table 22 Description of fit between the BSC SM and the EABF Requirements.

Code	Description of Fit with EABF Requirement
R_f1	The BSC SM supports the notion of explicit cause and effect relationships between different organizational objectives.
R_f2	The BSC SM provides the scheme for categorizing organizational objectives and goes up to the point of proposing common ones. The framework user is expected to define his/her own objectives using the categories of the framework.
R_f3	The feature is not relevant to the BSC SM, but it is possible to add it.
R_f4	The BSC SM incorporates the notion of establishing organizational performance metrics as a central part of the framework.
R_u1	The BSC SC supports the notion of cause and effect relationships between objectives that contribute to the achievement of other objectives, creating in essence links of interconnected objectives that ultimately point to high-level (strategic) organizational goals.
R_u2	The BSC SM provides an extensive categorization schema for the different kinds of organizational objectives, which allows one to drill down to the necessary detail level.
R_u3	The BSC SM provides an extensive categorization schema for the different kinds of organizational objectives, which allows one to get a bird's-eye view.
R_c1	The BSC SM, as part of the greater BSC framework, integrates natively with the BSC's strategic performance management tools.
R_c2	The BSC SM provides an extensive categorization schema that encompasses all possible aspects, processes and assets of an organization.

4.1.3 Structural Specifications

During the previous stage of the designing process of the EABF artifact it was concluded that there was no apparent need to design from scratch a novel artifact because there existed in the knowledge base another readily available artifact that could accommodate the specific Requirements ([R]), namely the BSC SM. For this reason, no Structural Specifications ([S]) were

explicitly specified from the Requirements and Assumptions. The actual BSC SM specifications are provided by their respective authors in [91], and also in [90]. Of course, a detailed description of the specifics of the implementation of the BSC SM for the purposes of the EABF in terms of its different aspects, elements and characteristics is provided in this document (Section 4.2).

Nevertheless, in the end of stage three a goal-based plan evaluation was performed, aiming at evaluating how goals, requirements and assumptions relate to each other (Table 23); as well as evaluating their individual value (provided as the column "Motivation" in Tables Table 19 and Table 20).

Table 23 Relationships among Goals, Requirements and Assumptions.

Goal	Requirement	Assumption
"Make explicit" (G1)	R_f1, R_u1	A_c1
"to practitioners" (G1)	R_u3	A_u1
"and researchers alike" (G1)	R_u2	A_u1
"the scientifically grounded" (G1)	R_f3	
"potential contribution of Enterprise Architecture" (G1)	R_c2	
"to the achievement of organizational goals" (G1)	R_c1	
G2	R_f2	
G3	R_f4	A_u2

4.1.4 Prototype

In the fourth stage, a first paper and pencil prototype of the EABF was realized as a proof of concept. The large number of EA Benefits and EA Benefits Relationships, led to a second iteration of the prototype building process, where a computer-based prototype was conceived and subsequently implemented in order to allow for the automated, quick and efficient generation of different versions of the EABF framework. This near-realistic testing of different EABF scenarios enhanced the common understanding of the to-be situation among the researchers and allowed for the tweaking of concepts in the EABF framework throughout a number of several other iterations, until the prototype was considered to be the embodiment of the Goal and Requirements.

4.1.5 Implementation

In the fifth stage we implemented the prototype by means of a peer review. In what could be called a formative process evaluation, peers were asked to undergo an individual exercise of assigning the EA Benefits (B.6.6) along the EABF Perspectives/Categories schema, while abiding to the specific description of the EABF (Section 4.2). A compare and contrast evaluation of their results against the list of *EA Benefits* of the EABF assured the researchers that the EABF description provided in Section 4.2 is sufficient for implementing the EABF in an environment compliant with the EABF design assumptions in [A].

4.1.6 Evaluation

In the sixth and last stage of the Design Cycle, a goal-based evaluation of the EABF artifact was performed. The researchers' goal was to examine if and how the EABF design met the design goals [G]. To achieve this, a one to one evaluation of [G] against the EABF characteristics was undertaken (Table 24).

Table 24 Evaluation of the EABF characteristics against the EABF design goals [G].

Goal	Evaluation
"Make explicit" (G1)	The EABF proposes a visual representation of the EA Benefits, where directed links are utilized to provide an explicit representation of the cause and effect Relationships between them.
"to practitioners" (G1)	The EABF provides an extensive categorization scheme for EA Benefits that selectively allows a bird's-eye view on how EA contributes to certain organizational goals.
"and researchers alike" (G1)	The EABF provides an extensive categorization scheme for EA Benefits that selectively allows a detailed view on how EA contributes to certain organizational goals.
"the scientifically grounded" (G1)	The EABF allows for backtracking from the EA Benefits to their original research study context.
"potential contribution of Enterprise Architecture" (G1)	The EABF provides an extensive categorization scheme for EA Benefits that allows for categorizing all possible kinds of EA Benefits.
"to the achievement of organizational goals" (G1)	The EABF inherits from the BSC SM and the broader BSC framework. As such, natively allows for integrating EABF-devised effectiveness metrics with existing BSC implementations.
G2	The EABF can be readily extended by providing additional EA Benefits from the knowledge base and using the categorization scheme provided by the framework to assign them to Perspectives/Categories.
G3	The EABF provides the necessary method for establishing EA Benefits effectiveness metrics by adapting the popular GQM method.

4.2 The Enterprise Architecture Benefits Framework

The EABF consists of three distinct artifacts: the *EA Benefits List (EABL)*, the *EA Benefits Relationships List (EABRL)* and the *EA Benefits Map (EABM)* (Figure 24).

The EABL (Appendix C.1, Table 74) list of unique *EA Benefits* is the result of the application of the categorization scheme for EA Benefits that was subsequently designed in the context of this research (part of the EABM) on the Unique Outcome Elements of the first research project (Appendix B.6.6, Table 72). The EABRL (Appendix C.1, Table 75) lists the relationships between the EA Benefits of the EABL.

The EABM was constructed in order to achieve the specific design goals discussed in Section 4.1.1. From a point of view, it can be stated that the EABM was constructed as a visual-oriented model to provide and enforce an appropriate structure in the lists of EA Benefits and EA Benefits Relationships, so that they can be efficiently and effectively understood and utilized. It could be argued that the sheer number and complexity of the EA Benefits and their relationships alone could provide the raison d'être for devising such an artifact.

On a meta-level, the EABM is defined with the aid and within the boundaries of two distinct concepts, namely the *EABM Metamodel* and the *EABM Concepts* (Figure 24). The EABM Concepts (Section 4.2.2) are the constituent elements of the EABM's underlying framework, each of which

includes a definition of its visual representation (or EABM Component). The EABM Metamodel (Section 4.2.1) documents the rules and relationships of the EABM Concepts and, as an extension of the EABM Components, their visual representation.

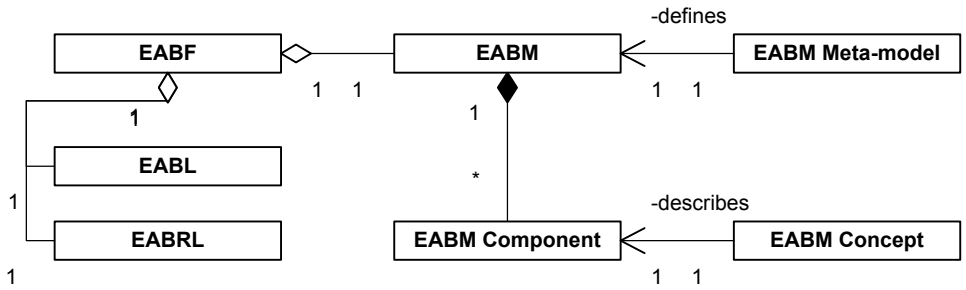


Figure 24 The EABF Meta-model using standard UML 2.0 class-diagram notation.

4.2.1 EA Benefits Map Metamodel

The EABM Metamodel (Figure 25) documents the rules that govern the relationships between the EABM Concepts and is constructed using standard UML 2.0 class-diagram notation. The metamodel echoes the reasoning, rules and structural elements of Kaplan & Norton's Balanced Scorecard Strategy Map (BSC SM) [91].

The EABM is comprised of four main *Perspectives*, as proposed in the original BSC [90], namely the *Financial Perspective*, *Customer Perspective*, *Internal Perspective* and *Learning & Growth Perspective*. Each of the four perspectives is comprised of a number of *Categories*, which can be thought of as the second-level logical grouping of *EA Benefits*.

The *Learning & Growth Perspective* consists of *the Human Capital*, *Information Capital* and *Organizational Capital Categories.* The *Customer Perspective* consists of the *Customer Outcome Category* and the *Financial Perspective* consists of the *Financial Outcome Category*. The *Internal Perspective* consists of the *Operations Management Processes*, *Customer Management Processes*, *Innovation Processes* and *Regulatory & Social Processes Categories*. All four *Categories* of the *Internal Perspective* are specialized in turn by four different sub-*Categories* (third-level logical grouping) each. The four *Categories* of the *Internal Perspective* are abstract notions and as such no direct instantiations are allowed. Instead, each *Internal Perspective Category* is expected to be used through its respective subtypes.

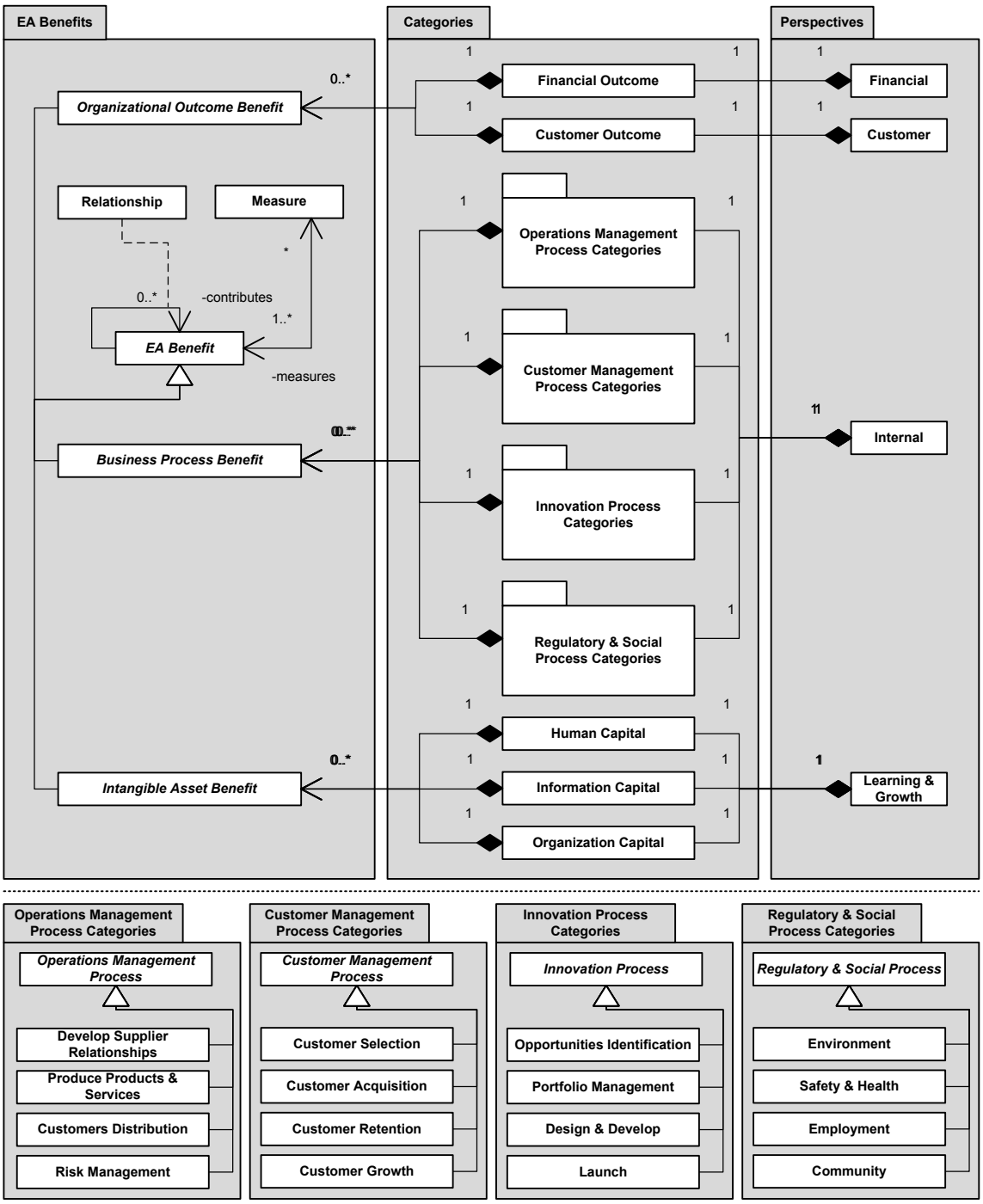


Figure 25 The EABM Metamodel .The top part describes the EABM Concepts and their relationships with the four *Categories* of the *Internal Perspective* abstracted into packages; the bottom part presents these packages expanded.

EA Benefits can be of three main types, namely *Intangible Asset Benefit*, *Business Process Benefit*, and *Organizational Outcome Benefit*. Each of the four *Perspectives' Categories and* sub-*Categories* are comprised of a number of instances of these three types of *EA Benefits*. The *Learning & Growth Perspective Categories* consist of instances of the *Intangible Asset Benefit* and the *Internal Perspective* of the *Business Process Benefit*. The *Customer Perspective* and the *Financial Perspective* both consist of any number of instances of the *Organizational Outcome Benefit* type. An instance of an *EA Benefit* subtype can belong only to one specific *Category*, which for convenience further denominates the instance's type: e.g. instead of referring to an instance of the type *Intangible Asset*

Benefit that belongs to the *Human Capital Category*, that instance can be alternatively referred upon as a *Human Capital Benefit*.

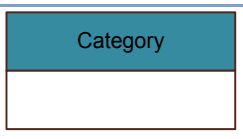
EA Benefits contribute *explicitly* to the realization of any number and type of other *EA Benefits* in a cause and effect relationship manner, as described in the EABRL (Appendix C.1, Table 75). All such important occurrences are denoted by a specific *Relationship* between two *EA Benefits*. Explicit *Relationships* between all *Categories' EA Benefits* are not usually found in the original Strategy Map among either the templates provided by the authors or the various case studies. Nevertheless, such Relationships are indeed allowed in the original Strategy Maps framework.

Finally, *Measure* is a concept dependent on that of *EA Benefit*. As such, an *EA Benefit* might be monitored by any number of *Measures*; a *Measure* though must be monitoring at least one *EA Benefit*.

4.2.2 EABM Concepts

In this subsection we present the EABM's constituent concepts, provide their definitions and relate them to their visual representation, the EABM Components. Although in the original BSC Strategy Maps [91], Kaplan & Norton do not provide us with an explicit notation for the Strategy Map, they do provide a series of "templates", which the reader is expected to freely adopt/cut to measure. Based on these templates we explicitly defined a specific notation in an attempt to provide and enforce a standard visual representation and subsequent communication of the EABM. This notation is presented in Table 25, along with a short description of the Components schematic properties and its corresponding Concept's semantics. The full description of the Concepts semantics follows right after.

Table 25 EABM Components

Component	Component Description
	***EA Benefit*** – An EA Benefit is a desirable organizational outcome, result of the EA Practice. It is denoted by an oval that encloses the name of the benefit. The background color of the oval is light blue.
	Relationship – A Relationship signifies an explicit, unidirectional causal relationship between two EA Benefits. It is denoted by a black solid line with a solid arrowhead pointing from the cause to the side of the effect.
	***Perspective*** – A Perspective represents the primary logical grouping of EA Benefits, a four-fold taxonomic reflection of the various aspects of an organization. Each perspective covers some area of the Map, having a black dotted line separating it from the next adjacent Perspective(s) and with its name displayed perpendicular to the separator.
	***Category*** – A Category represents the second-level (and deeper) logical grouping of EA Benefit subcategories. Categories are nested in Perspectives. A Category is denoted by a dark blue colored, solid line rectangle that encloses the name of the Category. Adjacent below it, a white colored, solid line rectangle that may include EA Benefits or other Categories.

To illustrate the usage of the EABM and its Components, we create an example EABM (Figure 26). In this example, we selected four EA Benefits from the EABL ("EA-Based Requirements Elicitation", which belongs to the Innovation Process Benefits Category of the Internal Perspective; "Increase Inter-organizational Business Process Support Transparency & Security" and "Comprehensive & Coordinated IT Management & Planning", which belong to the Information Capital Benefits Category of the Learning and Growth Perspective; and "Improve Intra-Organizational Communication" which belongs to the Organization Capital Benefits Category of the Learning and Growth Perspective also), for which four Relationships exist in the EABRL (from "EA-Based Requirements Elicitation" to "Increase Inter-organizational Business Process Support Transparency & Security" and to "Comprehensive & Coordinated IT Management & Planning", and from "Improve Intra-Organizational Communication" to "Increase Inter-organizational Business Process Support Transparency & Security" and to "Comprehensive & Coordinated IT Management & Planning").

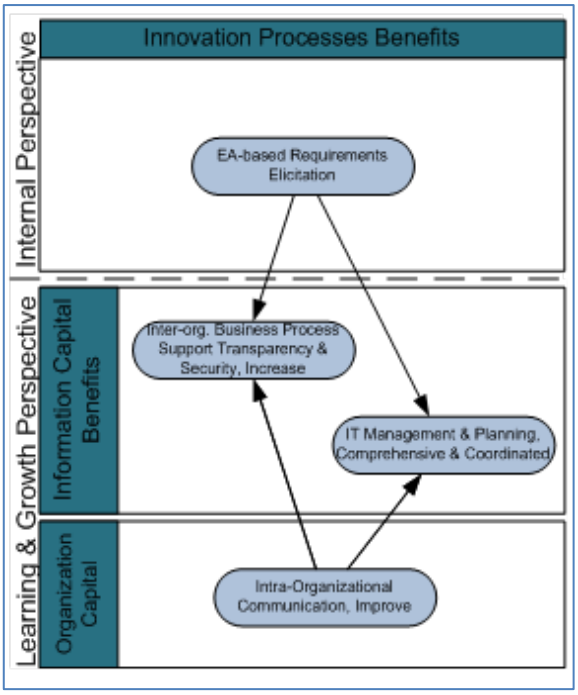


Figure 26 Example EABM

4.2.2.1 *EA Benefit*

The original BSC SM defines an Objectives-based framework for describing an organization's strategy. An Objective is a generic concept defined as an organizational goal that relates to and is only instantiated as an element of four distinct perspectives of an organization: financial, customer, internal business processes, and intangible assets (the full descriptions of which are provided in Section 4.2.2.3). An Objective usually refers to intermediate organizational goals, but displays two variations, namely the Strategic Theme and the Strategic Approach, both of which generally denote an ultimate organizational goal (also described in Section 4.2.2.3)[91].

A structurally equivalent, but semantically different notion to the BSC SCM Objective in the EABM is the *EA Benefit*. An *EA Benefit* is defined as a desirable organizational outcome, result of the direct or indirect effect generated from the application/introduction of a certain *EA Practice*-triggered *Mechanism* on the organizational structure. Such a desirable organizational outcome can be the positive effect on a certain process or artifact, the favorable introduction of a process or an entire program itself, the enablement of a certain competency, and even the contribution to the achievement of a business strategy. To the EABM, *EA Benefits* are a generic concept and thus always appear as instances of some subtype (see also Section 4.2.2.3 and depicted in the EABM Metamodel in Figure 25), namely the *Intangible Asset Benefit*, *Business Process Benefit*, and *Organizational Outcome Benefit*.

Intangible Asset Benefits are the results of the implementation of an EA program on the organization's intangible assets (human, organizational, and information capital). *Business Process Benefits* are the results of the implementation of an EA program on an organization's internal

business processes: those processes that relate to devising, creating, and delivering the organization's products and/or services. *Organizational Outcome Benefits* are the tangible or intangible organizational outcomes, results of the implementation of an EA program, referring to either financial or customer-value related organizational achievements.

4.2.2.2 *Relationships*

The original BSC SM proposes the use of links between the framework's objectives in order to denote the existence of a directed, unidirectional cause-and-effect relationship between them [91]. Similarly, in the EABM a *Relationship* is a unidirectional cause and effect association between two *EA Benefits*. Such a *Relationship* between two *EA Benefits* suggests some kind of effect or contribution from the cause-agent to the target *EA Benefit*.

4.2.2.3 *Perspectives, Categories & EA Benefit Subtypes*

The original BSC SM proposes a specific taxonomy for assigning and making sense of its strategic Objectives. This taxonomy uses two distinct notions to categorize objectives: Perspectives and Categories. Four Perspectives (Financial, Customer, Internal, and Learning & Growth) represent the first taxonomic level for Objectives. Two of the Perspectives (Internal and Learning & Growth) in turn contain multiple levels of Categories that are used to group Objectives. The other two (Financial and Customer) directly group Objectives. A detailed account of the Perspectives and their respective Categories is provided in the subsections that follow.

Similarly, in the EABM we make use of roughly the same taxonomy structure: four *Perspectives (Financia*l, *Customer*, *Internal*, and *Learning & Growth)* contain a number of different *Categories* and sub-*Categories* (a detailed account of which is provided in the subsections that follow) that are used to group *EA Benefits*. For reasons of semantic consistency, no *Perspective* directly groups *EA Benefits*; instead all *EA Benefits* are grouped in *Categories*. Additionally, *EA Benefits* are grouped in the *Category* where they produce their results or their effects manifest, and not in the *Category* they are created or in some Category they are heavily influenced by.

In the subsections that follow we provide an extensive account of the taxonomy of the four *Perspectives* and their respective *Categories*. In addition, we make use of the *Categories'* taxa, in terms of which we define the various subtypes of *EA Benefit*.

4.2.2.3.1 The Financial Perspective

The original BSC maintains the Financial Perspective as the ultimate objective for profit-maximizing companies and is used in order to describe the tangible outcomes of an organization's *single* strategy, in the form of general (financial) lag indicators of strategy achievement (i.e. ROI, profitability, shareholder value, etc) [91]. On the contrary, the EABM uses the *Financial Perspective* to describe how various financial-related organizational *EA Benefits*, results of the implementation of an EA program, contribute to the achievement of possibly *multiple* financial-related strategies. The *Financial Perspective* may comprise of any number of instances of the *Financial Outcome Benefit Category*.

A *Financial Outcome Benefit*, an instance of an *Organizational Outcome Benefit* belonging to the *Financial Outcome Category*, relates to financial-related organizational outcomes, including but not limited to, financial gains occurring in relation to or as a result of the

i) more effective use of artifacts, processes or other resources,
ii) re-use of artifacts, processes or other resources,
iii) cost-effective replication of artifacts, processes or other resources,
iv) increase in profit or similar financial indicators,
v) reduction in various costs,
vi) reduction in wasted resources.

Examples of *Financial Outcome Benefits* are: "Increase in Return On Sales (ROS)", "Improve IT Return On Investment (ROI)"). Additionally, a *Financial Outcome Benefit* can relate either to the contribution's effect to the achievement of a financial-related strategy or to the realization of the financial-related strategic approach itself (e.g. "Enhance Productivity Strategy").

4.2.2.3.2 The Customer Perspective

In the original BSC SM, the Customer Perspective describes the overall value proposition for an organization's customers. Similar to the Financial Perspective, it provides with general lag indicators of a *single* strategy's achievement, relating to the objectives of the organization's customer value proposition [91]. On the contrary, the EABM uses the *Customer Perspective* to describe how various customer-value-related organizational *EA Benefits*, results of the implementation of an EA program, contribute to the achievement of possibly *multiple* customer-value-related strategies. The *Customer Perspective* is comprised of any number of instances of the *Customer Outcome Benefit Category*.

A *Customer Outcome Benefit*, an instance of an *Organizational Outcome Benefit* belonging to the *Customer Outcome Category*, relates to customer-value-related organizational outcomes that refer either to a customer-value objective achieved or to the contributing effect on a customer-value objective. Additionally, *Customer Outcome Benefits* can relate to the

i) contributing effect on a customer-value-related strategy,
ii) achievement of a customer-value-related strategic approach,
iii) contributing effect on a strategically important customer characteristic,
iv) realization/attainment of a strategically important customer characteristic (e.g. customer group).

Examples of *Customer Outcome Benefits* are "Improve IT Assets Quality of Service (QoS)", "Customer Intimacy", and "Increase Subscribers".

4.2.2.3.3 The Internal Perspective

In the original BSC SM the Internal Perspective identifies those internal to the organization key processes that are critical for the realization of the desired strategic financial and customer outcomes -maintained in the Financial Perspective and the Customer Perspective respectively- and categorizes them into four categories: Operations Management Processes, Customer Management Processes, Innovation Processes, and Regulatory and Social Processes [91]. Akin, in the EABM the *Internal Perspective* is used to describe the various *Business Process Benefits* – results of the implementation of an EA program on internal business processes.

The EABM's *Internal Perspective* is comprised of four Categories, namely the *Operations Management Processes*, *Customer Management Processes*, *Innovation Processes*, and *Regulatory & Social Processes.*

Operations Management Processes Category

In the original BSC SM the Operations Management Processes category groups the basic processes pertaining to the production and delivery of an organization's products and services. In addition, a further four-fold sub-categorization of these processes is proposed along Supply Processes, Production Processes, Distribution Processes, and Risk Management Processes [91]. Similarly, in the EABM the *Operations Management Processes Category* groups the *Business Process Benefits* resulting from the implementation of an EA program on those internal business processes that relate to the production and delivery of an organization's products and services. Likewise to the original BSC SM, the *Operations Management Processes Category* is further divided in four sub-Categories, namely *Develop Supplier Relationships*, *Produce Products & Services*, *Customers Distribution*, and *Risk Management*.

Develop Supplier Relationships

In the original BSC SM the Supply Processes category identifies those Operations Management Processes that encompass the development and sustainment of supplier relationships. Common objectives for the Supply Processes are lowering the cost of ownership, Just-In-Time (JIT) delivery, increasing the supplies quality, use of supplier innovation, supplier partnerships, and outsourcing [91]. In the EABM, the *Develop Supplier Relationships Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those Operations Management Processes that relate to the development and sustainment of supplier relationships, and their aforementioned objectives. An example of a *Develop Supplier Relationships Benefit* is "Supplier Integration".

Produce Products & Services

In the original BSC SM the Production Processes category identifies those Operations Management Processes that encompass the production of the products and services that an organization's customers acquire or make use of. Common objectives for the Production Processes are lowering the production cost, continuous improvement of processes, improving process responsiveness, improving fixed asset utilization, and improving working capital efficiency [91].

Similarly, in the EABM the *Produce Products & Services Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those processes, process standards and process performance measures that relate to the production of the organization's products and services, and to the following objectives:

i) Lowering the production cost of services and products.
ii) Continuous improvement of processes–including objectives related to process standardization, agility, efficiency, alterability, transformation, and consolidation.
iii) Improving processes responsiveness.
iv) Improving fixed assets utilization–including objectives related to processes flexibility.
v) Improving working capital efficiency.

Examples of *Produce Products & Services Benefits* are "Improve Agility", "Enable Business Transformation", and "Operational Excellence".

Customers Distribution

In the original BSC SM the Distribute to Customers category identifies those Operations Management Processes that encompass the delivery of an organization's products and services to its customers. Common objectives for the Distribute to Customers Processes are lowering the distribution/service cost, improving delivery time, and enhancing delivery quality [91]. Similarly, in the EABM the *Customers Distribution Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those Operations Management Processes that relate to the delivery of products and services to the customer, and their aforementioned objectives. An example of a *Customers Distribution Benefit* is "Improve On-Time Delivery".

Risk Management

In the original BSC SM the Risk Management category identifies those Operations Management Processes that encompass mitigation of risk in all its possible forms. Common objectives for Risk Management Processes have been found to revolve around managing three types of organizational risk, namely financial, operating, and technological [91]. Similarly, in the EABM the *Risk Management Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those Operations Management Processes that relate to the management of all three aforementioned types of organizational risk. An example of a *Risk Management Benefit* is "Reduce Business Risk".

Customer Management Processes Category

In the original BSC SM the Customer Management Processes category groups the basic processes pertaining to acquiring customers and expanding the organization's relationships with them. In addition, a further four-fold sub-categorization of these processes is proposed among Customer Selection, Customer Acquisition, Customer Retention, and Customer Growth [91]. Similarly, in the EABM the *Customer Management Processes Category* groups the *Business Process Benefits* resulting from the implementation of an EA program on those internal business processes that relate to customer acquisition and customer relationship sustainment and growth. Likewise to the original BSC SM, the *Customer Management Processes Category* is further divided in four sub-Categories, namely *Customer Selection*, *Customer Acquisition*, *Customer Retention*, and *Customer Growth*.

Customer Selection

In the original BSC SM the Customer Selection category identifies those Customer Management Processes that encompass the identification of potential customer segments and the creation of appropriate customer-value propositions and brand images. Common objectives for Customer Selection Processes are: understand customer segments, weed out unprofitable customer segments and target high-value ones, and manage the brand image [91]. Similarly, in the EABM the *Customer Selection Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those Customer Management Processes that aim to identify attractive customer segments by screening the unprofitable and targeting the high-value ones, shape appealing customer-value propositions for them, and manage products' and services' branding. An example of a *Customer Management Benefit* is "Reduce Unprofitable Customers".

Customer Acquisition

In the original BSC SM the Customer Acquisition category identifies those Customer Management Processes that relate to the acquisition of new customers: from communicating the brand to the

market to converting leads to customers. Common objectives for Customer Acquisition Processes have been found to be: communicating the customer-value proposition, mass-marketing customization, new customer acquisition, and developing dealer/distributor relationships [91]. Similarly, in the EABM the *Customer Acquisition Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those Customer Management Processes that aim at acquiring new customers, and their aforementioned common objectives. An example of a *Customer Acquisition Benefit* is "Increase Percentage of Leads Conversion".

Customer Retention

In the original BSC SM the Customer Retention category identifies those Customer Management Processes that relate to customer retention efforts through guaranteeing quality of the products and services, resolving customer issues, and ensuring high customer satisfaction. Common objectives for Customer Retention Processes have been found to be: provision of premium customer service, creation of value-added partnerships, provision of service excellence, and creating customer loyalty [91]. Similarly, in the EABM the *Customer Retention Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those Customer Management Processes that aim at retaining an organization's existing customers, and their aforementioned common objectives. An example of a *Customer Retention Benefit* is "Improve Customer Satisfaction".

Customer Growth

In the original BSC SM the Customer Growth category identifies those Customer Management Processes that relate to the augmentation of the relationships an organization holds with its existing customers. Common objectives for Customer Growth Processes have been found to be: cross selling, solutions selling, and partnering with customers [91]. Similarly, in the EABM the *Customer Growth Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those Customer Management Processes that aim at growing the relationships between an organization and its existing customers, and their aforementioned common objectives. An example of a *Customer Growth Benefit* is "Improve Customer Cross Selling".

Innovation Processes Category

In the original BSC SM the Innovation Processes category groups the Research and Development (R&D) processes targeting new products, services and other organizational processes. In addition, a further four-fold sub-categorization of these processes is being proposed among Identifying the Opportunities, Managing the Portfolio, Design and Develop (D&D), and Launch [91]. Similarly, in the EABM the *Innovation Processes Category* groups the *Business Process Benefits* resulting from the implementation of an EA program on those internal business processes pertaining to product/service/process innovation through R&D programs. Likewise to the original BSC SM, the *Innovation Processes Category* is further divided in four sub-Categories, namely *Opportunities Identification*, *R&D Portfolio Management*, *Design and Develop*, and *Launch*.

Opportunities Identification

In the original BSC SM the Identifying the Opportunities category identifies the Innovation Processes pertaining to the identification of opportunities for new products and services. Common objectives for Opportunities Identification Processes have been found to be: future customer needs anticipation and the discovery and development of new, more effective or safer products and services [91]. Similarly, in the EABM the *Opportunities Identification Category* groups those *Business*

Process Benefits resulting from the implementation of an EA program on those Innovation Processes that aim at identifying not only new products and services, but additionally new business processes, and relate to the aforementioned common objectives. An example of an *Opportunities Identification Benefit* is "Better Future Customer-Needs Anticipation Capabilities".

R&D Portfolio Management

In the original BSC SM the Managing the Portfolio category identifies the Innovation Processes pertaining to the management of the R&D portfolio of the organization. Common objectives for Managing the Portfolio Processes have been found to be: choosing and managing the correct mix of products, extending the current products to new markets, and extending the product portfolio through collaboration [91]. Similarly, in the EABM the *R&D Portfolio Management Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those *Innovation Processes* that aim at managing the products and services of an organization, and relate to the aforementioned common objectives. An example of an *R&D Portfolio Management Benefit* is "Better Management of Licensed Products".

Design & Development

In the original BSC SM the Design and Develop category identifies the Innovation Processes pertaining to an organization's new products and services design and development. Common objectives for Design and Develop Processes have been found to be: managing the projects portfolio, reducing development cycle time, and managing the development cycle costs [91]. Similarly, in the EABM the *Design & Development Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those *Innovation Processes* that aim at managing the portfolio of new products and services projects of an organization. More specifically, those processes encompass a broad spectrum of tasks: from the initial concept development and product and process design, to prototyping and testing. Common denominator to all the aforementioned processes is the effort to manage the development cycle time and cost. Examples of *Design & Development Benefits* are "Increase Requirements Specifications Accuracy", "Deliverables Consistency", and "Reduce IS Development Time".

Launch

In the original BSC SM the Launch category identifies the Innovation Processes related to bringing the organization's new products and services to the market. Common objectives for Launch Processes have been found to be the rapid launch, and the effective production, marketing, distribution and sales of new products [91]. Similarly, in the EABM the *Launch Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those *Innovation Processes* that aim at introducing a new product or service to the market. More specifically, those processes encompass a broad spectrum of tasks, from pilot production to "ramping up" commercial production. Common denominator to all the aforementioned processes is the effort to manage the effective production of new products (meet targeted levels of product functionality, quality and cost) and their effective marketing, distribution and sales. Examples of *Launch Benefit* are "Reduce Customer Returns of New Products" and "Increase Number of New Products Launched".

Regulatory & Social Processes Category

In the original BSC SM the Regulatory and Social Processes category groups those processes organizations employ in order to manage and report their performance on national and/or local

regulations and other aspects of social interest. In addition, a further four-fold sub-categorization of these processes is being proposed among Environmental Performance, Safety and Health Performance, Employment Practices, and Community Investment [91]. Similarly, in the EABM the *Regulatory & Social Processes Category* groups the *Business Process Benefits* resulting from the implementation of an EA program on those internal business processes pertaining to the management and reporting of organizational performance on national and/or local regulations and other aspects of social interest related to environmental, employee safety and health, employment practices, and community investment issues. Likewise to the original BSC SM, the *Regulatory & Social Processes Category* is further divided in four sub-Categories, *namely Environmental Performance*, *Employee Safety & Health*, *Employment Practices*, and *Community Investment*.

Environmental Performance

In the original BSC SM the Environmental Performance category identifies the Regulatory and Social Processes pertaining to the management and reporting of an organization's environmental performance along several dimensions like energy and resource consumption, water and air emissions, solid waste production and disposal, product environmental performance, and other aggregate environmental measures. The common objectives for Environmental Performance Processes focus in increasing shareholder value and simultaneously on reducing the organizational ecological footprint [91]. Similarly, in the EABM the *Environmental Performance Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those *Regulatory & Social Processes* that aim at managing and reporting the environmental performance of an organization (usually along the aforementioned dimensions) in order to comply with or outperform national and/or local regulations related to environmental issues and increase shareholder value by simultaneously reducing the organizational ecological footprint. Examples of Environmental Performance Benefits are "Improve Environmental Reporting" and "Enhance Visibility of Environmental Impact of Processes".

Employee Safety & Health

In the original BSC SM the Safety and Health category identifies the Regulatory and Social Processes pertaining to the management and reporting of an organization's employee safety and health performance [91]. Similarly, in the EABM the *Employee Safety & Health Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those *Regulatory & Social Processes* that aim at managing and reporting the employee safety and health performance of an organization in order to comply with or outperform national and/or local regulations related to occupational safety and health issues. An example of an *Employee Safety & Health Benefit* is "Improve Occupational Safety & Health Administration (OSHA) Compliance Reporting".

Employment Practices

In the original BSC SM the Employment Practices category identifies the Regulatory and Social Processes pertaining to the management and reporting of an organization's employment practices performance; with the most prominent dimension being workforce diversity [91]. Similarly, in the EABM the *Employment Practices Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those *Regulatory & Social Processes* that aim at managing and reporting the employment practices performance of an organization in order to comply with or outperform national and/or local regulations. An example of an *Employment Practices Benefit* is "Improve Employment Practices Compliance Reporting".

Community Investment

In the original BSC SM the Community Investment category identifies the Regulatory and Social Processes pertaining to the management and reporting of an organization's performance in investing in the community in the form of funding community-based organizations, by volunteer work done by company employees, or otherwise [91]. Similarly, in the EABM the *Community Investment Category* groups those *Business Process Benefits* resulting from the implementation of an EA program on those *Regulatory & Social Processes* that aim at managing and reporting the community investment performance of an organization in order to comply with or outperform national and/or local regulations. Organizational community investment might take up many forms (e.g. funding, volunteering) and occur for a variety of reasons like philanthropy and deriving competitive advantage (e.g. investing in educational programs) [91]. An example of a *Community Investment Benefit* is "Improve Community Investment Performance Data-Gathering".

4.2.2.3.4 The Learning & Growth Perspective

In the original BSC SM the Learning & Growth Perspective describes the most important intangible assets in terms of strategic importance and how these intangible assets create value or support the value-creating processes of the Internal Perspective. In a nutshell, the Learning & Growth Perspective describes what jobs, which systems, and what organizational characteristics (e.g. culture, alignment, knowledge sharing) are necessary in order to support an organization's *single* strategy. The intangible assets are being categorized in three distinct "components": Human capital, Information Capital, and Organizational capital [91]. Similarly, in the EABM, the *Learning & Growth Perspective* is used to describe those various *Intangible Asset Benefits*–results of the implementation of an EA program on the intangible assets of an organization. On the contrary though, the EABM uses the *Learning & Growth Perspective* to describe how these *Intangible Asset Benefits* contribute to the achievement of possibly *multiple* organizational strategies. In an analogy to the BSC SM, a distinction is made for different *Intangible Asset Benefits* between three main Categories, namely the *Human Capital*, *Information Capital* and *Organization Capital*.

Human Capital Category

In the original BSC SM the Human Capital category describes those intangible assets required in order to perform the critical internal processes that support the organizational strategy, such as employee skills, talent, and know-how [91]. Similarly, in the EABM the *Human Capital Category* groups the *Intangible Asset Benefits* resulting from the implementation of an EA program on those intangible assets that relate to an organization's stock of workforce competencies (i.e. skills, talent, and know-how). Examples of *Human Capital Benefits* are "Minimize Technical Competencies Variations" and "Improve Goal Attainment".

Information Capital Category

In the original BSC SM the Information Capital category describes those intangible assets required in order to perform the critical internal processes which support the organizational strategy, such as information systems, networks and the required infrastructure. More specifically, Information Capital groups intangible assets of two types: IT infrastructure and information capital applications. IT infrastructure refers to both physical (e.g. hardware, networks) and management (e.g. IT management, architecture, standards, security) infrastructure. Information capital applications can refer to transaction processing (e.g. ERP), analytic (applications for analyzing, making sense of and sharing information) and transformational applications (transaction processing or analytic

applications with key strategic impact) [91]. Similarly, in the EABM the *Information Capital Category* groups the *Intangible Asset Benefits* resulting from the implementation of an EA program on the two aforementioned types of intangible assets (IT infrastructure and information capital applications), which make information and knowledge available to an organization. Examples of *Information Capital Benefits* are "Cleanup Enterprise Applications", "Integrate Infrastructure Technologies", and "Improve IS Security".

Organization Capital Category

In the original BSC SM the Organization Capital category describes those intangible assets required in order to enable tangible and intangible assets to integrate and align with the organizational strategy. More specifically, Organization Capital groups intangible assets of four types: culture (i.e. shared mission, vision, and core values perceptions), leadership development and accountability, individual alignment to strategic objectives and incentives, and teamwork and knowledge sharing (i.e. use of Knowledge Management Systems (KMS) to generate, organize, develop and distribute knowledge)[91]. Similarly, in the EABM the *Organization Capital Category* groups the *Intangible Asset Benefits* resulting from the implementation of an EA program into the four aforementioned types of intangible assets:

i) Culture: employee perception and internalization of the organization's mission and core values, employee attitude and behavior, and employee satisfaction at all levels of the organization.
ii) Leadership: organizational leadership development and accountability, leadership value creation and strategy execution, and human capital development.
iii) Alignment: alignment of individual employees to BU and/or strategic objectives and incentives, alignment between individual employees, alignment between inter/intra-organizational structures. Alignment usually manifests in, but also causes, improved collaboration and communication.
iv) Teamwork and knowledge sharing: data, information, and knowledge generation, organization, development, and distribution.

Examples of *Organization Capital Benefits* are "Improve Intra-Organizational Collaboration" (Alignment), "Improve IS & IT Governance Arrangements Communication" (Culture), "Improve Inter-organizational Information Sharing" (Teamwork).

4.2.2.4 *EA Benefits per Category*

In this section we present an overview of the EA Benefits assigned to Categories and their Perspectives. In Table 26 we sum the EA Benefits of the EABL, grouped per Category (and Subcategory where applicable).

The majority of the EA Benefits belong to the Learning & Growth (52%) and the Internal (30%) Perspectives. The Financial Perspective ranks third (16%), and the Customer Perspective appears almost completely underrepresented (2%). From the 52 EA Benefits of the Learning & Growth Perspective, almost two thirds belong to the Information Capital Category (60%), exactly one third to the Organizational Capital Category (33%), and just 8% to the Human Capital Category. From the 30 Internal Perspective EA Benefits, half belong to the Innovation Processes Category, almost all of the other half (47%) to the Operations Management Processes Category, only one belongs to the Customer Management Processes Category (3%), and none to the Regulatory & Social Processes Category. All of the 15 Innovation Processes Category's EA Benefits belong to its Design & Development Subcategory. Similarly, most of the Operations Management Processes' EA Benefits belong to its Produce Products & Services Subcategory.

***Perspective*/Category/**Subcategory	**Benefits**
Learning & Growth Perspective	***52***
Information Capital	**31**
Organization Capital	**17**
Human Capital	**4**
Internal Perspective	***30***
Innovation Processes	**15**
Design & Development	15
Opportunities Identification	0
R&D Portfolio Management	0
Launch	0
Operations Management Processes	**14**
Produce Products & Services	11
Risk Management	2
Develop Supplier Relationships	1
Customers Distribution	0
Customer Management Processes	**1**
Customer Retention	1
Customer Selection	0
Customer Acquisition	0
Customer Growth	0
Regulatory & Social Processes	**0**
Environmental Performance	0
Employee Safety & Health	0
Employment Practices	0
Community Investment	0
Financial Perspective	***16***
Customer Perspective	***2***
Grand Total	***100***

Table 26 Total EA Benefits per Perspective, Category, and Subcategory

4.2.3 The EA Benefits Map

In this section we present versions of the EABM, which were constructed by abiding to the EABM Metamodel, while we instantiated the EABM Concepts' Components with the EABL and EABRL entries.

The EABM can be used to display all or any subset of EA Benefits from the EABL. Although no definitive specification is provided for the vertical and horizontal placement order of the Perspectives and their Categories, we suggest the adoption of the templates provided in Appendix C.2, covering the entire range of different Categories scope levels. The rationale behind the proposed placement of the Perspectives and their Categories follows that of the original BSC SM, and reflects its underlying semantic connection between the different perspectives: the Learning & Growth Perspective supports the Internal Perspective that in turn realizes the Customer and Financial Perspectives [91]. Additionally, when creating an EABM it is allowed to omit empty Perspectives and Categories from the diagram.

In Figure 27 we draw an EABM that includes all those EA Benefits from the EABL (Appendix C.1, Table 74) that are part of an explicit Relationship in the EABRL (Appendix C.1, Table 75). In Figure 28

we draw an EABM that displays all EA Benefits from the EABL and all their possible Relationships from the EABRL.

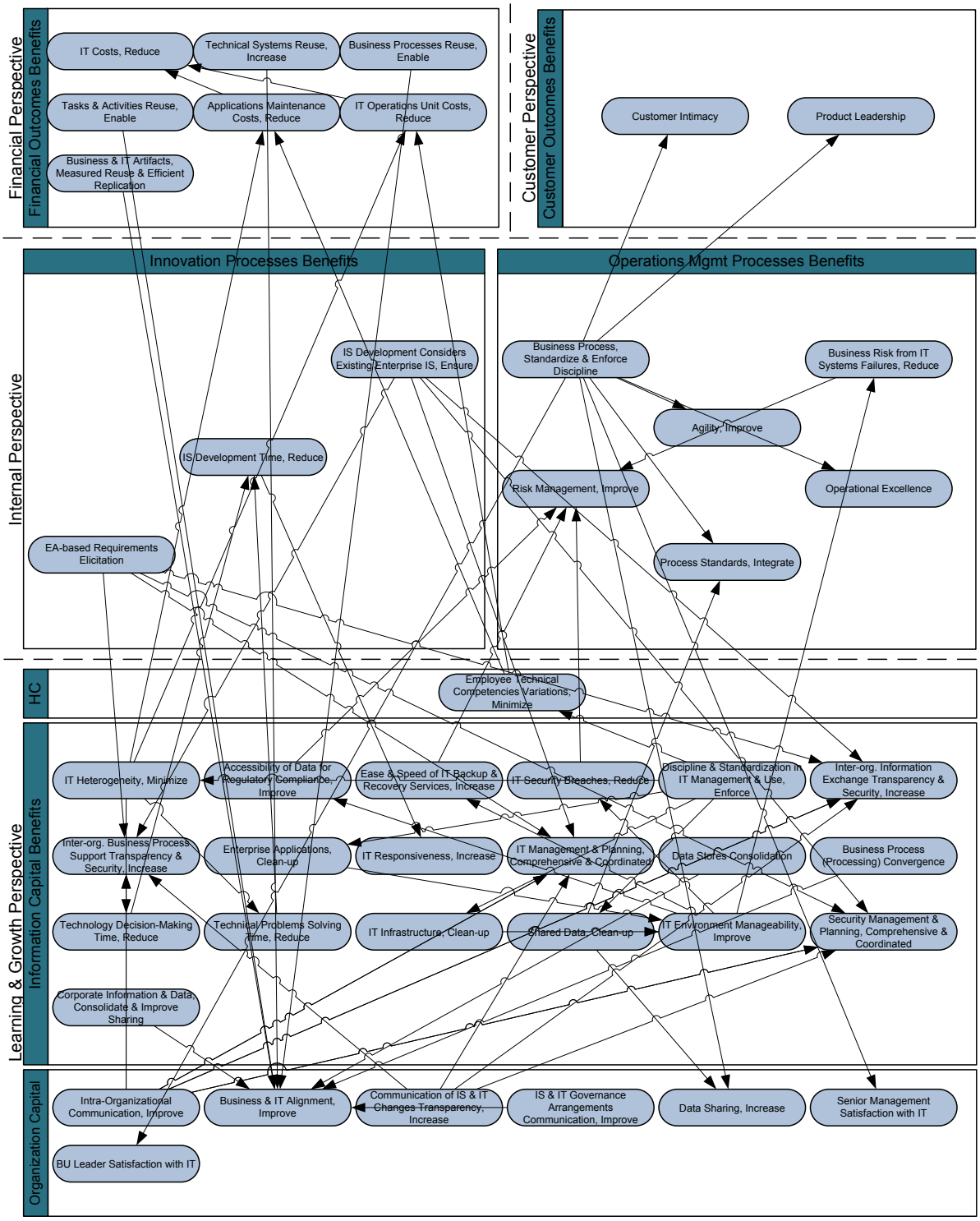


Figure 27 EABM only for those EA Benefits in the EABL that are part of a Relationship in the EABRL.

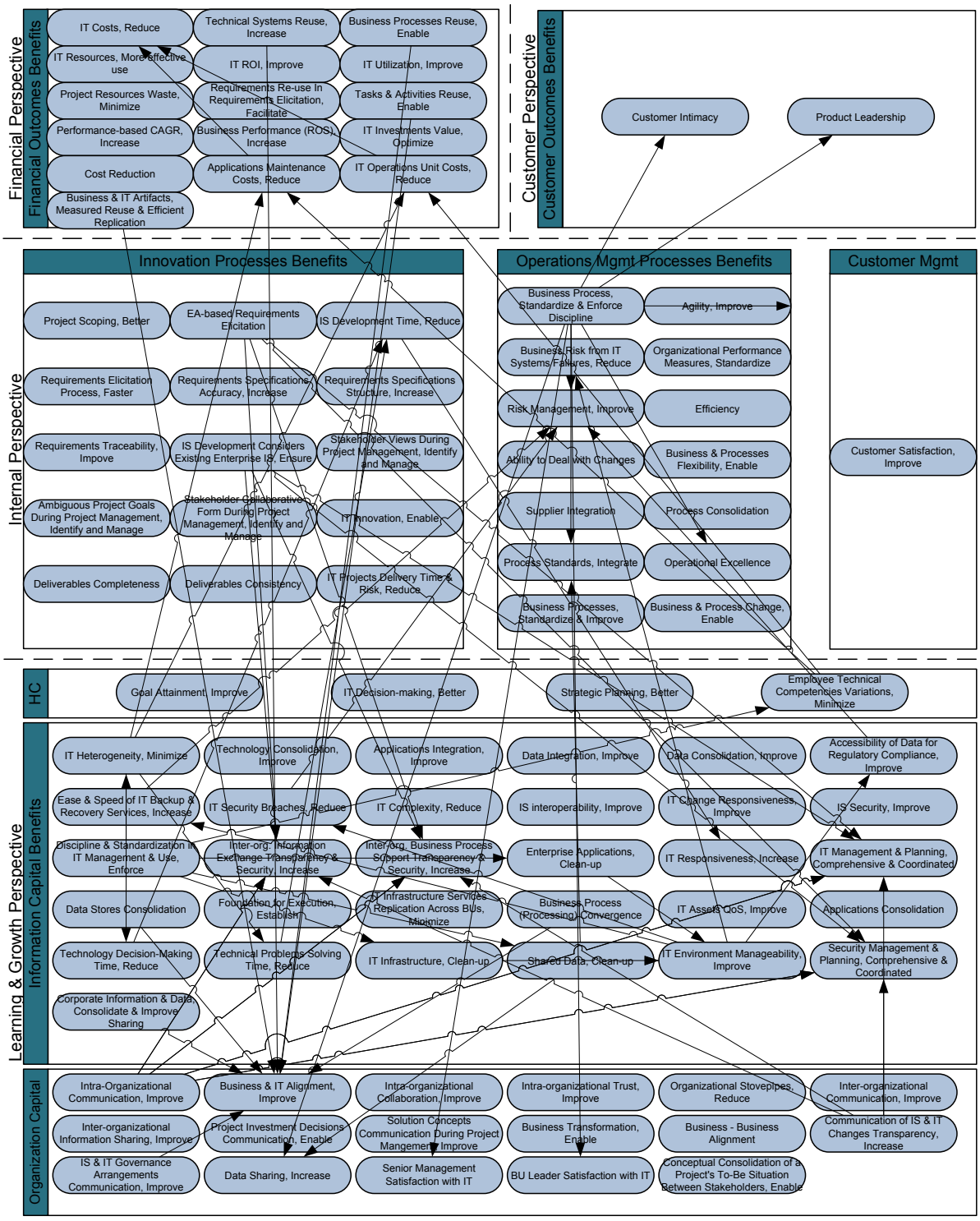


Figure 28 EABM for all EA benefits in the EABL all their Relationships in the EABRL.

4.2.4 The EA Measures of Effectiveness

As Basili et al (1999) assert, *measurement* is in essence a corporate memory-creating mechanism that helps in determining the strength, weaknesses and quality of products, services, and processes; provides the necessary rationale for adopting/refining techniques; and aids in assessing a project's progress, taking corrective actions, and evaluating the corrective actions taken [82]. In the original BSC SM, a good number of Measures is being proposed in order to monitor the performance of an organization's strategic Objectives, as they are defined in each of the four Perspectives [91]. In a

similar manner, in the EABF we employ *Measures* in order to capture the actual contribution of any *EA Benefit* of every *Perspective* and *Category* over some time period.

Although in the original BSC SM Measures do play a vital role, there is no specific methodology provided by the authors for specifying them. For this reason in the EABF, for managing *Measures* we propose the widely used Goal-Question-Metric Method (GQM), established primarily in the work of Basili & Weiss [92]. The rationale for the selection of the GQM rests on its proven-quality for selecting and implementing metrics [93] and additionally, on its usage in relevant research undertakings (e.g. [11, 12]).

4.2.4.1 *The Goal-Question-Metric Method*

The GQM method rests on the assumption that measurement should be goal-oriented [93]. As such, the GQM contends that effective measuring entails first specifying the goals, then operationalizing them by specifying the data that will define them in practice, and finally providing a framework to make sense of the data in relation to the goals. The outcomes of the application of the GQM are a measuring system that targets specific issues, and a set of rules to interpret the measurement data [82]. The interpretation of the data provides an answer whether the goals have been attained [94].

The overall GQM methodology encompasses all aspects of managing the measurement process and consists of four phases (Figure 29) [94]:

i) *Planning*: selection, definition, characterization of, and planning a project for measurement application; creation of the project plan.
ii) *Definition*: define and document the measurement program's goals, questions, and metrics.
iii) *Data Collection*: collect data.
iv) *Interpretation*: process collected data into measurements that provide answers for evaluating goal attainment.

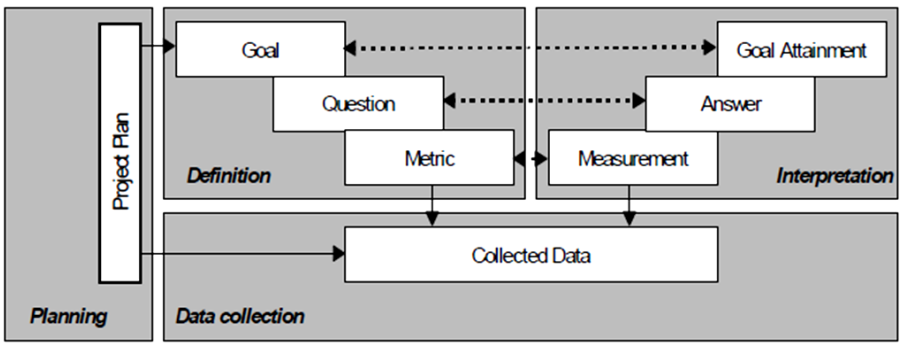


Figure 29 The four phases of the GQM method (adopted from [93])

For the Definition phase specifically, the GQM provides a three-level measurement model for constructing the measurement system [82]:

i) Conceptual Level–*Goal*: Goals are defined for various Objects of measurement, along three coordinates (i.e. *issue*, *object*, and *viewpoint*) and a *purpose*. In other words, when specifying a goal, first the purpose of measurement has to be defined, then an object and a relating issue to measure, and finally a specific viewpoint from which to take the measure.
ii) Operational Level–*Question*: Questions are defined to characterize the Object of measurement in relation to some quality issue and in order to determine its quality from a

specific viewpoint. To refine the goal and break it down into its main components it is necessary to ask at least three groups of questions:

a. How can the Object be characterized with respect to the overall goal of the GQM model?
b. How can the Object's attributes that are relevant to the GQM model's issue be characterized?
c. How can the Object's characteristics that are relevant to the GQM model's issue be evaluated?

iii) Quantitative Level–*Metric*: Data are associated with a question in order to provide an answer in a quantitative way. Data can be either *objective* (depend only on the Object being measured) or *subjective* (depend both on the object and the viewpoint from which they are taken).

4.2.4.2 *Applying the Goal-Question-Metric Method*

In the context of the EABF we focus on the Definition phase and the GQM model. More specifically, we employ the three-level measurement model and describe how it is employed for defining the EA Benefits effectiveness metrics. A wider span of focus on the GQM methodology phases would be out of this research project's scope, since it would refer to the issues concerning a wider–though certainly at least equally intricate–span of activities related to the general management of measurement projects, to various data-collection methods, and to other data analysis and interpretation activities. For more information concerning the aforementioned activities (of the remaining phases 1, 3, and 4 of the GQM methodology), the reader should refer to [93] and [94].

The GQM model can be readily applied to defining metrics related to *single EA Benefits* by simply substituting *EA Benefit* for *Goal*. As an example we can apply the GQM on the EA Benefit "Reduce IT Costs". We begin by breaking up the *EA Benefit* into its constituent parts, along the three coordinates (i.e. *issue*, *object*, and *viewpoint*) and the *purpose*. Having defined the purpose ("reduce"), object ("IT") and issue ("cost") of measurement (there is no specific viewpoint in this instance), we operationalize the goal into three questions that can provide appropriate answers relating to our selected goal's achievement and finally, for each of the questions, we associate specific metrics that will provide quantitative answers to the questions (Table 27).

Table 27 GQM Model applied on the EA Benefit "Reduce IT Costs".

Goal (EA Benefit) **Purpose** **Issue**		#7 Reduce the *costs* of	**Object** **Viewpoint**	IT --
Question	**Q1**	How much are the current IT costs?		
Metric	**M1**	Total IT cost (€)		
Question	**Q2**	What is the deviation of the current IT costs from the estimated?		
Metric	**M2**	Actual IT cost deviation from estimate (%)		
Question	**Q3**	Are the IT Costs reducing?		
Metric	**M3**	Difference of current from baseline IT costs (€)		

The real power of the EABF though, lies in the enablement of assessing the real contribution of EA towards specific organizational goals, by taking into account the intermediate effects that EA is generating or contributing to. In other words, the real contribution of EA to the achievement of

organizational goals should become more readily apparent and less difficult to measure by establishing effectiveness metrics along the trails of cause and effect relationships between those EA Benefits that directly or indirectly contribute to them. Establishing trails of performance metrics and the results of such a practice have been acknowledged in similar research undertakings [12]. Additionally, we think it is within reason to assume that whenever an explicit cause and effect relationship exists between *EA Benefits*, there ought to be two sets of metrics whose measurements will reflect that relationship. This means that between explicitly connected EA Benefits, it must be possible to define two sets of metrics, one for each EA Benefit, whose relationship can be explained in terms of some function. Of course, it must be stressed at this point, that not any two sets of metrics will necessarily reveal such a relationship that will render it possible to define it through a function.

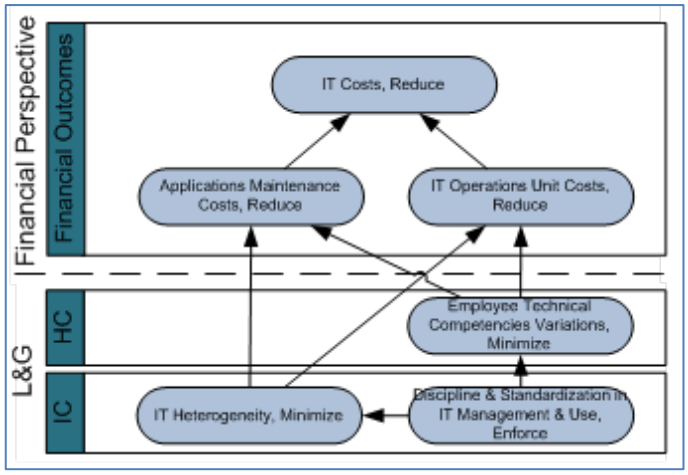


Figure 30 EABM depicting EA Benefit "Reduce IT Costs" and all its contributing EA Benefits. Abbreviations stand for: i)L&G: ii)Learning and Growth Perspective; iii)IC: Information Capital Category; iv)HC: Human Capital Category.

Building on the previous example, we select to construct the EABM for the EA Benefit “Reduce IT Costs” and all its contributing *EA Benefits*, in order to get a clearer picture of the ways EA is contributing to achieving IT costs reduction. Using the list of *EA Benefits Relationships* (Appendix C.1, Table 75) we find that there are five directly or indirectly contributing EA Benefits. Using the list of *EA Benefits* (Appendix C.1, Table 74) categorized by EABM Perspective and Category, we find that they span three Categories in two Perspectives. Using the resulting EABM (Figure 30), we finally select to define additional effectiveness metrics (Table 28) on all the directly contributing EA Benefits of the same Perspective (Financial) since (we assume that) they provide sufficient causal indication for the behavior of the goal/*EA Benefit* of interest and its metrics. The next phases, that are not part of this research, would be to proceed with the actual collection and interpretation of the data. By means of statistical analysis, it would be then theoretically possible to uncover those relationships between the sets of metrics of the three EA Benefits that can be described by some functions.

Table 28 GQM models for EA Benefits "Reduce IT Costs", "Reduce Applications Maintenance Costs", and "Reduce IT Operations Unit Costs". A Viewpoint is not specified for any of the three EA Benefits since none is given in their description.

Goal (EA Benefit) **Purpose** **Issue**		#7 Reduce the *costs* of	**Object** **Viewpoint**	IT --
Question	**Q1**	How much are the current IT costs?		
Metric	**M1**	Total IT cost (€)		
Question	**Q2**	What is the deviation of the current IT costs from the estimated ones?		
Metric	**M2**	Actual IT cost deviation from estimate (%)		
Question	**Q3**	Are the IT Costs reducing?		
Metric	**M3**	Difference of current from baseline IT costs (€)		
Goal (EA Benefit) **Purpose** **Issue**		#120 Reduce the *costs* of	**Object** **Viewpoint**	applications maintenance --
Question	**Q1**	How much are the current application maintenance costs?		
Metric	**M1**	Total application maintenance cost (€)		
Question	**Q2**	What is the deviation of the current application maintenance costs from the estimated ones?		
Metric	**M2**	Actual application maintenance cost deviation from estimate (%)		
Question	**Q3**	Are the application maintenance costs reducing?		
Metric	**M3**	Difference of current from baseline application maintenance costs (€)		
Goal (EA Benefit) **Purpose** **Issue**		#156 Reduce the *unit costs* of	**Object** **Viewpoint**	IT operations --
Question	**Q1**	How much are the current IT operations unit costs?		
Metric	**M1**	Total IT operations unit costs (€)		
Question	**Q2**	What is the deviation of the current IT operations unit costs from the estimated ones?		
Metric	**M2**	Actual IT operations unit costs deviation from estimate (%)		
Question	**Q3**	Are the IT operations unit costs reducing?		
Metric	**M3**	Difference of current from baseline IT operations unit costs (€)		

4.3 An Example EABF Use-case

In this section we give an example of a hypothetical use-case for the EABF.

4.3.1 Background

The hypothetical scenario concerns an architect of (the fictitious) Acme Corp., which is planning to establish an organizational-wide EA program in the near future. One of Acme's major goals for implementing EA is improving business/IT alignment. Acme has already in place a full-fledged BSC-based strategic performance measurement system. The architect needs to determine the possible, scientifically established ways through which EA can contribute to improving business/IT alignment and then define appropriate metrics that will realistically reflect the performance of the business/IT alignment goal. These performance metrics will then be integrated with the BSC in place. The ultimate goal of the architect is to establish a performance baseline prior to implementing the EA, so as to be able to compare and contrast with future performance measurements, in an effort to assess

the success of Acme's undertaking, always concerning the specific goal of improving business/IT alignment.

4.3.2 Building the EABM

The architect begins by locating the EA Benefit "Business and IT Alignment, Improve" (ID = 4) in the EABF table *EA Benefits* (Appendix C.1, Table 74). Using a recursive search technique on the table *EA Benefits Relationships* (Appendix C.1, Table 75), the architect identifies all those EA Benefits that directly or indirectly contribute to the achievement of the "Business and IT Alignment, Improve" EA Benefit (Table 29). Having located the identified EA Benefits, the architect identifies each EA Benefit's Perspective and Category (Table 2) from the *EA Benefits* table. By knowing the EA Benefits, their Relationships and their respective categorization, the architect proceeds with the construction of the EABM (Figure 31).

Table 29 Subset of the EABRL table that contains the Relationships between those (highlited in grey) EA Benefits (column [EA Benefit ID From]) that either contribute directly to the EA Benefit-goal "Business and IT Alignment, Improve" (column [EA Benefit ID To]) or contribute to the the EA Benefit-goal indirectly, by contributing to another EA Benefit that itself contributes directly or indirectly to the the EA Benefit-goal.

Relationship ID	EA Benefit ID From	EA Benefit ID To
352	17	4
353	18	4
351	76	4
354	77	4
123	100	4
188	141	4
440	158	4
441	159	4

Table 30 EA Benefits directly or indirectly contributing to the EA Benefit "Business and IT Alignment" and their Perspectives/Categories.

ID	EA Outcome Name	Perspective	Category
17	Technical Systems Reuse, Increase	Financial	Financial Outcome
18	Business Processes Reuse, Enable	Financial	Financial Outcome
76	Data Stores Consolidation	Learning & Growth	Information Capital
77	Tasks & Activities Reuse, Enable	Financial	Financial Outcome
100	Business Process (Processing) Convergence	Learning & Growth	Information Capital
141	IS & IT Governance Arrangements Communication, Improve	Learning & Growth	Organization Capital
158	Corporate Information & Data, Consolidate & Improve Sharing	Learning & Growth	Information Capital
159	Business & IT Artifacts, Measured Reuse & Efficient Replication	Financial	Financial Outcome

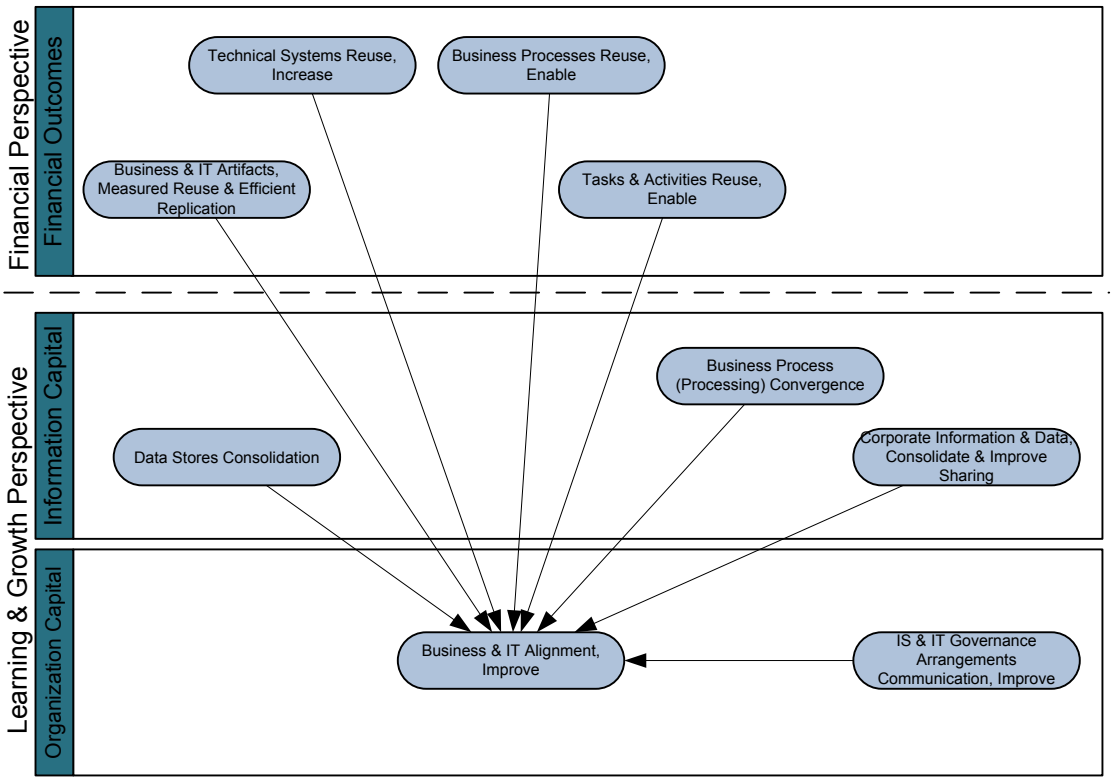


Figure 31 EABM depicting EA Benefits that have been found in the EABRL to explicitly contribute to the EA Benefit "Business & IT Alignment, Improve".

4.3.3 Developing the EA Effectiveness Metrics

Using the EABM's visual representation of those EA Benefits that contribute to the achievement of the EA Benefit "Improve Business & IT Alignment", the architect decides (arbitrarily for the example's sake) that the Information Capital Category's EA Benefits provide a realistic enough representation of the causal relationships that ultimately target the EA Benefit of interest, and that assigning EA Effectiveness Metrics for these EA Benefits will be enough so as to establish a baseline measurement now and an effective measurement dataset for comparing against in the future.

In this line, the architect applies the GQM model on the EA Benefits "Improve Business & IT Alignment", "Data Stores Consolidation", "Business Process (Processing) Convergence", and "Corporate Information & Data, Consolidate & Improve Sharing". The first step is to break up the EA Benefits/goals into their constituent parts, along the three coordinates (i.e. *issue*, *object*, and *viewpoint*) and the *purpose*. For the "Improve Business & IT Alignment" EA Benefit specifically, the architect selects defining questions and appropriate metrics from the viewpoint of the CIO. The second step is to operationalize the goals into relevant questions that will provide answers relating to the goal's achievement. The third step is to define and associate specific metrics for each of the questions that will provide the quantitative answers. The result of the application of the GQM is presented in Table 31.

Table 31 GQM models for EA Benefits "Reduce IT Costs", "Data Stores Consolidation", "Business Process (Processing) Convergence", and "Corporate Information & Data, Consolidate & Improve Sharing". A Viewpoint is not specified for the three contributing EA Benefits since none is given in their description.

Goal (EA Benefit) **Purpose** **Issue**	#4 Improve the *alignment* of		**Object** **Viewpoint**	business & IT CIO
Question	**Q1**	What is the current alignment rating?		
Metric	**M1**	Subjective rating by the CIO		
Question	**Q2**	What is the deviation of the current alignment rating vs. the estimated one?		
Metric	**M2**	Subjective evaluation by the CIO		
Question	**Q3**	Is the current alignment performance satisfactory?		
Metric	**M3**	Subjective evaluation of the CIO		
Question	**Q4**	Is the alignment performance actually improving?		
Metric	**M4**	Subjective rating by the CIO.		
Goal (EA Benefit) **Purpose** **Issue**	#76 Consolidate the *storage* of		**Object** **Viewpoint**	data --
Question	**Q1**	What percentage of the total data is currently in consolidated data stores?		
Metric	**M1**	Current data in consolidated data stores (%)		
Question	**Q2**	What is the deviation of the data currently in consolidated data stores from the estimated ones?		
Metric	**M2**	Subjective rating by the CIO		
Metric	**M3**	Actual data in data stores deviation from estimate (%)		
Question	**Q3**	Are data being increasingly consolidated in data stores?		
Metric	**M4**	Ratio of current data in consolidated data stores over baseline of data in consolidated data stores (%)		
Goal (EA Benefit) **Purpose** **Issue**	#100 Converge the *processing* of		**Object** **Viewpoint**	business processes --
Question	**Q1**	How many business processes' processing has been currently converged?		
Metric	**M1**	Total business processes whose processing has been converged		
Question	**Q2**	What is the deviation of the business processes whose processing has been converged from the estimation?		
Metric	**M2**	Actual number of business processes whose processing has been converged deviation from estimate (%)		
Question	**Q3**	Is the number of business processes whose processing has been converged increasing?		
Metric	**M3**	Ratio of current business processes whose processing has been converged over baseline measurement (%)		
Goal (EA Benefit) **Purpose** **Issue**	#158 Consolidate & Improve the *sharing* of		**Object** **Viewpoint**	corporate information & data --
Question	**Q1**	How much corporate information and data is being shared?		
Metric	**M1**	Subjective evaluation by the CIO		
Question	**Q2**	What is the deviation of the current corporate information and data being shared from the estimated ones?		
Metric	**M2**	Subjective CIO evaluation deviation from estimate (%)		

Question	**Q3**	Is the corporate information and data sharing being increasingly consolidated and improving?
Metric	**M3**	Ratio of CIO's subjective rating of corporate information and data sharing consolidation and improvement over baseline measurement.

5 Discussion

5.1 SLR Discussion

5.1.1 Major Findings & Quality of the Evidence

The results of our research indicate the ways that EA has been found (in the scientific knowledge base and other relevant practitioner-oriented literature) to contribute to the achievement of certain organizational goals. In other words, our research results provide a consolidated and scientifically established picture of the potential organizational benefits of EA. In addition, our research results provide rich, end-to-end supporting evidence on the ways those benefits contribute to each other and ultimately, to certain organizational goals. End-to-end stands for a full account of the available research findings: unlike similar research on EA benefits (e.g. [17, 39]) that reported on EA benefits without taking into account any relevant context, this research sought to understand and report not only the context within which certain benefits appear as results of the application of an EA program on an organizational structure, but also the generative mechanisms of EA that cause them.

The final results of the Structured Literature Review concern the review of 14 eligible contributions and their subsequent analysis under the CIMO-logic prism. The analysis revealed the current state of the scientific and practitioner's literature concerning the potential benefits of EA, as describing 29 unique contexts within which EA has been found to deliver value, 100 unique benefits of EA, and 3 mechanisms that generate the value of EA. The analysis of the results in relevant themes, pinpointed the evident emphasis of the selected studies towards IT and IT-related issues, both in terms of applicability Contexts and Outcomes—benefits of EA. What is more, there appears to be some consensus on the contexts and outcomes located in the contributions: although very few studies explicitly research outcomes under specific contexts, there appears to be a thematic match—to a certain extent—between the researched contexts and outcomes of different studies, like Risk Management and IT Cost Reduction. We hold this match to be especially indicative of the perceived importance those issues hold for EA researchers and practitioners.

The results of the search show clearly that the manual additions to the search process had a greater impact on the final list of accepted contributions, both analogically and as a bottom-line contribution, than those originating from search engines. The results additionally show that the vast majority of the potential contributions were finally excluded from the research synthesis. That is not primarily attributed to the overall quality of the contributions though. From those contributions that were excluded, approximately one out of three was found to be relevant to the synthesis goals but even so, was subsequently excluded on the grounds of various methodological or other qualitative deficiencies, as they were established based on the assessment screening questions and the assessment research-related questions. We hold these results as indicative of the absence of a sufficient number of research programs being conducted on the potential benefits of EA. Additionally, we hold these results as indicative of the relatively poor quality standards of either the contributing research or its reporting; at least as those score against the criteria that were set for this systematic review.

Another interesting finding is the support we found for the claim that the domain of EA is young and evolving [10-12] in the increasing number of total accepted and rejected contributions per year (contributions which were initially considered as potentially eligible and their full-text was

subsequently reviewed). From these contributions, the oldest ones were published in the late 90's, which more or less corresponds with influential publications for the field of EA like Zachman's [7] and the IEEE 1471 [13].

Another aspect of the results of this review concerns the methodological design of the accepted contributions. Qualitative and quantitative research designs contribute almost equally to the total number of accepted contributions. At a first glance, that might mean that there is a well-balanced representation of both worlds. We believe though that the quantitative research design is not the most appropriate for researching and reporting rich, highly contextual evidence relating to the organizational benefits of EA. As a result, we hold the almost equal ratio of qualitative and quantitative research supportive to the notion of a deficit on the relative amount of rich evidence available from the accepted contributing studies. Additional supportive evidence to the same claim comes from the large number of IO-logic design propositions found (in addition to CIO-, CIM-, and CI-logic[2]), as compared to the number of CIMO-logic design propositions found, which is a clear indication of the relatively shallow depth of analysis undertaken in several contributing studies. This last effect was nevertheless expected; it has been acknowledged by other researchers as it appears to be a common characteristic of the research conducted in the management domain [31].

5.1.2 Meaning & Importance of the Major Findings

Providing an account of EA benefits is important and desirable by both practitioners and researchers of the field. The results of this research project respond to recent calls for research, not only on the potential benefits of EA [17] but–equally important–on the relationships among them [39]. This study however delivers additional value in that it takes into consideration the context in which EA benefits occur and the mechanisms through which the benefits are generated.

For the problem of defining the applicability of EA as an organizational problem-solving tool, relating EA benefits with a specific context functions as a heuristic for minimizing the problem space. In other words, providing information regarding an EA benefit is a good thing because it informs us of the potential of EA. Providing information regarding the context though, within and for which EA has been found to deliver the specific benefit, is potentially a better thing because it supplies critical information on the characteristics of the environment, which might (or might not) act restrictively on the applicability of EA and the actual generation of the aforementioned, claimed benefit.

Additionally, relating EA benefits with specific mechanisms of EA that generate them, provides an answer on *how* the benefits were actually brought about and offers an additional, critical layer of understanding of the applicability of EA. For example, reporting on the proven effectiveness of EA in improving enterprise data integration is definitely good news for practitioners but doesn't provide any actionable information; however reporting that the mechanism that actually achieves this is the introduction of EA standards, provides the critical, actionable information that will enable practitioners to benefit.

[2] We use different combinations of the initials (C, I, M, and O) of the Context Intervention Mechanism Outcome logic elements, to refer to the different combinations of elements found in the accepted contributions. For example, CIM-logic would refer to a design proposition that consists of Context, Intervention, and Mechanism Element(s), as opposed to CI-logic that would refer to a design proposition that consists only of Context and Intervention element(s).

5.1.3 Overall Completeness & Applicability of the Evidence

An evaluation of the results of the literature review, in terms of their relevance to the review question, led us to ascertain that they indeed support the review question, as they provide a competent amount of evidence regarding the identification of the benefits of EA, as these are perceived or established by researchers and practitioners of the field. As an extension, the results of the literature review provide an answer to the first research question of this research (RQ1).

The evidence put forth by the review, is only *transferable* to the extent that the individual, eligible studies' results are. One of the reasons why the SLR method was selected for conducting the literature review was the advanced capabilities it had to offer in terms of allowing ample transparency in the review process and its results. The implication is that in order to establish the transferability of individual CIMO Elements and Relationships, the reader is empowered to check the eligibility decisions (and their rationale) made during the review, as well as to refer to the original contributions.

It has been previously noted that much of the evidence found during this literature review does not provide sufficient contextual account of its applicability. Even in those cases that the context is indeed related to specific outcomes, it mostly refers to one specific context (e.g. in the context of a case-study) and not to an investigation of the achievement of specific outcomes under different contexts (e.g. different EA maturity levels). This shortcoming of the included studies adds to the argument that the results of the literature review should be seen as *potential* benefits of EA and that their realization in real-world scenarios might depend on many other contextual factors that require careful examination.

The results of the SLR carry several implications for both researchers and practitioners. The main implication is that of enhancing the understanding of EA by providing valuable information on the potential outcomes (benefits) of EA and their relationships, their applicability (context), and the mechanisms that generate them. The second implication is that of enabling the scientifically grounded reasoning about how EA might contribute to the achievement of certain business goals, establishing thus the business case for EA and EA projects. The third implication is that of providing an extensive list of EA benefits that can function as a source for defining relevant objectives for EA programs.

5.1.4 Potential Biases & Limitations in the Review Process

The SLR method utilized for conducting the literature review enabled a highly structured process with transparent and traceable results: all aspects of the evidence produced and the relevant rationale that produced them, are readily available and reported in this document. Although extensively reported, the literature review, the contributions' eligibility compliance check, and the subsequent analysis were undertaken solely by the main researcher and thus decisions were based on his discretion. To counter possible bias in the process, ambiguities were resolved after consulting with members of the review panel. Members of the review panel were found to be authors of two contributions that were initially considered for inclusion in the review as potentially relevant. However, after a full-text examination by the primary researcher, these two contributions were excluded on the grounds of being irrelevant to the objectives of the literature review synthesis.

Although the study contends to be highly inclusive regarding the total number studies that are available in the knowledge base on the subject of the benefits of EA, we understand that it is highly

improbable to have located all of them with the reported search process, for a number of good reasons. First, we expect additional studies to be available in other languages than the one our search focused on (English). Second, we expect more grey literature to exist in sources that the researchers do not currently have access to or are not aware of (e.g. organizational statistics, internal reports). Third, we have consciously excluded from the search keywords that relate to Service Oriented Architecture (SOA), as we believe that the relationship between EA and SOA is currently vaguely—and sometimes even contradictory—defined in the relevant literature. We expect that a number of current contributions that relate to the benefits of SOA exists in the knowledge base.

5.1.5 Suggestions for Further Research

Due to the limitations of the review process described in the previous section, we deem important that several research steps are undertaken in the future in order to assess an even broader range of original contributions, and thus achieve a greater extent of literature inclusion in the context of the systematic review. Following this line of thought, we propose that additional systematic reviews are conducted in the future with the aim of locating multilingual contributions and locating additional grey literature from "unofficial" sources. Additionally, we would expect that research is being conducted on defining the exact relationship status between EA and SOA. Such a scientifically established clarification could potentially allow claiming "ownership" on any reported benefits of SOA for the EA domain.

Judging by the reported findings of this systematic review, it is only natural to call for more original, rigorously designed, executed, and reported research on the ways EA contributes to the achievement of specific organizational goals. Furthermore, we propose that future research targeting the benefits of EA, might utilize the CIMO-logic prism in an effort to create useful, rich evidence that successfully relates outcomes to specific contexts and generative mechanisms; breaking thus away from the sterile IO-logic usually purported in the management domain.

5.2 EABF Evaluation & Discussion

5.2.1 EABF Design Evaluation

In this section we evaluate the design of the EABF, the main resulting artifact of this project's second research part. As this second part of the project was design science research, the EABF was constructed by conforming to the *Designing Cycle,* a generic design-oriented research methodology by Verschuren and Hartog [22]. As an evaluation instrument of our work, we use the conceptual framework and guidelines of Hevner et al. [27] (Table 32) in order to assess the relevance and quality of the designed artifact, the EABF.

Below follows an elaboration on the aforementioned design science guidelines with the aim of explicating the ways in which this research project conforms to them.

Table 32 Design Science Guidelines [27].

#	Guideline	Description
1	Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
2	Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
3	Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
4	Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
5	Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
6	Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
7	Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

Design as an Artifact

As we have already defined in Section 2.2.1, the main resulting artifact of this design-science research project is the EA Benefits Framework (EABF) which has been purposefully designed, mainly in order to enhance the understanding of researchers and practitioners on the capabilities and contribution of EA and how it can thus benefit an organization. In essence, the EABF provides a multi-abstraction-layer, visual-oriented model for enforcing an appropriate structure for EA Benefits and EA Benefits Relationships so that they can be efficiently and effectively understood and utilized. The EABF design has been bundled with an extensive description of its categorization scheme and implementation details, additionally supported by relevant examples in an attempt to augment the understanding of reviewers and potential users alike.

The real contribution of the EABF research though is multifold since it delivers:

- A set of *constructs*, the EABM Concepts (Section 4.2.2), in terms of which the problem of describing the contribution of EA towards the achievement of organizational goals is decomposed and defined.
- A *model*, the EABM Metamodel (Figure 25), which documents the rules that govern the relationships between the EABM Concepts.
- A *method* for defining EA Effectiveness Metrics (Section 4.3.3) in the context of the EABF by adapting the GQM method of Basili & Weiss [92].
- A double *instantiation*, which refers to the list of EA Benefits assigned to the categorization scheme of the EABF (see EABL in Appendix C.1) and a number of representations of these EA benefits utilizing the EABM (Section 4.2.3).

Although the EABF comes "preloaded" with the aforementioned EABL and EABRL, the EABM itself is designed in a content-agnostic manner that enables it to be used as a tool for describing chains of cause-and-effect relationships that represent the effects of the application of an EA program on

organizational structures. The EABF has been designed with extensibility in mind, which means that the EABL and EABRL lists can be amended in the future in order to incorporate/exclude findings from future research on the organizational effects of EA.

Problem Relevance

The main problem addressed by this research project has been defined in Section 2.1 as being that of the absence of a scientifically grounded, comprehensive framework of EA benefits that establishes the contribution of EA towards the achievement of organizational goals. In other words, there exists no single comprehensive view of the ways an architectural practice might add value to an organization. The direct implications of the main problem have been presented analytically in Section 1.2. In Sections 2.3.1 and 2.3.2 we elaborate on their scientific and business relevance, respectively.

Design Evaluation

During the designing process of the EABF, various evaluation types (Table 33) have been employed per designing stage of the Designing Cycle [22], in an attempt to enforce a rigorous designing approach and ensure the quality of the resulting artifact. A formal evaluation, or *product* evaluation [22] during the last stage of the Designing Cycle (see column [Evaluation] in Table 33), of the usability of the EABF artifact has not been attempted though, as this is a next step outside the context of this research project. Instead, we have limited ourselves in a *process* evaluation during the *Implementation stage* where we evaluated the adequacy of the EABF description provided in Section 4.2 for implementing the EABF in an environment compliant with the EABF design assumptions [A] and a *goal-based* evaluation of the EABF, with the goal to examine if and how the EABF design met the design goals [G].

Table 33 EABF Design evaluation types per Designing Cycle stage. Table inspired by [35]

Stage / Evaluation	First Hunch	Requirements & Assumptions	Structural Specifications	Prototype	Implementation	Evaluation
Plan	✓	✓	✓			
Process				✓	✓	
Product				✓		
Formative				✓	✓	
Summative						
Ex-ante						
Ex-post				✓		
Goal-based	✓	✓	✓	✓	✓	✓
Goal-free						

Research Contributions

This design-science research project provided several clear contributions to the following areas of design-science research:

1. *Design Artifact*: The EABF artifact is expected to enhance the understanding of researchers on the contribution of EA to the achievement of organizational goals by presenting a novel categorization of scientifically established EA organizational benefits.

2. *Foundations*: The EABF presents a novel way of expressing how EA contributes to the achievement of organizational goals by appropriately extending and adapting existing

foundations in the scientific knowledge base. Answering recent research calls, it can function as a theoretical foundation for examining and testing theoretical propositions relating to the value of EA [17] and illuminating the relationships between EA Benefits [39]. In addition, we hold the utility of the EABF to be promising for charting the focus of the current literature on EA benefits with the aim of pinpointing as of yet unexplored organizational aspects of EA effectiveness, thus directing future research on the subject.

3. Methodologies: The EABF makes a contribution to the scientific knowledge base by means of the creative use/adaptation of the GQM method of Basili & Weiss [92] for *defining* EA effectiveness metrics, but does not provide EA effectiveness metrics per se.

In addition, the EABF makes several contributions to the business environment, some of which are closely related to the aforementioned contributions made to design-science research. As the EABF is a framework designed with the intent of enhancing the understanding of the benefits of EA, it further enhances their research and practice contributions, as they were already established in the first part of this research project (Section 5.1.3), by augmenting the available descriptive capabilities through the application of an extensive taxonomy for EA Benefits, coupled with a visual model that allows for multiple scope-level representations of EA benefits from different aspects of an organization. More specifically, the EABF contributes to the business environment in the following ways:

1. Further enhances the understanding of practitioners on the, mostly indirect, ways through which EA contributes to the achievement of organizational goals.

2. Enables practitioners to establish the business case for EA by allowing for a scientifically established justification of the contribution of EA to the achievement of business goals.

3. Enables practitioners to chart the as-is, as well as the to-be situation concerning the effects of EA on an organizational structure and how they contribute to the achievement of certain organizational goals.

4. Guides the development of highly specific EA effectiveness metrics that can be readily integrated to existing organizational performance measurement systems.

Research Rigor

In order to ensure the appropriate level of scientific rigor, we consulted the knowledge base and selected to establish the design of the various aspects of the EABF artifact in proven, widely accepted frameworks and methods. The EABF itself is not a novel design per se, but more of an adaptation of the popular Balanced Scorecard (BSC) [19, 90, 95] framework's Strategy Maps (SM) [91]. The BSC is a strategic performance management tool and the SM is employed as a visual-oriented representation of an organization's strategy. The decision to make use of the BSC SM though, was not only justified by the results of the assessment (Section 4.1.2) of the available frameworks/methods in the scientific knowledge base that could potentially fit our purposes, where the BSC SM framework appeared to be more versatile for our purpose; we also considered the recurring uses of the BSC SM framework in the literature as the base for relevant undertakings (e.g. [19, 48]) to be a reinforcing factor for our decision. In addition, the BSC is known to have inspired numerous spin-off frameworks that are currently in use by practitioners like the Consultant

Scorecard [96] and the Total Performance Scorecard [97], as well as those that have been adopted in various scientific endeavors like the Enterprise Architecture Scorecard Framework (EASF) [11]. Other parts of the EABF, like the method for developing EA effectiveness metrics, is an adaptation of the widely used Goal-Question-Metric Method (GQM), established primarily in the work of Basili & Weiss [92]. The rationale for the selection of the GQM rests on its proven quality for selecting and implementing metrics [93] and additionally, on its usage in relevant research undertakings (e.g. [11, 12]).

For the design of the EABF we chose to conform to the *Designing Cycle,* a generic design-oriented research methodology by Verschuren and Hartog [22], in which evaluation at all stages of the designing process is a central concept. This design methodology provided the means by which we enforced several different evaluation types and methods throughout the designing process. The evaluation of the EABF itself, at this point, has been limited to what Verschuren and Hartog [22] specify as a *process* and a *goal-based* evaluation. A *product* [22] evaluation, that is an evaluation of the usability of the EABF and its effects, is still pending and it is a next step outside the context of this research project.

Design as a Search Process

Hevner at al. [27] adopt the line of thought of Simon [98] for defining problem solving as *"[…] utilizing available means to reach desired ends while satisfying laws of the environment"* [27]. By *means* are meant those resources available for constructing the artifact, as well as the actions imposed on them. *Ends* are the solution goals and any constraints imposed on them. As *laws* are seen the constants–or "uncontrollable forces" [27]–in the environment of the designed artifact.

In accordance with Hevner et al.'s [27] line of thought, in the context of this research and in respect to designing the main artifact, an EA Benefits Framework that is meant to augment our understanding on the ways EA contributes to the achievement of certain organizational goals, we would need to devise all the possible frameworks (*means*), determine their utility and constraints (*ends*) and specify all understanding-enhancing constants (*laws*). Of course, the aforementioned approach wouldn't be feasible due to the complexities that would arise from attempting to manage and compute a potentially vast solution space. Such issues are acknowledged in design science literature [27].

In this case, the proper research approach [27] is to engage in what Simon defined as *satisficing* [98]–the search for a solution that is possibly not optimal, but meets the requirements for adequacy. Following this solution-space optimizing research approach, we defined several requirements for the design of the EABF, based on the explicit goals it needed to fulfill. By utilizing the explicit requirements, we set out to investigate the knowledge base for existing solutions that could possibly match them. An assessment of the potentially matching solutions led us to the exclusion of frameworks like Zachman's EA Framework (ZF) [5-7] and the ZF's derivative Enterprise Unified Process (EUP) extension for the ZF [89] because although they do cover a wide breadth of organizational perspectives and do enable relating different elements of those perspectives, they lack the expressive capability of describing explicitly and flexibly–in terms of detail abstraction–the relationships between those elements. The one framework that was eventually selected as fulfilling the requirements was Kaplan and Norton's Balanced Scorecard Strategy Maps (BSC SM) framework [90, 91], upon which the EABF was based.

Research Communication

Concerning the communication of the EABF research for technology-related audiences, we present in sufficient detail the specifics necessary for its implementation. This has been established by an evaluation of the adequacy of the provided design-details of the EABF (Section 4.2) for implementing the EABF in an environment compliant with the EABF design assumptions in [A], in the context or a peer-review. Additionally, we present a detailed account of the designing process of the EABF (Section 4.1), so as to ensure this research's repeatability, as well as to enable its future extensibility.

Concerning the communication of the EABF research for management-oriented audiences, we explicitly and clearly establish the relevant problem and its importance (Sections 1.2 and 2.1), as well as the novelty and effectiveness of our approach (Section 2.3.2).

5.2.2 Potential Biases & Limitations

As mentioned in the analysis of the *Design Evaluation* guideline in the previous section, although the EABF was designed by conforming to a methodology that promoted scientific rigorousness, it has not been as of yet empirically evaluated. This last evaluation is pending as a following step outside the context of this research project.

Another issue refers to the categorization scheme of the EABF, which structurally closely follows, but semantically largely differs from that of the Strategy Map. This means that the categorization scheme of the SM has been adapted as needed by the authors in an attempt to categorize in a meaningful way the entire breadth of organizational benefits of EA. Although the categorization of the EABF has been evaluated in the context of a peer review which effectively duplicated the authors' own assignment choices (which means that the current categorization description appears consistent), it would be interesting to observe how the devised taxonomy will be able to accommodate additional results from future research. It is our view that the categorization details do not matter *as much as* consistency does. In other words, the choice of assigning an EA benefit in a specific category instead of another category is important only on a semantic level, as no group/category effect is at play among categories or perspectives themselves (as opposed to the SM framework). This means that even if a reviewer/potential user of the EABF would feel unsatisfied with the categorization choices of the authors, they would still be able to make amendments in the semantics or even in the structure of the categories and at the same time enjoy the same effects the EABF would otherwise deliver. What is thus more important is the adherence to a certain standard so as to unambiguously communicate under all circumstances the benefits of EA.

5.2.3 Suggestions for Further Research

During the course of the designing-process and in the context of translating the relevant concepts of the SM to the EA domain, we encountered the concept of the *implicit* relationship. In the SM, an implicit relationship relates two perspectives in a cause-and-effect manner. The implication of such a relationship is the general or cumulative contribution of all the included objects in the perspective-cause, to all the included objects of the perspective-target. While the concept was admittedly found to be of great importance for understanding the cumulative effects of the EA Benefits within a perspective towards the benefits of another perspective, it was not possible to adopt it as-is in the EABF, the reason being that it would introduce explicit relationships that were not there in the first place. We find it very interesting to examine in future research how and if such a general or implicit relationship could be established on the EABF.

Another issue for future research concerns to the investigation of possible ways for integrating in a more apparent way (possibly visually) in the EABF the information relating to the Context and Mechanisms of those EA Benefits that have been established in the first part of this research project. Although the information is available by back-tracing from the tables provided in the Appendix of this document, we understand that this might not be the optimal solution for effectively enhancing the understanding of the applicability of EA.

Concerning the metrics of EA effectiveness, we propose the following research: The first issue concerns assessing possible ways for visually integrating metrics achievement-related information into the EABM in a way that will enable the EABM to be used as a tool for assessing or documenting the maturity of EA-related processes and their results. A second issue concerns a call for research with the aim of establishing standard contribution metrics of EA effectiveness to the already established EA Benefits, as well as to new ones. In the same research context the contextual applicability of the metrics themselves might be established. A third issue concerns exploring the possibilities for establishing a methodology for selecting the most appropriate metrics from all the possible metrics of the cause-and-effect chains of contributing EA Benefits.

6 Conclusion

In the research project that was undertaken, we designed a scientifically grounded framework of EA benefits that expresses in a novel way how EA contributes to the achievement of organizational goals. The EABF, the resulting artifact, shows that it is possible to present in an effective way to both practitioners and researchers, the scientifically established benefits of EA. To answer the relevant research questions of this research project we worked along the lines of the concept behind the divide-and-conquer paradigm for algorithm design in computer science: we first broke up the problem into two sub-problems that could be directly solved and finally we combined the individual solutions to tackle the original problem.

We first conducted a systematic review of the literature relating to the effectiveness of EA, with the explicit goal to discover those ways that the EA has been found to contribute to certain organizational goals. The review produced rich, end-to-end supporting evidence on the ways EA contributes to organizational goals, answering thus our first research question, and at the same time revealed the current state of the relevant literature. Insights gained include an evident emphasis of the existing research targeting IT and IT-related effects of EA, an evident shortage of research programs being generally conducted on the issue, an apparent poor research design and/or research reporting quality of several literature contributions, and an apparent "shallow" research evidence depth— to an extent the result of the quantitative research design focus of several studies. However, we acknowledge that the study might not have covered the entire span of available literature for a number of reasons (e.g. the language of the retrieved publications).

The second step was to design a framework that would serve as a theoretical foundation for examining specifically the effects of EA on an organizational structure. The design-science designing process subsequently followed, delivered the EABF, which consists of a set of constructs—including a taxonomy for EA Benefits—for describing and decomposing the contribution of EA towards the achievement of organizational goals, a model that defines the rules that govern the construct's relationships and their representation, and a method for defining EA effectiveness metrics. We then combined the individual results by applying the taxonomy of the EABF on the organizational effects of EA that were found in the first part of the research. The results constituted the answer for our second research question. However, we acknowledge that although we have followed a rigorous method for designing the EABF, which included multiple evaluation activities, an empirical evaluation of the design is still pending and is the next step outside the context of this research.

Appendix A SLR Protocol

A.1 Background

A.1.1 Research Topic Identification & Justification

Currently, there is no scientifically grounded, comprehensive framework of Enterprise Architecture (EA) benefits that establishes the contribution of EA towards the achievement of organizational goals. In other words, there exists no single comprehensive view of the ways an architectural practice might add value to an organization.

The formal objective of the overarching research project is the establishment of a theoretical framework of EA benefits (EABF) that will enable a better understanding of the applicability of EA and its potential contribution towards the achievement of various business goals.

To this end, this research sub-activity concerns itself with an attempted synthesis of the potential benefits of EA appearing in the existing knowledge base. In other words, the aim of this explorative research sub-step is to discover from within the existing knowledge base, those ways an EA practice might contribute to the achievement of business goals, as seen by both researchers and practitioners of the field.

A.1.2 SLR Rationale & Importance

As established in the previous section, the aim of this research activity is to review the relevant literature in order to discover potential benefits of EA for organizations. To achieve the necessary cogency required in the context of a design science research [27] project, a research strategy has to be developed in the lines of an established and well-accepted methodology for conducting literature reviews. Such a methodology has to provide the necessary provisions for enforcing the transparency, traceability and reproducibility of the final outcome.

Tranfield *et al*. [21] propose such a methodology for conducting Structured Literature Reviews (SLR) pertinent to the management research domain by transposing relevant, established and highly influential methodologies from the medical research domain, like the ones described in the *"Cochrane Handbook for Systematic Reviews of Interventions" [28]* by *The Cochrane Collaboration* and the *"Systematic Reviews: CRD's guidance for undertaking reviews in health care"* [29] by York University's *Center for Research & Dissemination* (CRD).

Armitage & Keeble-Allen studied the application of the aforementioned methodology of Tranfield *et al*. in respect to research projects undertaken by graduate students. While in general they find the approach of Tranfield *et al*. to be highly relevant and necessary as a qualitative literature review methodology–especially in the management discipline–, their research findings suggest that for such projects particularly, it is inappropriate because of the new set of conceptual, methodological and data collection demands that the specific research paradigm imposes. For this reason they developed the Rapid Structured Literature Review (RSLR), a "light" version of SLR, specifically designed for smaller-scale research projects and propose its usage over SLR specifically for graduate projects [30].

However, Armitage & Keeble-Allen further report, that, those graduate student researchers that make use of such a rigorous and structured approach, appear to benefit from an important

additional bottom-line contribution to the overall insight and knowledge acquired from the domain under question. Having full knowledge of the additional work load that is needed for conducting a SLR instead of a RSLR, and for this last reason, the researchers of this project opt following the SLR methodology proposed by Tranfield *et al*. [21].

To this extent, a SLR method will be developed for scanning through and locating potential EA benefits in the relevant EA scientific literature. Although the aforementioned methodology provides us with the overall guidelines for conducting the systematic review and the rationale for the necessary method adaptations to the management domain, it is deemed necessary to consult additional sources (mainly [29]) for certain aspects that require deeper subject-matter knowledge and clarification than those provided in Tranfield *et al*. [21].

A.2 Objectives

Tranfield *et al*. specifically advise against defining a concrete research question in order not to restrain the creativeness of the researchers in conducting an effective exploratory literature review [21]. In the context of this research though, the authors consider appropriate the definition of an exact research question that will set the overall direction and boundaries of the entire research, allowing for a highly targeted–and thus more effective–evaluation of the appropriateness of the potential core contributions.

For this, we define below the relevant research question of this SLR:

> *What is the potential contribution of Enterprise Architecture to the achievement of various business goals, as seen by researchers and practitioners of the field?*

A.3 Methods

Due to the highly explorative nature of the literature review to be undertaken, it is worth-mentioning at this point that all methodological sub-sections that appear below represent *guidelines* and not laws. In other words, they form the base strategy for conducting the SLR and they are subject to change on a need basis, in order to accommodate the findings of the SLR. This approach to protocol construction reflects the versatile nature of the management domain knowledge base itself and is of course acknowledged by Tranfield *et al*., in that

> *"[t]he aim is to produce a protocol that does not compromise the researcher's ability to be creative in the literature review process, whilst also ensuring reviews be less open to researcher bias […]"* [21].

Flexibility need not compromise overall research rigor; instead, any changes to the protocol and the relevant rationale will be judiciously recorded and reported in the final report in full detail in order to ensure the transparency, traceability and reproducibility of the review.

A.3.1 Criteria for considering studies for this review

A.3.1.1 Eligible types of studies

This SLR will focus on all quantitative, qualitative (ethnomethodology, grounded theory, phenomenology etc.) and mixed-method contributions to the knowledge base. In other words, an inter-disciplinary approach on primary data is adopted in order to capture the broadest possible definitions of EA benefits that appear in the literature.

More specifically, the eligible types of core contributions are the following:

xi. Academic journal articles
xii. Practitioner-oriented journal articles
xiii. Conference proceedings
xiv. Workshop proceedings
xv. Research reports/briefings
xvi. Organizational literature
xvii. Government & organizational statistics, including surveys
xviii. Dissertations, theses
xix. Unpublished papers

A.3.1.2 Studies evaluation criteria

An attempt to research the relevant literature on evaluation criteria for quantitative, qualitative and mixed-method studies unavoidably drags one in, in what is widely known in the academia as a paradigm war between not only quantitative versus qualitative research proponents but also among the qualitative research advocates as well.

There is an ongoing debate going on, concerning not only what should be the criteria to judge qualitative research but more importantly if qualitative research ought to be judged in the first place [70, 71] . As Walsh & Downe inform us, this is an issue that has been quite often avoided by some researchers in the past with the rationale that being all-inclusive is more important than the individual rigor of the studies in question [72].

Sandelowski effectively frames the whole issue on the diverse nature of qualitative research and on the lack of consensus both on its conforming rules and its comparability to quantitative research [73]. The latter sparks another debate, whether qualitative research can and should be assessed using the same criteria with qualitative research [71]. Although there are multiple views on the subject, we understand the issue using the simplifying binary classification scheme proposed by Murphy *et al*. that makes a distinction between *post-positivism* [70] and–as Mays & Pope explicate– *anti-realism* [71].

Anti-realists advocate the use of different evaluation criteria. Post-positivism is associated with those researchers that advocate the use of the same broad criteria for evaluating all research [70]. For this research, we adopt a post-positivism standpoint and more specifically, we constructively embrace the *subtle-realism* philosophy [74] which advocates that,

> *"quality in qualitative research can be assessed with the same broad concepts of validity and relevance used for quantitative research, but these need to be operationalised differently to take into account the distinctive goals of qualitative research"* [71].

According to Hammersley, *relevance* is a quality a study displays when it is investigating issues of significance and either makes an original contribution to the existing knowledge base or tests what we already know [74]. In other words,

> *"[…] to be relevant, research must in some way contribute to the accumulation of knowledge"* [70].

Validity reflects a common, recurring research evaluation criterion in the scientific literature. For Murphy, it is the extent to which you limit the likelihood of the occurrence of error [70]. Yin breaks down the concept of validity into *construct* (appropriateness of the operationalization of the investigated concepts), *internal* (the extent to which the effects' causality is established) and *external validity* (establishment of the study's generalization context) [75].

In the context of the criteria that will be used for the literature evaluation, we operationalize the concepts of validity and relevance using insights from criteria checklists for qualitative and quantitative research from various sources. First, we define screening questions (Table 34), applicable to all research methodology designs. The answers to these screening questions are critical in deciding on the appropriateness of further evaluation of a specific literature contribution and for inclusion in the data synthesis process. The concept of relevance is specifically assessed by questions *S1* and *S2*. Failure to positively answer any of the screening questions results in automatic exclusion from the synthesis (*S5*="No"). Question *S5* represents the final judgment of the reviewer towards the specific contribution. The questions are not necessarily answered in sequence.

Table 34 Assessment Screening Questions

ID	Assessment Question	Answer Possibility
S1	Relevant to synthesis	{Agree|Partially Agree|Disagree|Other}
S2	Scientifically relevant	{Agree|Partially Agree|Disagree|Other}
S3	Research aims clearly stated	{Agree|Partially Agree|Disagree|Other}
S4	Methodology appropriate	{Agree|Partially Agree|Disagree|Other}
S5	Include in synthesis	{Agree|Partially Agree|Disagree|Other}

In Table 35 we present the criteria against which qualitative research studies will be evaluated for inclusion or exclusion. Questions QL1 to QL7 operationalize the concept of validity in the context of qualitative research. The criteria list is an adaptation of the criteria lists appearing in the Public Health Resource Unit's (PHRU) Critical Appraisal Skills Programme (CASP) [76], in [77] as well as in [71].

Table 35 Qualitative Research Assessment Questions

Category	ID	Assessment Question	Answer Possibility
Research Design	QL1	Research design appropriate	{Agree|Partially Agree|Disagree|Other}
Sampling	QL2	Sampling strategy appropriate	{Agree|Partially Agree|Disagree|Other}
Data Collection	QL3	Data collection addresses research issue	{Agree|Partially Agree|Disagree|Other}
Data Analysis	QL4	Data analysis rigorous	{Agree|Partially Agree|Disagree|Other}
Findings	QL5	Findings explicitly stated	{Agree|Partially Agree|Disagree|Other}
Research Value	QL6	Findings are transferable	{Agree|Partially Agree|Disagree|Other}
Reflexivity	QL7	Researcher bias recognized	{Agree|Partially Agree|Disagree|Other}

In Table 36 we present the criteria against which quantitative research studies will be evaluated for inclusion or exclusion. Questions QN1 to QN6 operationalize the concept of validity in the context of quantitative research. The criteria list is an adaptation of the list appearing in the University of

Salford Health Care Practice Research & Development Unit's (HCPRDU) "Evaluation Tool for Quantitative Research Studies" [78].

Table 36 Quantitative Research Assessment Questions

Category	ID	Assessment Question	Answer Possibility
Research Design	QN1	Research design appropriate	{Agree|Partially Agree|Disagree|Other}
Sampling	QN2	Sampling strategy appropriate	{Agree|Partially Agree|Disagree|Other}
Outcome Measurement	QN3	Outcome measures useful/appropriate for practice	{Agree|Partially Agree|Disagree|Other}
Research Value	QN4	Findings are transferable	{Agree|Partially Agree|Disagree|Other}
Ethics	QN5	Ethical issues adequately addressed	{Agree|Partially Agree|Disagree|Other}

The evaluation criteria presented in Table 35 and Table 36 do not represent absolute checklists in the sense that a specific contribution will not be evaluated solely on its "elegant" research design. As this research adopts a *realist synthesis* approach (see Section A.3.3.3) for the data synthesis part of this review, the previously stated explicit evaluation criteria will be used as *supplements* to the overall evaluation of a specific contribution and as an extension to the cumulative qualitative evaluation of the existing literature on the domain of EA that aims to identify the potential benefits of EA.

In line with other researchers' views, every contribution should be mainly judged based on its "fit for purpose" [79], on whether it adds anything important to our understanding of the phenomenon under review [80] and on its quality as it is established in relation to the rest of the contributions of the synthesis [81]. It is therefore expected that highly relevant and original contributions will be included in the review even if they display certain quality issues.

To operationalize the above concept, evaluation criteria in Table 35 and Table 36 only *partially* shape the reviewer's final decision towards the screening question *S5*. In certain cases, the final decision for a contribution will be based not only on the appropriate research assessment questions from either Table 35 or Table 36, but also on the overall judgment of the relevance and value of the contribution to the review.

A.3.2 Search methods for identification of studies

A.3.2.1 Electronic searches

The following search engines (Table 37) will be used in order to track the relevant literature contributions. Some of them are freely available to the public for searching while some require a subscription which is available to the researchers as part of their institution's library[3] subscriptions.

[3] Utrecht University Library (http://www.uu.nl/en/library/Pages/default.aspx).

Table 37 Search Engines

Search Engine	URL
CiteSeerX	http://citeseerx.ist.psu.edu/
IEEE Computer Society Digital Library	http://www.computer.org/portal/web/csdl
Science Citation Index (SCI)	http://www.isiknowledge.com/
EBSCO	http://search.ebscohost.com/
Elsevier/Science Direct	http://www.sciencedirect.com/
Emerald	http://www.emeraldinsight.com

In each of the aforementioned search engines, the following keywords (Table 38) will be searched for in the title and/or the abstract of contributions. Capitalized *AND*, *OR* are Boolean operators. Phrases in quotes will be treated by the search engines as inseparable, exact matches.

Table 38 Search Keywords

Keywords
("enterprise architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("it architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("business architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("organizational architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)

A.3.2.2 Other searches

A number of relevant contributions have already been identified in the context of the researchers' personal collection of studies or in the context of the scoping study performed earlier in the process of this SLR. Additionally, relevant studies are expected to be located by examining the references of relevant contributions.

All these studies are going to be incorporated in the list of results of the electronic searches described in Section A.3.2.1.

A.3.3 Data collection and analysis

A.3.3.1 Selection of studies

Tranfield *et al*. inform us that the process of selecting the appropriate studies, on which the actual review will be performed, is an iterative process [21]. In Table 39, we present the (slightly adapted) process that will be followed for selecting the studies that conform to the selection criteria, as defined in the Cochrane Handbook [28], and we show the correspondence between the studies selection process and the overarching SLR method's phases:

Table 39 Study selection process steps overview.

Selection of studies process steps	SLR Phase
1. Search results merging and duplicate records removal	**- 4 - Selection of Studies**
2. Obviously irrelevant record removal	
3. Potentially relevant records full text retrieval	
4. Link together multiple reports of the same study	

5. Full-text eligibility criteria compliance examination	**- 5 - Study Quality Assessment**
6. Eligibility clarification & further information requests	
7. Finalize study inclusion	

Certain selection process steps require further definition, which we provide in the next sub-sections (per step).

A.3.3.1.1 Search results merging and duplicate records removal

The initial search results will be merged using the RefWorks[4] online reference management software. Using the reference management facilities provided by RefWorks, duplicate records will be deleted. The initial search results will be documented.

A.3.3.1.2 Obviously irrelevant records removal

An initial examination will be conducted in order to examine titles and abstracts and remove obviously irrelevant reports. The records that will be removed will be documented together with the reason for the removal (exclusion).

A.3.3.1.3 Potentially relevant records full text retrieval

Retrieve the full text of the potentially relevant records remaining after the previous step. This includes locating full text records under currently available repositories (according to the researchers' institutional library accounts) as well as retrieving or purchasing full text records on a need basis.

A.3.3.1.4 Link together multiple reports of the same study

Link together multiple reports of the same study in order to resolve (potentially) duplicate or overleaping results.

A.3.3.1.5 Full-text eligibility criteria compliance examination

Examine full-text reports for compliance of studies with eligibility criteria (Section A.3.1.1) and evaluation criteria (Section A.3.1.2).

A.3.3.1.6 Eligibility clarification & further information requests

Correspond with investigators, where appropriate, to clarify study eligibility (it may be appropriate to request further information, such as missing results, at the same time).

A.3.3.1.7 Finalize study inclusion

Make final decisions on study inclusion and proceed to data collection. Any disagreements will be resolved with the aid of the Review Panel.

A.3.3.2 Data extraction and management

Data will be collected from the eligible contributions using electronic extraction forms which will be created in the MS Access environment. The forms will allow for extracting instances of CIMO-logic component variables (see Section A.3.3.3, Table 40) present in the contributions and give the ability to trace back each CIMO-logic component variable to their respective contribution.

Data will be extracted by the principal researcher only. Any disagreements will be resolved with the aid of the Review Panel.

[4] http://www.refworks.com/

A.3.3.3 Data synthesis

The research synthesis method that will be used for summarizing, integrating and possibly cumulating [21] the findings of the SLR, is that of *design-oriented research synthesis* proposed by Denyer *et al.* [31], which is in essence an extension of Pawson's *realist synthesis* method [32]. The design-oriented research synthesis method can be used in order to develop *design propositions* (or *technological rules* [33]) in the lines of the Context Intervention Mechanism Outcome logic or simply *CIMO-logic* [31].

For Aken, a technological rule is a fragment of general knowledge (or general solution) that in a specific field of application links an intervention or an artefact with some expected outcome or performance [34]. Denyer et al. similarly see a design proposition as offering a general template for creating solutions for a specific class of problems [31].

Table 40 The components of Design Propositions (adapted from [31])

Component	Explanation
Context (C)	The given (problematic) context in which a specific intervention *I* will produce an outcome *O*.
Interventions (I)	An intervention type (or artefact) to be used for solving a specific problem.
Mechanisms (M)	The mechanism that in a certain context *C* is triggered by the intervention *I*. A generative mechanism answers the question "why does this intervention (in this context) produce this outcome?" [34].
Outcome (O)	The outcome of the intervention in its various aspects, such as performance improvement, cost reduction or low error rates.

A design proposition made up of CIMO-logic components (Table 40) is formed in principle as follows: for some problematic Context(s), use some specific Intervention(s) that will invoke some generative Mechanism(s) that in turn will deliver the desired Outcome(s). Design propositions thus not only inform us on what to do in a specific situation in order to create a specific effect but more importantly, they offer some insight on why this happening [31].

It is important to stress at this point that the CIMO-logic does not prescribe the specific form of a design proposition, but rather forms its underlying logic. As Denyer at al. point out, design propositions "[...] in organization and management studies are seldom reduced to algorithms and can take the form of an article, a report, a training manual or a whole book" [31]. What is more, a design proposition may be comprised of multiple CIMO-logic component variables (*C*, *I*, *M*, *O*), combined in various ways, spanning multiple scope detail levels and appearing in possibly nested structures [31].

Using CIMO-logic, the accepted contributions will be processed in order to extract such design propositions. In other words, contributions will be scanned for CIMO-logic components (CIMO Elements) and possible interrelationships between them. Due to its focus, in the context of this structured literature review we define one Intervention Element, the EA. Context Elements are thus some contexts for which the Intervention (EA) has been found to be appropriate. Mechanism Elements provide an answer to how or why EA produces or contributes, directly or indirectly, to certain Outcome Elements. It is possible though that in the literature that will be processed, design propositions will be found that describe only IO-logic (Intervention Outcome, i.e. "if A then do B").

This is also acknowledged by Denyer et al., that popular management literature usually concerns IO-logic, completely ignoring the outcomes' contextual dependencies and generative mechanisms [31].

Appendix B SLR Report

B.1 Background

B.1.1 Research Topic Identification & Justification

Currently, there is no scientifically grounded, comprehensive framework of Enterprise Architecture (EA) benefits that establishes the contribution of EA towards the achievement of organizational goals. In other words, there exists no single comprehensive view of the ways an architectural practice might add value to an organization.

The formal objective of the overarching research project was the establishment of a theoretical framework of EA benefits (EABF) that will enable a better understanding of the applicability of EA and its potential contribution towards the achievement of various business goals.

To this end, this research sub-activity concerned itself with a synthesis of the potential benefits of EA appearing in the existing knowledge base. In other words, the aim of this explorative research sub-step was to discover from within the existing knowledge base, those ways an EA practice might contribute to the achievement of business goals, as seen by both researchers and practitioners of the field.

B.1.2 SLR Rationale & Importance

As established in the previous section, the aim of this research activity was to review the relevant literature in order to discover potential benefits of EA for organizations. A research strategy was developed in the lines of the methodology for conducting literature reviews proposed by Tranfield *et al*. [21]. The methodology provided the necessary provisions for enforcing the transparency, traceability and reproducibility of the final outcome.

The methodology of Tranfield *et al*. [21] for conducting Structured Literature Reviews (SLR) was made pertinent to the management research domain by transposing relevant, established and highly influential methodologies from the medical research domain, like the ones described in the *"Cochrane Handbook for Systematic Reviews of Interventions"* [28] by *The Cochrane Collaboration* and the *"Systematic Reviews: CRD's guidance for undertaking reviews in health care"* [29] by York University's *Center for Research & Dissemination* (CRD).

Armitage & Keeble-Allen studied the application of the aforementioned methodology of Tranfield *et al*. in respect to research projects undertaken by graduate students. While in general they find the approach of Tranfield *et al*. to be highly relevant and necessary as a qualitative literature review methodology–especially in the management discipline–, their research findings suggest that for such projects particularly, it is inappropriate because of the new set of conceptual, methodological and data collection demands that the specific research paradigm imposes. For this reason they developed the Rapid Structured Literature Review (RSLR), a "light" version of SLR, specifically designed for smaller-scale research projects and propose its usage over SLR specifically for graduate projects [30].

However, Armitage & Keeble-Allen further report, that, those graduate student researchers that make use of such a rigorous and structured approach, appear to benefit from an important additional bottom-line contribution to the overall insight and knowledge acquired from the domain

under question. Having full knowledge of the additional work load that was needed for conducting a SLR instead of a RSLR, and for this last reason, the researchers of this project opted following the SLR methodology proposed by Tranfield *et al*. [21].

To this extent, a SLR method was developed for scanning through and locating potential EA benefits in the relevant EA scientific literature. Although the aforementioned methodology provided us with the overall guidelines for conducting the systematic review and the rationale for the necessary method adaptations to the management domain, it was deemed necessary to consult additional sources (mainly [29]) for certain aspects that required deeper subject-matter knowledge and clarification than those already provided in Tranfield *et al*. [21].

B.2 Objectives

Tranfield *et al*. specifically advise against defining a concrete research question in order not to restrain the creativeness of the researchers in conducting an effective exploratory literature review [21]. In the context of this research though, the authors considered appropriate the definition of an exact research question that would set the overall direction and boundaries of the entire research, allowing for a highly targeted–and thus more effective–evaluation of the appropriateness of the potential core contributions.

For this, we defined the relevant research question of this SLR as:

> *What is the potential contribution of Enterprise Architecture to the achievement of various business goals, as seen by researchers and practitioners of the field?*

B.3 Methods

Due to the highly explorative nature of the literature review that was undertaken, it is worth-mentioning at this point that all methodological sub-sections that appear below represent *guidelines* and not laws. In other words, they formed the base strategy for conducting the SLR and they were subject to change on a need basis, in order to accommodate the findings of the SLR. This approach to protocol construction reflects the versatile nature of the management domain knowledge base itself something that is also acknowledged by Tranfield *et al*., in that

> *"[t]he aim is to produce a protocol that does not compromise the researcher's ability to be creative in the literature review process, whilst also ensuring reviews be less open to researcher bias […]"* [21].

Flexibility need not compromise overall research rigor; instead, any changes to the review protocol and the relevant rationale and base strategy have been judiciously recorded and are reported in this final report (Section B.6.1) in full detail in order to ensure the transparency, traceability and reproducibility of the review.

B.3.1 Criteria for considering studies for this review

B.3.1.1 Eligible types of studies

This SLR focused on all quantitative, qualitative (ethnomethodology, grounded theory, phenomenology etc.) and mixed-method contributions to the knowledge base. In other words, an inter-disciplinary approach on primary data was adopted in order to capture the broadest possible

definitions of EA benefits that appear in the literature. More specifically, the eligible types of core contributions were the following:

xx. Academic journal articles
xxi. Practitioner-oriented journal articles
xxii. Conference proceedings
xxiii. Workshop proceedings
xxiv. Research reports/briefings
xxv. Organizational literature
xxvi. Government & organizational statistics, including surveys
xxvii. Dissertations, theses
xxviii. Books
xxix. Book Chapters

The eligible types of contributions cover not only scholarly (peer reviewed) research but also include *grey literature* (i.e. literature that has not been formally published). This did not pose any threat to the validity of the literature review results as the individual quality of each of the contributions was established within the context of the synthesis of this literature review (Section B.3.1.2). In addition, inclusion of grey literature to systematic reviews is even considered to be advantageous in order to help minimize publication bias effects [67, 68]. Especially in the context of systematic reviews that undertake meta-analysis, researchers are encouraged to include grey literature that meets some predefined inclusion criteria [69].

B.3.1.2 Studies evaluation criteria

An attempt to research the relevant literature on evaluation criteria for quantitative, qualitative and mixed-method studies unavoidably drags one in, in what is widely known in the academia as a paradigm war between not only quantitative versus qualitative research proponents but also among the qualitative research advocates as well.

There is an ongoing debate going on, concerning not only what should be the criteria to judge qualitative research, but more importantly if qualitative research ought to be judged in the first place [70, 71] . As Walsh & Downe inform us, this is an issue that has been quite often avoided by some researchers in the past with the rationale that being all-inclusive is more important than the individual rigor of the studies in question [72].

Sandelowski effectively frames the whole issue on the diverse nature of qualitative research and on the lack of consensus both on its conforming rules and its comparability to quantitative research [73]. The latter sparks another debate, whether qualitative research can and should be assessed using the same criteria with qualitative research [71]. Although there are multiple views on the subject, we chose to understand the issue using the simplifying binary classification scheme proposed by Murphy *et al*. that makes a distinction between *post-positivism* [70] and–as Mays & Pope explicate–*anti-realism* [71].

Anti-realists advocate the use of different evaluation criteria. Post-positivism is associated with those researchers that advocate the use of the same broad criteria for evaluating all research [70]. For this research, we adopt a post-positivism standpoint and more specifically, we constructively embrace the *subtle-realism* philosophy [74] which advocates that,

> *"quality in qualitative research can be assessed with the same broad concepts of validity and relevance used for quantitative research, but these need to be operationalised differently to take into account the distinctive goals of qualitative research"* [71].

According to Hammersley, *relevance* is a quality a study displays when it is investigating issues of significance and either makes an original contribution to the existing knowledge base or tests what we already know [74]. In other words,

> *"[…] to be relevant, research must in some way contribute to the accumulation of knowledge"* [70].

Validity reflects a common, recurring research evaluation criterion in the scientific literature. For Murphy, it is the extent to which you limit the likelihood of the occurrence of error [70]. Yin breaks down the concept of validity into *construct* (appropriateness of the operationalization of the investigated concepts), *internal* (the extent to which effects' causality is established) and *external validity* (establishment of the study's generalization context) [75].

In the context of the criteria that were used for the literature evaluation, we operationalized the concepts of validity and relevance using insights from criteria checklists for qualitative and quantitative research from various sources. First, we defined screening questions (Table 41), applicable to all research methodology designs. The answers to these screening questions were critical in deciding on the appropriateness of further evaluation of a specific literature contribution and for inclusion in the data synthesis process. The concept of relevance was specifically assessed by questions S_1 and S_2. Failure to positively answer any of the screening questions resulted in automatic exclusion from the synthesis (S_6="No"). Question S_6 represents the final judgment of the reviewer towards the specific contribution. The questions were not necessarily answered in sequence.

Table 41 Assessment Screening Questions

ID	Assessment Question	Answer Possibility
S_1	Eligible contribution type	{TRUE|FALSE}
S_2	Relevant to synthesis	{Agree|Partially Agree|Disagree|Other}
S_3	Scientifically relevant	{Agree|Partially Agree|Disagree|Other}
S_4	Research aims clearly stated	{Agree|Partially Agree|Disagree|Other}
S_5	Methodology appropriate	{Agree|Partially Agree|Disagree|Other}
S_6	Include in synthesis	{Agree|Partially Agree|Disagree|Other}

In Table 42 we present the criteria against which qualitative research studies were evaluated for inclusion or exclusion. Questions QL_1 to QL_7 operationalize the concept of validity in the context of qualitative research. The criteria list is an adaptation of the criteria lists appearing in the Public Health Resource Unit's (PHRU) Critical Appraisal Skills Programme (CASP) [76], in [77] as well as in [71].

In Table 43 we present the criteria against which quantitative research studies were evaluated for inclusion or exclusion. Questions QN_1 to QN_6 operationalize the concept of validity in the context of quantitative research. The criteria list is an adaptation of the list appearing in the University of Salford Health Care Practice Research & Development Unit's (HCPRDU) "Evaluation Tool for Quantitative Research Studies" [78].

Table 42 Qualitative Research Assessment Questions

Category	ID	Assessment Question	Answer Possibility
Research Design	QL_1	Research design appropriate	{Agree|Partially Agree|Disagree|Other}
Sampling	QL_2	Sampling strategy appropriate	{Agree|Partially Agree|Disagree|Other}
Data Collection	QL_3	Data collection addresses research issue	{Agree|Partially Agree|Disagree|Other}
Data Analysis	QL_4	Data analysis rigorous	{Agree|Partially Agree|Disagree|Other}
Findings	QL_5	Findings explicitly stated	{Agree|Partially Agree|Disagree|Other}
Research Value	QL_6	Findings are transferable	{Agree|Partially Agree|Disagree|Other}
Reflexivity	QL_7	Researcher bias recognized	{Agree|Partially Agree|Disagree|Other}

Table 43 Quantitative Research Assessment Questions

Category	ID	Assessment Question	Answer Possibility
Research Design	QN_1	Research design appropriate	{Agree|Partially Agree|Disagree|Other}
Sampling	QN_2	Sampling strategy appropriate	{Agree|Partially Agree|Disagree|Other}
Outcome Measurement	QN_3	Outcome measures useful/appropriate for practice	{Agree|Partially Agree|Disagree|Other}
Research Value	QN_4	Findings are transferable	{Agree|Partially Agree|Disagree|Other}
Ethics	QN_5	Ethical issues adequately addressed	{Agree|Partially Agree|Disagree|Other}

The evaluation criteria presented in Table 42 and Table 43 do not represent absolute checklists in the sense that a specific contribution was not evaluated solely on its "elegant" research design. As this research adopted a *realist synthesis* approach (see Section B.3.3.3) for the data synthesis part of this review, the previously stated explicit evaluation criteria were used as *supplements* to the overall evaluation of a specific contribution and as an extension to the cumulative qualitative evaluation of the existing literature in the domain of EA that aims to identify the potential benefits of EA.

In line with other researchers' views, every contribution was mainly judged based on its "fit for purpose" [79], on whether it added anything important to our understanding of the phenomenon under review [80] and on its quality, as it was established in relation to the rest of the contributions of the synthesis [81]. Thus, highly relevant and original contributions were included in the review even if they displayed certain quality issues.

To operationalize the above concept, evaluation criteria in Table 42 and Table 43 only *partially* shaped the reviewer's final decision towards the screening question S_5. In certain cases, the final decision for a contribution was based not only on the appropriate research assessment questions from either Table 42 or Table 43, but also on the overall judgment of the relevance and value of the contribution to the review.

B.3.2 Search methods for identification of studies

B.3.2.1 Electronic searches

The following academic-oriented search engines (Table 44) were used in order to track the relevant literature contributions. Some are freely available to the public while some require a subscription which is available to the researchers as part of their institution's library[5] subscriptions.

Table 44 Search Engines. Column [Last Search] specifies the date of the last search performed for each of the Search Engines.

Search Engine	URL	Last Search
CiteSeerX	http://citeseerx.ist.psu.edu/	08/10/2010
IEEE Computer Society Digital Library	http://www.computer.org/portal/web/csdl	08/10/2010
Science Citation Index (SCI)	http://www.isiknowledge.com/	08/10/2010
EBSCO	http://search.ebscohost.com/	08/10/2010
Elsevier/Science Direct	http://www.sciencedirect.com/	08/10/2010
Emerald	http://www.emeraldinsight.com	08/10/2010
ACM (The ACM Guide)	http://portal.acm.org/guide.cfm	08/10/2010

Table 45 Search Keywords

Keywords
("enterprise architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("it architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("information technology architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("business architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)
("organizational architecture") AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness)

In each of the aforementioned search engines, the following keywords (Table 45) were generally searched for in the abstract of contributions. Capitalized *AND*, *OR* are Boolean operators. Phrases in quotes are treated by the search engines as inseparable, exact matches. The exact/operational search strings for each of the databases and searches performed are provided in Appendix B.6.3, Table 57. The total number of results returned by all searches in all search engines was *613*.

B.3.2.2 Other searches

In the context of the researchers' personal collection of studies and in the context of the scoping study performed earlier in the process of this SLR, *19* relevant contributions were identified. Additionally, during the review process, an additional *18* relevant studies were located by examining the references of the contributions. All these studies found through other types of searches (Table 46) were incorporated in the list of results of the electronic searches as "manually added contributions" and "back-references" respectively.

[5] Utrecht University Library (http://www.uu.nl/en/library/Pages/default.aspx).

Table 46 Manually-added Contributions

Addition Type	Contributions
Manually added contributions	[3, 10, 12, 14, 17, 26, 36-48]
Back-references	[49-66]

B.3.3 Data collection and analysis

B.3.3.1 Selection of studies

Tranfield *et al*. inform us that the process of selecting the appropriate studies, on which the actual review will be performed, is an iterative process [21]. In Table 47, we present the (slightly adapted) process that was followed for selecting the studies that conform to the selection criteria, as defined in the Cochrane Handbook [28], and we show the correspondence between the studies selection process and the overarching SLR method's phases:

Table 47 Study selection process steps overview.

Selection of studies process steps	SLR Phase
1. Search results merging and duplicate records removal	**- 4 - Selection of Studies**
2. Obviously irrelevant record removal	
3. Potentially relevant records full text retrieval	
4. Link together multiple reports of the same study	
5. Full-text eligibility criteria compliance examination	**- 5 - Study Quality Assessment**
6. Eligibility clarification & further information requests	
7. Finalize study inclusion	

Certain selection process steps require further definition, which we provide in the next sub-sections (per step).

B.3.3.1.1 Search results merging and duplicate records removal

The initial search results were merged using the RefWorks[6] online reference management software. Using the reference management facilities provided by RefWorks, duplicate records were deleted and all initial search results were eventually documented.

B.3.3.1.2 Obviously irrelevant records removal

An initial examination was conducted in order to examine titles and abstracts and remove obviously irrelevant reports. The records that were removed were documented together with the reason for their removal (exclusion).

B.3.3.1.3 Potentially relevant records full text retrieval

The full text of the potentially relevant records remaining after the previous step was retrieved. This included locating full text records under currently available repositories (according to the researchers' institutional library accounts) as well as retrieving or purchasing full text records on a need basis.

B.3.3.1.4 Link together multiple reports of the same study

Multiple reports of the same study were linked together in order to resolve (potentially) duplicate or overleaping results.

[6] http://www.refworks.com/

B.3.3.1.5 Full-text eligibility criteria compliance examination

Full-texts of contributions were examined for compliance with eligibility criteria (Section B.3.1.1) and evaluation criteria (Section B.3.1.2).

B.3.3.1.6 Eligibility clarification & further information requests

Contributions' authors were contacted, where appropriate, to clarify study eligibility.

B.3.3.1.7 Finalize study inclusion

Final decisions on study inclusion were made. A Review Panel member was consulted for deciding on the inclusion of certain contributions. Data collection followed right after.

B.3.3.2 Data extraction and management

Data was collected from the 14 eligible contributions (Appendix B.6.2, Figure 35) using electronic extraction forms created in the MS Access environment (Appendix B.6.2, Figure 36). The forms allowed for extracting instances of CIMO-logic component variables (see Section B.3.3.3, Table 48) present in the contributions and gave the ability to trace back each CIMO-logic component variable to their respective contribution.

Data was extracted by the principal researcher only. No disagreements occurred, so the Review Panel was not called for resolving any disputes at this stage.

B.3.3.3 Data synthesis

The research synthesis method that was used for summarizing, integrating and cumulating [21] the findings of the SLR, was that of *design-oriented research synthesis* proposed by Denyer *et al.* [31], which is in essence an extension of Pawson's *realist synthesis* method [32]. The design-oriented research synthesis method was used in order to develop *design propositions* (or *technological rules* [33]) in the lines of the Context Intervention Mechanism Outcome logic or simply *CIMO-logic* [31].

For Aken, a technological rule is a fragment of general knowledge (or general solution) that in a specific field of application links an intervention or an artefact with some expected outcome or performance [34]. Denyer et al. similarly see a design proposition as offering a general template for creating solutions for a specific class of problems [31].

Table 48 The components of Design Propositions (adapted from [31])

Component	Explanation
Context (C)	The given (problematic) context in which a specific intervention *I* will produce an outcome *O*.
Interventions (I)	An intervention type (or artefact) to be used for solving a specific problem.
Mechanisms (M)	The mechanism that in a certain context *C* is triggered by the intervention *I*. A generative mechanism answers the question "why does this intervention (in this context) produce this outcome?" [34].
Outcome (O)	The outcome of the intervention in its various aspects, such as performance improvement, cost reduction or low error rates.

A design proposition made up of CIMO-logic components (Table 48) is formed in principle as follows: for some problematic Context(s), use some specific Intervention(s) that will invoke some generative Mechanism(s) that in turn will deliver the desired Outcome(s). Design propositions thus not only

inform us on what to do in a specific situation in order to create a specific effect but more importantly, they offer some insight on why this happens [31].

It is important to stress at this point that the CIMO-logic does not prescribe the specific form of a design proposition but rather forms its underlying logic. As Denyer at al. point out, design propositions "[...] in organization and management studies are seldom reduced to algorithms and can take the form of an article, a report, a training manual or a whole book" [31]. What is more, a design proposition may be comprised of multiple CIMO-logic component variables (*C*, *I*, *M*, *O*), combined in various ways, spanning multiple scope detail levels and appearing in possibly nested structures [31].

Using CIMO-logic, the accepted contributions were processed in order to extract such design propositions. In other words, contributions were scanned for CIMO-logic components (CIMO Elements) and possible interrelationships between them. For Outcome Elements specifically, and to allow for greater analyzability, effort was made to extract and decode them using the conceptual schema for the definition of Goals in the Goal-Question-Metric (GQM) method [82]. In the GQM, a Goal is specified along three coordinates (i.e. *issue*, *object*, and *viewpoint*) and a *purpose*. Following this line of thought, we defined that an Outcome has to consist at least of the Object the Outcome refers to. The remaining coordinates (Issue, Viewpoint) and the Purpose may all exist or not. Using Extended Backus-Naur Form notation (EBNF) [83], the encoding scheme we adopted for Outcomes was:

$$Outcome = [Issue], Object, [Purpose], [Viewpoint] \quad (1)$$

Due to its focus, in the context of this structured literature review we define one Intervention Element, the EA. Context Elements are thus some contexts for which the Intervention (EA) has been found to be appropriate. Mechanism Elements provide an answer to how or why EA produces or contributes, directly or indirectly, to certain Outcome Elements. It is possible though that in the literature that will be processed, design propositions will be found that describe only IO-logic (Intervention Outcome, i.e. "if A then do B"). This is also acknowledged by Denyer et al., that popular management literature usually concerns IO-logic, completely ignoring the outcomes' contextual dependencies and generative mechanisms [31].

B.4 Results

B.4.1 Description of studies

B.4.1.1 Results of the search

During the electronic search, there were 35 searches performed for all Search Engines (Section B.3.2.1). In total there were 613 results retrieved (Table 49). A detailed account of the searches is provided in the Appendix B.6.3, Table 57. During the SLR phases 4.1 and 4.2 (Sections B.3.3.1.1 and B.3.3.1.2 respectively), 543 contributions were found to be either duplicates or obviously irrelevant, judging by the titles and abstract. In the end of phase 4.2 there were 70 potentially eligible contributions remaining.

Table 49 Electronic Search Results per Search Engine, in descending order of Results.

Search Engine	Results	% of Total Results
Science Citation Index (SCI)	187	30.5
The ACM Guide	161	26.3
IEEE Computer Society Digital Library	128	20.9
CiteSeerX	50	8.2
Emerald	37	6.0
Elsevier/Science Direct	33	5.4
EBSCO	17	2.8
Total	**613**	**100.0**

B.4.1.2 Included studies

During Phase 5 of the SLR, 107 contributions in total (70 from electronic searches and 37 manual additions) were examined for qualitative eligibility (see Table 50) according to their type (specified in Section B.3.1.1) and according to the evaluation criteria (specified in Section B.3.1.2). From these 107 potential contributions, 93 have been subsequently excluded (Appendix B.6.4, Table 59), resulting in 14 eligible (accepted) contributions (Appendix B.6.4, Table 58) in total.

Table 50 Summary of all Contributions

ID	Contributions Sources Name	Count
SE	Contributions from Electronic Searches	70
M	Manually Added Contributions	19
BR	Manually Added Back-References	18
	Total Contributions for Full-text Eligibility Examination	107
	– Rejected Contributions	93
	Eligible (Accepted Contributions)	**14**

Table 51 Accepted Contributions Research Designs Frequencies

Research Design	Frequency	(% of Total)
Survey	8	57%
Case study	4	29%
Action Research	2	14%
Total	**14**	**100%**

Table 52 Ratio of Accepted and Rejected Contributions per Source over Total Contributions for Examination of Full-text Eligibility.

	SE	M	BR	Total
Accepted	6 (5.6%)	6 (5.6%)	2 (1.9%)	**14 (13.1%)**
Rejected	64 (59.8%)	13 (12.1%)	16 (15.0%)	**93 (86.9%)**
Total	**70 (65.4%)**	**19 (17.8%)**	**18 (16.8%)**	**107 (100.0%)**

The accepted contributions' full-text eligibility review details and comments are provided separately for qualitative (Appendix B.6.4, Table 60) and quantitative (Appendix B.6.4, Table 61) research studies. From the 14 accepted contributions, 8 where qualitative research and 6 quantitative. The most common contribution types were conference proceedings, with journal articles and

organizational statistics following (Figure 33). The most common contributions' research designs were those of survey (57%) and case study (29%) (Table 51).

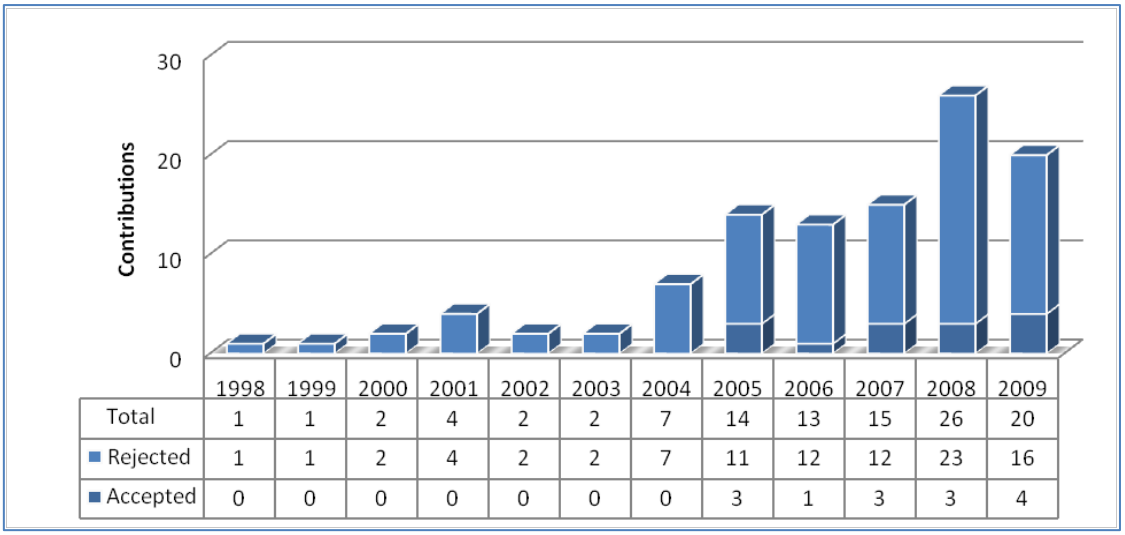
Table 53 Ratio of Accepted and Rejected Contributions per Source over Total Relevant to Synthesis Contributions (Screening Question S_2).

	SE	M	BR	Total
Accepted	6 (15.4%)	6 (15.4%)	2 (5.1%)	**14 (35.9%)**
Rejected	14 (35.9%)	8 (20.5%)	3 (7.7%)	**25 (64.1%)**
Total	**20 (51.3%)**	**14 (35.9%)**	**5 (12.8%)**	**39 (100.0%)**

Considering the number of the accepted contributions as a ratio of the initial 107 contributions, only 13.1% was finally accepted: 5.6% come from search engines and 7.5% from manual (M+BR) additions (Table 52). Considering the number of the accepted contributions as a ratio of the 39 relevant to the synthesis contributions (i.e. from the initial 107, only those 39 that successfully passed Screening Question S_2), only 35.9% were subsequently accepted: 15.4% come from search engines and 20.5% from manual (M+BR) additions (The accepted contributions' full-text eligibility review details and comments are provided separately for qualitative (Appendix B.6.4, Table 60) and quantitative (Appendix B.6.4, Table 61) research studies. From the 14 accepted contributions, 8 where qualitative research and 6 quantitative. The most common contribution types were conference proceedings, with journal articles and organizational statistics following (Figure 33). The most common contributions' research designs were those of survey (57%) and case study (29%) (Table 51).

Table 53). Although the number of accepted contributions originating from electronic searches (SE=6) is equal to that of contributions originating from manually added contributions (M=6) and greater than those originating from back-references (BR=2), the contributing ratio of accepted contributions for each source type over the total number of contributions that were deemed appropriate for full-text examination for each of the sources, is considerably larger for manually added contributions (32%) than that of contributions from back references (11%) and search engines (9%). The ratio of accepted contributions from search engines over the total number of the search engines' search results reveals a staggering 1.1%.

An overview of the total number of contributions that were considered as potentially relevant, as well as the subsequent number of accepted and rejected contributions per year, is supportive of the notion of the field of EA being a young, evolving domain (Figure 32).

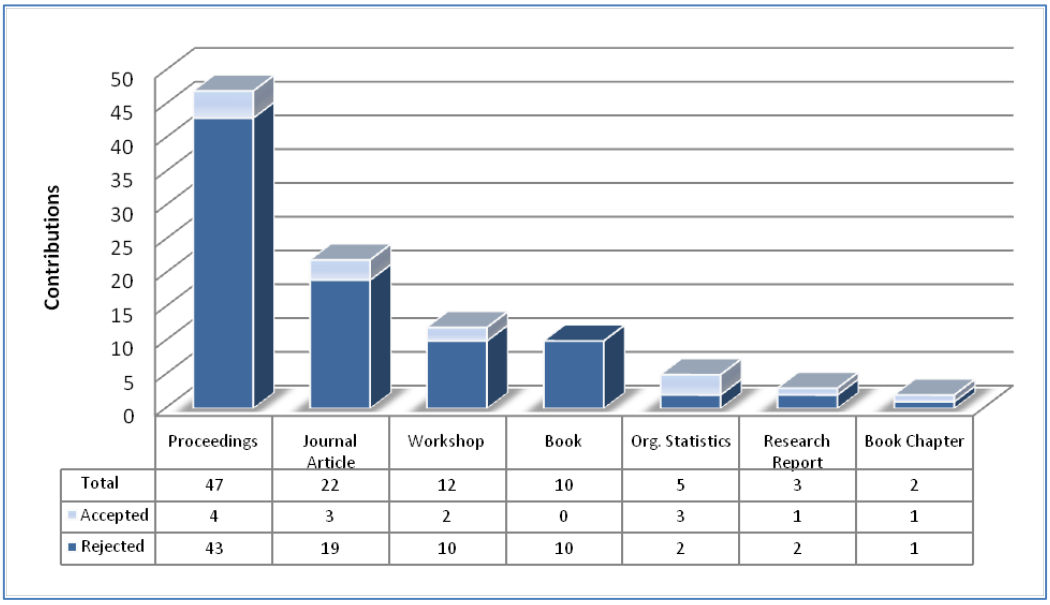


	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total	1	1	2	4	2	2	7	14	13	15	26	20
Rejected	1	1	2	4	2	2	7	11	12	12	23	16
Accepted	0	0	0	0	0	0	0	3	1	3	3	4

Figure 32 Frequencies of Accepted and Rejected Contributions per Year

B.4.1.3 Excluded studies

During the same Phase 5 of the SLR, 107 contributions in total (70 from electronic searches and 37 manual additions) were examined for qualitative eligibility (see Table 50) according to their type (specified in Section B.3.1.1) and according to the evaluation criteria (specified in Section B.3.1.2). From these 107 potential contributions, 93 were subsequently excluded (Appendix B.6.4, Table 59). The most commonly rejected contribution type was conference proceedings with journals, books and workshops following (Figure 33). Because the process of judging the contributions against the screening questions would immediately stop as a contribution would fail, there was only one consistently assessed screening question, relating to the contribution type eligibility (S_1); that screening question found 87 out of the total 93 contributions having valid contribution types (Table 54).



	Proceedings	Journal Article	Workshop	Book	Org. Statistics	Research Report	Book Chapter
Total	47	22	12	10	5	3	2
Accepted	4	3	2	0	3	1	1
Rejected	43	19	10	10	2	2	1

Figure 33 Frequencies of Accepted and Rejected Contributions with valid Contribution Types, by Contribution Type

The 93 contributions are distinguished in two major groups: first, 74 contributions that although were found to be of potential relevance during Phase 4 of the SLR, were disqualified following a

closer examination of their full-text against the screening questions (Table 41); second, 19 contributions that passed successfully the initial screening but subsequently failed to qualify against the qualitative (Table 42) or quantitative (Table 43) research assessment questions. A detailed account of all rejected contributions, along with a reason for exclusion for all those contributions that passed the initial screening and were qualitatively or quantitatively evaluated, is given in Appendix B.6.4, Table 62.

Table 54 Frequencies of Rejected Contributions with Invalid Contribution Types

Contribution Type	Frequency
Magazine (Peer Reviewed)	1
Other	1
Periodical (Edited)	1
Poster	1
Proceedings Introduction	1
Seminar Paper	1

B.4.2 Risk of bias in included studies

In general, the risk of bias appears not to have been appropriately mitigated by their respective authors in the included qualitative research design contributions. It seems that there exists a general deficiency in reporting any bias on the part of the authors of those contributions. Although some kind of bias in qualitative research is understandable and unavoidable due to the inherently subjective nature of qualitative research itself [99], many authors were found not to report on the potential bias that was eventually introduced into their research's design and process.

B.4.3 Main Findings

During the execution of Phases 6 and 7 of the SLR, the 14 eligible contributions were processed with CIMO-logic and the data was extracted accordingly into the appropriate forms. In total, there were 163 CIMO Elements and 181 CIMO Elements Relationships extracted (Table 56, column [Frequency]). Context, Intervention and Mechanism Elements were extracted as they were found in their respective contributions (e.g. in surveys) or as they were understood by the researchers (e.g. in case-studies). Individual Elements are provided in Appendix B.6.5: Contexts in Table 64, Interventions in Table 65, Mechanisms in Table 66, and Outcomes in Table 67; while CIMO Elements Relationships are provided in Table 68. All Intervention Elements that have been found refer to EA. The reason why EA is referred to multiple times and why it is a different Element, is to maintain a separate account of the CIMO Elements Relationships found between *different* contributions. Additionally, there were instances where EA was referred to multiple times and was also a different Element within the scope of the *same* contribution. This occurred because there were instances where within the same contribution, multiple unrelated design propositions where found that involved, one way or another, the EA as Intervention (e.g. Figure 34, "A", where both I1 and I2 semantically stand for EA).

Table 55 CIMO Elements Frequencies by Contribution.

Contribution ID	C	I	M	O	Total
6	15	1	1	-	**17**
19	1	2	-	18	**21**
27	-	1	-	28	**29**
2811	-	1	-	5	**6**
2817	1	1	-	9	**11**
2999	1	1	-	6	**8**
3039	1	1	-	4	**6**
3095	1	1	1	4	**7**
3131	1	1	1	6	**9**
3160	1	2	-	13	**16**
3161	-	1	-	13	**14**
3177	7	1	-	-	**8**
3185	1	1	-	3	**5**
3191	1	1	-	4	**6**
Total	**31**	**16**	**3**	**113**	**163**

Table 56 CIMO Elements Frequencies.

CIMO Element	Frequency	Merged Frequency
Context	31	29
Intervention (EA)	16	1
Mechanism	3	3
Outcome	113	100
Total	**163**	**133**

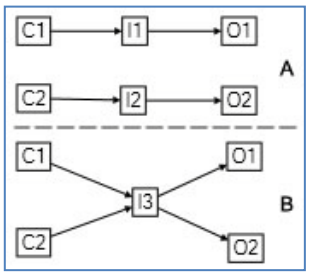


Figure 34 Merging of CIMO Elements and CIMO Elements Relationships.

Merging the semantically common Intervention Element at this point, for all design propositions, would have introduced transitive relationships between otherwise unrelated Elements (e.g. Figure 34, "B"). In this example instance, it would mean that O2 is an outcome achieved by introducing intervention I3 in the context of C1, which is not true. For the purpose of simply registering the CIMO Elements and all their relationships, these transitive relationships were undesirable.

An account of the CIMO Elements that were registered for each contribution is given in Table 55. A careful examination of the elements' frequencies by contribution reveals that the vast majority of the CIMO Elements found concerns Outcomes (69%), then Contexts (19%), and almost no Mechanisms (2%). Of the 14 contributions, only 2 report on complete CIMO propositions (3095, 3131). 6 report on Outcomes that relate each to a specific context (19, 2817, 2999, 3039, 3185, and 3191) without any reference to Mechanisms. 1 reports on Contexts where a Mechanism has been found to provide Outcomes (6), without any reference to Outcomes. 5 report on Outcomes devoid of any Context or Mechanism (19, 27, 2811, 3160, and 3161). 2 report only of Contexts (3177, 3160). The contributions mentioned do not add up to 14 because we have taken them into account as separate, unrelated CIMO-logic propositions that appeared within the same contribution.

In the next step, those CIMO Elements that were deemed to be semantically equivalent were merged in order to create a list of unique CIMO Elements for the purpose of this research. The merging decisions were not only based on the name or textual description of the CIMO Elements but also on the research context of their originating contribution. After the merge, there were in total 133 *Unique CIMO Elements* (Table 56, column [Merged Frequency]) and 168 *Unique CIMO Elements Relationships*. Individual *Unique Context* Elements are provided in Appendix B.6.6 in Table 69, *Unique Interventions* in Table 71, *Unique Mechanisms* in Table 70, and *Unique Outcomes* in Table 72; Unique CIMO Elements Relationships are provided in Table 73. A very important effect of the merging of the CIMO Elements and CIMO Elements Relationships was the introduction of the transitivity property of certain relationships (e.g. Figure 34, "B") that were not originally found to

have this property. To counter this effect, we defined that Unique CIMO Element Relationships are *not* transitive, unless otherwise explicitly stated. The scientifically established transitivity of relationships that occur as part of the research of the original contributions is not excluded of course, and can be found by referring to the CIMO Elements and CIMO Elements Relationships tables.

For the last step of the synthesis, defining a subset of the Unique CIMO Elements and their Relationships was sufficient: we defined the term *EA Benefits* as being semantically equivalent to the 100 Unique Outcome Elements included in Table 72 (Appendix B.6.6). Accordingly, we defined the term *EA Benefits Relationships* as representing that subset of the 65 Unique CIMO Elements Relationships in Table 73 (Appendix B.6.6) which refer to relationships among EA Benefits (or Unique Outcome Elements) only. These last two lists/subsets of EA Benefits and EA Benefits Relationships especially, represent the answer to the SLR goal as it was established in Section B.2.

B.4.3.1 Analysis of CIMO Elements

The analysis of the Unique CIMO Elements that were identified and subsequently extracted from the 14 contributions revealed certain themes relating to the contexts of the EA utilization, as well as to the potential benefits of EA. No capable number of mechanisms was retrieved so as to proceed with an analysis.

B.4.3.1.1 Context Elements Themes

As a convention in the following sub-sections, a parenthesis that refers to a Unique Context Element begins with a number that corresponds to the unique ID of a Unique Context Element in column [CIMO_UNIQUE ID] of Table 69 (Appendix B.6.6), followed by a comma and the reference number(s) that corresponds to the entry in the References section of this document and relate the Unique Context to its originating contribution(s).

Organizational Design

EA has been found to provide the necessary support in the context of organizational design problems. These problems might relate to the design of new organizational structures (137, [50]) or the re-design of existing ones, during mergers and acquisitions (13, [46]; 33, [10]), and during general organizational change and restructuring (92, [87]; 244, [40]).

Project Portfolio Management

EA has been found to provide support in the context of Project Portfolio Management, in cases like project portfolio planning (15, [10]), IT portfolio management (135, [46]), and in addition in related investment decisions. (165, [46])

Decision Making

EA has been found to aid in the context of general decision-making (131, [46]) activities, as well as in making decisions relating to Sourcing (14, [10]) and the adoption of COTS Software (34, [10]).

Regulatory Compliance

EA has been found to provide support in the context of regulatory compliance, be it general compliance management (32, [10]) or quality management (31, [10]).

Systems Development

EA has been found to be of help in the context of Systems Development, from the first phases during Project Initialization (e.g. project scoping) (29, [10]) to general Systems Development support (134, [46]).

Risk Management

EA has been proposed to aid in the context of Risk Management. Although there were cases identified were EA has been found to assist in Business Continuity Planning (26, [10]) most of the risk management scenarios identified were IT-related; ranging from Security Management (27, [10]), Technology Risk Management (28, [10]), and IT Service Management (35, [10]), to more specific cases of integrated Security Management solutions in business networks with heterogeneous ICT (59, [85]).

IT Costs Reduction

EA has also been found to be supportive in the context of reducing IT-related costs, either through IT Consolidation (e.g. by eliminating costly, redundant technological platforms) (37, [10]) or by better Management of IT Operations Costs (36, [10]).

B.4.3.1.2 Outcome Elements—EA Benefits Themes

As a convention in the following sub-sections, a parenthesis that refers to a Unique Outcome Element begins with a number that corresponds to the unique ID of a Unique Outcome Element in column [CIMO_UNIQUE ID] of Table 72 (Appendix B.6.6), followed by a comma and the reference number(s) that corresponds to the entry in the References section of this document and relate the Unique Outcome to its originating contribution.

IS & IT

The vast majority (46%) of the discovered Outcomes refers or relates to (Computer) Information Systems (IS) and Information Technology (IT). Reflecting the broad subject-matter of the IS and IT domains themselves, the Outcomes that fall within this category can be further divided in sub-themes.

Enhancing IT Management and Decision-making

EA has been found to produce Outcomes that enhance or improve the IS/IT Management and decision-making process. More specifically EA has been found to enforce discipline and standardization in IT Management (and use) (53, [26]), to generally improve the manageability of the IT Environment (148, [26]) and to offer a comprehensive and coordinated way to perform IT Management and Planning (75, [85]). Additionally, that application of EA has been found to result in better IT decision-making (116, [41]) and to reduce both the technology decision-making time (144, [26]) and the time spent by managerial personnel in solving technical problems (145, [26]).

Increasing IT Value and Reducing IS & IT Costs

The application of EA has been found to increase the value of IT by improving the IT Return On Investment (ROI) (40, [17]) and optimizing the value of IT investments themselves (107, [40]). In addition, EA has been found to generally reduce the IT costs (7, [26, 40]). There are both direct and indirect ways this cost reduction is achieved. Direct ways include reductions in applications maintenance costs (120, [26]) and IT operations unit costs (156, [26]). Indirect ways include a reduction in the IS development time (12, [17, 26]), the more effective use of IT resources (39, [17]),

the enablement for the reuse of technical systems (17, [88]), the improvement in IT utilization (41, [17]), the minimization of IT infrastructure services replication across Business Units (BUs) (98, [25]), and the measured reuse and efficient replication of business & IT artifacts (159, [54]).

IS & IT Consolidation, Integration & Homogeneity

In the general quest for cleanness and manageability in the organizational IT domain, EA has been found to play an important role in reducing IT complexity (38, [17]); minimizing heterogeneity (6, [25, 26, 40]) and variations in employees' technical competencies (143, [26]); and cleaning-up enterprise applications (72, [26]), shared data (147, [26]) and the IT infrastructure (146, [26]). Additionally, the application of EA has been found to contribute in consolidating technology (9, [41]), data (16, [41]), data stores (76, [88]), applications (112, [41]), and in general, consolidating and improving the sharing of corporate information and data (158, [54]). EA has been also found to contribute to the achievement of integration between enterprise applications (10, [25]) and data (11, [25]), as well as improving the interoperability of IS (42, [17]). Finally, EA has been found to contribute to the convergence of business process processing (100, [88]).

IS & IT Openness & Responsiveness

EA has been found to contribute to a more open and responsive IS/IT domain. Openness is reflected on the improved accessibility of data for regulatory compliance (22, [26]), the increased data-sharing (149, [26]) the improved communication of the IS and IT Governance arrangements (141, [54]) and the increase in the transparency of the communication of IS and infrastructure changes (121, [85]). Responsiveness is reflected in the increase in IT responsiveness (74, [26]) and also the improvement of IT change responsiveness (43, [17]).

Enhancing IT Risk Management

EA has been found to contribute to the general improvement of IT-related risk management (73, [26]) and the reduction of the associated risks from IT Systems failures (21, [26]). More specifically, EA has been found to contribute to an increase in the ease and speed of IT backup and recovery services (23, [26]) and a reduction to the risk (as well as the time) related to the delivery of IT projects (162, [40]). Additionally, EA has been found to contribute to comprehensive and coordinated security management and planning (157, [85]), as well as to an improvement in the IS security (44, [17]) and to a possible reduction of the IT Security Breaches (24, [26]). Additionally, more specific outcomes are those of increasing the transparency and security of inter-organizational business process support (61, [85]) and information exchange (60, [85]).

Enhancing Organizational Processes & Process Standards

EA has been found to contribute to the achievement of a number of EA Outcomes that relate to an organization's processes and the processes' performance and standards. More specifically, EA has been found to contribute in enforcing discipline (5, [26]), standardization and improving business processes (161, [40]). What is more, EA not only contributes to the establishment of an organization's "foundation for execution" (86, [86]), but in addition enables the consolidation (113, [41]) and reuse (18, [88]) of business processes, and the integration of process standards (150, [26]). Additional findings relate to the EA enabling a greater degree of business and process change (163, [40]), flexibility (101, [40]), and agility (8, [26, 41, 86]).

Project Management

EA has been found to contribute to the achievement of a multitude of Outcomes relating to projects, most important of which appears to be the enhancement of communication and collaboration among the project stakeholders in a variety of contexts: from enabling the communication of project investment decisions (78, [50]), to enabling the conceptual consolidation of a project's "to-be" situation (164, [50]), and improving the communication of the solution-related concepts (92, [87]). Additionally, EA has been found to be helpful in the context of project management, in that it contributes to the identification and management of the various stakeholder views (93, [87]), of the ambiguous project goals (94, [87]), and of the appropriate collaborative form of the stakeholders (95, [87]). Finally, EA has been found to contribute to better project scoping (1, [50]), in minimizing project resources waste (51, [17]), and in enhancing the completeness (114, [41]) and consistency (115, [41]) of project deliverables.

Requirements Engineering

EA has been found to play an important role in the entire requirements engineering process, primarily because the requirements elicitation can be based on an organization's existing EA documentation (2, [85]), thus facilitating the reuse of requirements during the requirements' elicitation (56, [84]) and subsequently increasing the speed of the requirements' elicitation process (54, [84]). In addition, EA has been found to increase the accuracy (55, [84]) and structure (63, [84]) of requirements' specifications, as well as to generally improve the requirements' traceability (64, [84]).

Enhancing Organizational Performance

EA has been linked with enhancing the performance of the organization, as it is reflected in increases in general lag indicators of organizational achievement like the performance-based CAGR, (87, [86]) and the Return On Sales (ROS)(88, [86]). Additionally, EA has been found to contribute to increased organizational efficiency (89, [86]) and the achievement of Operational Excellence (153, [26]).

Enhancing Intra- & Inter-Organizational Communication & Collaboration

EA has been found to contribute to the improvement of both intra- (3, [17, 40, 85]) and inter-organizational (50, [17]) communication. Additionally, EA has been found to contribute to the improvement of intra-organizational collaboration (46, [17]) and trust (47, [17]), as well as to the improvement of inter-organizational information sharing (69, [17]).

B.5 Discussion

B.5.1 Summary of main results and quality of evidence

The final results of the Structured Literature Review concern the review of 14 eligible contributions and their subsequent analysis under the CIMO-logic spectrum, which revealed the current state of the scientific and practitioner's literature concerning the potential benefits of EA as describing 29 unique contexts within which EA has been found to deliver value, 100 unique benefits of EA, and 3 mechanisms that generate the value of EA. The analysis of the results in relevant themes, pinpointed the evident emphasis of the selected studies towards IT and IT-related issues, both in terms of applicability Contexts and Outcomes—benefits of EA. What is more, there appears to be some consensus on the contexts and outcomes located in the contributions: although very few studies explicitly research outcomes under specific contexts, there appears to be a thematic match—to a certain extent—between the researched contexts and outcomes of different studies, like Risk Management and IT Cost Reduction. We hold this match to be especially indicative of the perceived importance those issues hold for EA researchers and practitioners.

The results of the search show clearly that the manual additions to the search process had a greater impact on the final list of accepted contributions, both analogically and as a bottom-line contribution, than those originating from search engines. The results additionally show that the vast majority of the potential contributions were finally excluded from the research synthesis. That is not primarily attributed to the overall quality of the contributions though. From those contributions that were excluded, approximately one out of three was found to be relevant to the synthesis goals but even so, was subsequently excluded on the grounds of various methodological or other qualitative deficiencies, as they were established based on the assessment screening questions and the assessment research-related questions. We hold these results as indicative of the absence of a sufficient number of research programs being conducted on the potential benefits of EA. Additionally we hold these results as indicative of the relatively poor quality standards of either the contributing research or its reporting; at least as those score against the criteria that were set for this systematic review.

Another interesting finding is the support we found for the claim that the domain of EA is young and evolving [10-12] in the increasing number of total accepted and rejected contributions per year, which were initially considered as potentially eligible and their full-text was subsequently reviewed. From these contributions, the oldest ones were published in the late 90's, which more or less corresponds with influential publications like Zachman's [7] and IEEE 1471 [13].

Another aspect of the results of this review concerns the methodological design of the accepted contributions. Qualitative and quantitative research designs contribute almost equally to the total number of accepted contributions. At a first glance, that might mean that there is a well-balanced representation of both worlds. We believe though that the quantitative research design is not the most appropriate for researching and reporting rich, highly contextual evidence relating to the organizational benefits of EA. As a result, we hold the almost equal ratio of qualitative and quantitative research supportive of the notion of a deficit in the relative amount of rich evidence available from the accepted contributing studies. Additional supportive evidence to the same claim comes from the large number of IO-logic design propositions found (in addition to CIO-, CIM-, and CI-

logic[7]), as compared to the number of CIMO-logic design propositions found, which is a clear indication of the relatively shallow depth of analysis undertaken in several contributing studies. This last effect was nevertheless expected; it has been acknowledged by other researchers as it appears to be a common characteristic of the research conducted in the management domain [31].

B.5.2 Overall completeness and applicability of evidence

An evaluation of the results of the literature review, in terms of their relevance to the review question, led us to ascertain that they indeed support the review question, as they provide a competent amount of evidence regarding the identification of the benefits of EA, as these are perceived or established by researchers and practitioners of the field. As an extension, the results of the literature review provide an answer to the first research question of this research (RQ1).

The evidence put forth by the review is only *transferable* to the extent that individual eligible studies' results are. One of the reasons why the SLR method was selected for conducting the literature review was the advanced capabilities it had to offer in terms of allowing ample transparency in the review process and its results. The implication is that in order to establish the transferability of individual CIMO Elements and Relationships, the reader is empowered to check the eligibility decisions (and their rationale) made during the review, as well as to refer to the original contributions.

It has been previously noted that much of the evidence found during this literature review does not provide sufficient contextual account of its applicability. Even in those cases that the context is indeed related to specific outcomes, it mostly refers to one specific context (e.g. in the context of a case-study) and not to an investigation of the achievement of specific outcomes under different contexts (e.g. different EA maturity levels). This shortcoming of the included studies adds to the argument that the results of the literature review should be seen as *potential* benefits of EA and that their realization in real-world scenarios might depend on many other contextual factors that require careful examination.

The results of the SLR carry several implications for both researchers and practitioners. The main implication is that of enhancing the understanding of EA by providing valuable information on the potential outcomes (benefits) of EA and their relationships, their applicability (context), and the mechanisms that generate them. The second implication is that of enabling the scientifically grounded reasoning about how EA might contribute to the achievement of certain business goals, establishing thus the business case for EA and EA projects. The third implication is that of providing an extensive list of EA benefits that can function as a source for defining relevant objectives for EA programs.

B.5.3 Potential biases in the review process

The SLR method utilized for conducting the literature review enabled a highly structured process with transparent and traceable results: all aspects of the evidence produced and the relevant rationale that produced them are readily available and reported in this document. Although

[7] We use different combinations of the initials (C, I, M, and O) of the Context Intervention Mechanism Outcome logic elements, to refer to the different combinations of elements found in the accepted contributions. For example, CIM-logic would refer to a design proposition that consists of Context, Intervention, and Mechanism Element(s), as opposed to CI-logic that would refer to a design proposition that consists only of Context and Intervention element(s).

extensively reported, the literature review, the contributions' eligibility compliance check and the subsequent analysis were undertaken solely by the main researcher and thus decisions were based on his discretion. To counter possible bias in the process, ambiguities were resolved after consulting with members of the review panel. Members of the review panel were found to be authors of two contributions that were initially considered for inclusion in the review as potentially relevant. However, after a full-text examination by the primary researcher, these two contributions were excluded on the grounds of being irrelevant to the objectives of the literature review synthesis.

Although the study contends to be highly inclusive regarding the total number studies that are available in the knowledge base on the subject of the benefits of EA, we understand that it is highly improbable to have located all of them with the reported search process for a number of good reasons. First, we expect additional studies to be available in other languages than the one our search focused on (English). Second, we expect more grey literature to exist in sources that the researchers do not currently have access to or are not aware of (e.g. organizational statistics, internal reports). Third, we have consciously excluded from the search keywords that relate to Service Oriented Architecture (SOA), as we believe that the relationship between EA and SOA is currently vaguely—and sometimes even contradictorily—defined in the relevant literature. We expect that a number of current contributions that relate to the benefits of SOA exist in the knowledge base.

B.6 SLR Report Appendix

B.6.1 Differences between Protocol and Review

- Section B.3.1.2:
  - It was necessary to include in the Assessment Screening Questions (Table 41) another screening question “Eligible contribution type”, which is used to specify a Boolean truth value that represents the eligibility of a contribution against the applicable contribution types (Section A.3.1.1).
- Section B.3.2.1:
  - During the search procedure, we identified the ACM search engine as promising for our cause and as such, it was subsequently utilized.
  - During the search procedure it became evident that certain keywords were treated differently by different search engines. In our case, the keyword “IT” (for Information Technology) was treated by some search engines as i) the literal “it” (third-person, singular neutral pronoun); ii) the abbreviation of the term Information Technology; and iii) a “common” word and subsequently disregarded from the search query. As a solution, we performed additional searches using the term “Information Technology” instead of “IT”.

B.6.2 Extraction Forms

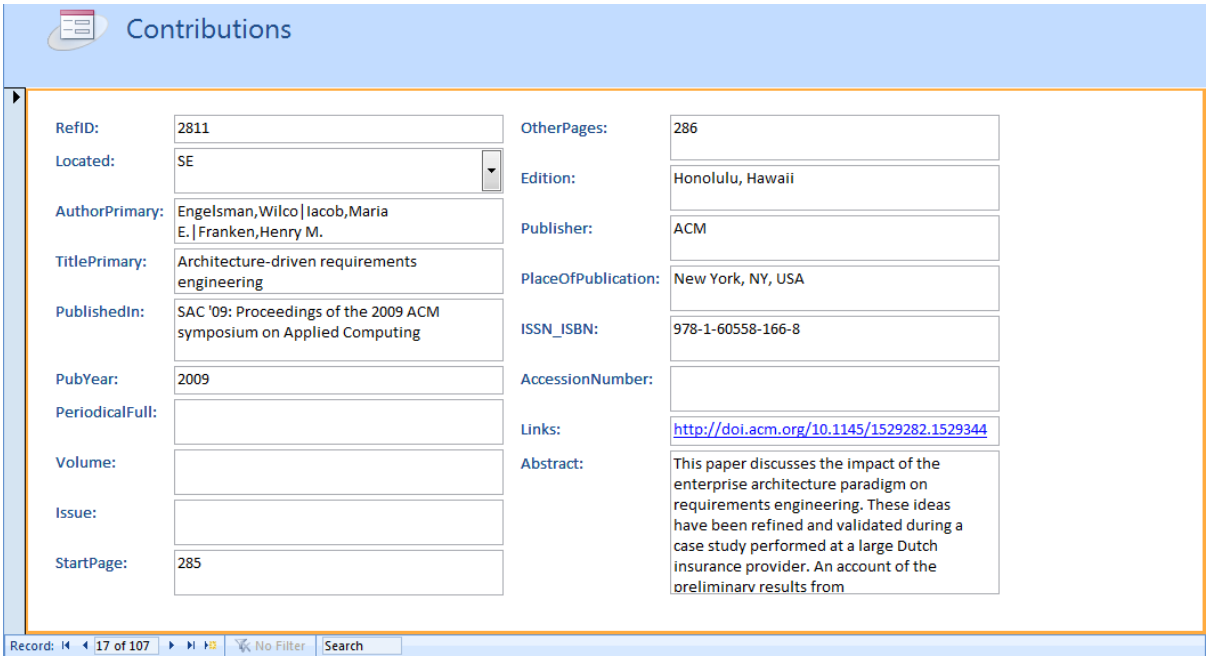


Figure 35 Contributions Extraction Form. Used for storing all Contributions details.

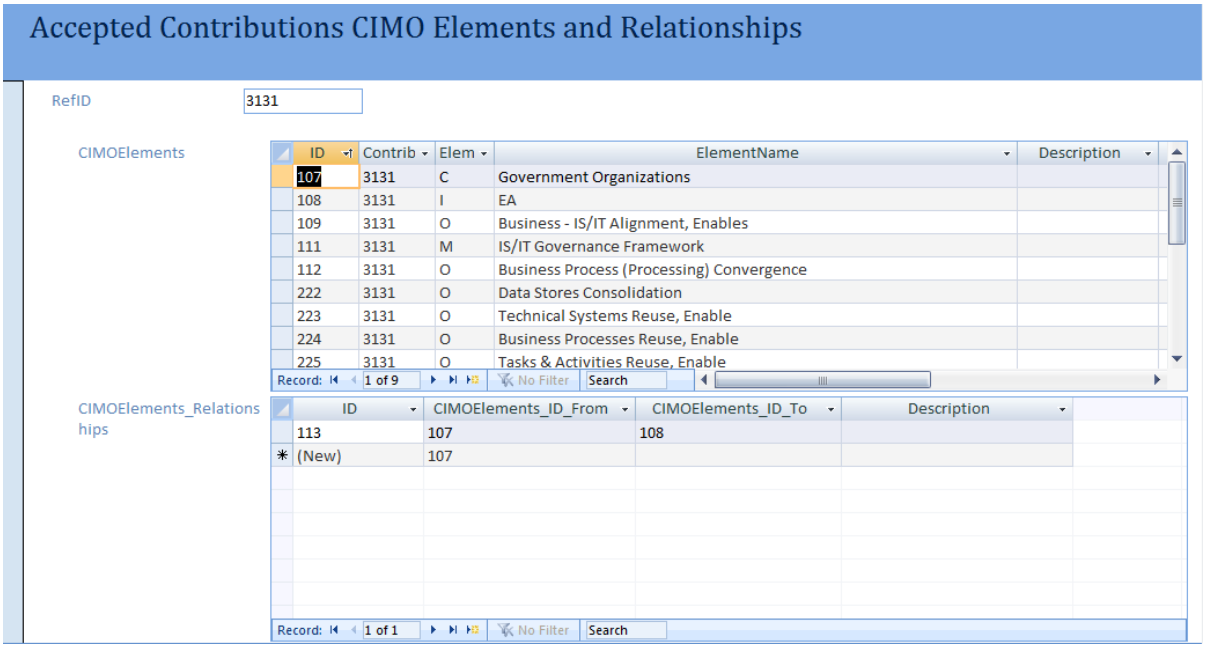


Figure 36 CIMO Elements Extraction Form. Used for storing extracted CIMO Elements from the Accepted (eligible) Contributions. The upper half contains the CIMO Elements and the lower half contains each Element's relationships (if any).

B.6.3 Search Engines Searches

Table 57 Academic Search Engine Searches. There were 613 results retrieved in total. The comment "No provision for 'IT' word" means that the word was treated as the literal "it" (and not as an abbreviation for Information Technology) or completely ignored by the search engine; the results returned were irrelevant and thus were not considered in the review.

Search Term	Search Medium	Search Date	Results	Comments
(((Abstract:"enterprise architecture") and (Abstract:contribution or Abstract:benefit or Abstract:value or Abstract:goal or Abstract:impact or Abstract:capabilities or Abstract:effectiveness) and (PublishedAs:periodical OR PublishedAs:proceeding OR PublishedAs:book OR PublishedAs:thesis OR PublishedAs:report)))	The ACM Guide	08/10/2010	105	
(((Abstract:"business architecture") and (Abstract:contribution or Abstract:benefit or Abstract:value or Abstract:goal or Abstract:impact or Abstract:capabilities or Abstract:effectiveness) and (PublishedAs:periodical OR PublishedAs:proceeding OR PublishedAs:book OR PublishedAs:thesis OR PublishedAs:report)))	The ACM Guide	08/10/2010	19	
((Abstract:"it architecture") and (Abstract:contribution or Abstract:benefit or Abstract:value or Abstract:goal or Abstract:impact or Abstract:capabilities or Abstract:effectiveness) and (PublishedAs:periodical OR PublishedAs:proceeding OR PublishedAs:book OR PublishedAs:thesis OR PublishedAs:report))	The ACM Guide	08/10/2010	29	
(((Abstract:"information technology architecture") and (Abstract:contribution or Abstract:benefit or Abstract:value or Abstract:goal or Abstract:impact or Abstract:capabilities or Abstract:effectiveness) and (PublishedAs:periodical OR PublishedAs:proceeding OR PublishedAs:book OR PublishedAs:thesis OR PublishedAs:report)))	The ACM Guide	08/10/2010	2	
(((Abstract:"organizational architecture") and (Abstract:contribution or Abstract:benefit or Abstract:value or Abstract:goal or Abstract:impact or Abstract:capabilities or Abstract:effectiveness) and (PublishedAs:periodical OR PublishedAs:proceeding OR PublishedAs:book OR PublishedAs:thesis OR PublishedAs:report)))	The ACM Guide	08/10/2010	6	
abstract:("enterprise architecture" AND (contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness))	CiteSeerX	08/10/2010	35	
abstract:("it architecture" AND (contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness))	CiteSeerX	08/10/2010	-	No provision for "IT" word.
abstract:("information technology architecture" AND (contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness))	CiteSeerX	08/10/2010	0	

Search Term	Search Medium	Search Date	Results	Comments
abstract:("business architecture" AND (contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness))	CiteSeerX	08/10/2010	8	
abstract:("organizational architecture" AND (contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness))	CiteSeerX	08/10/2010	7	
(Abstract:"enterprise architecture") AND (Abstract:contribution OR Abstract:benefit OR Abstract:value OR Abstract:goal OR Abstract:impact OR Abstract:capabilities OR Abstract:effectiveness)	IEEE Computer Society Digital Library	08/10/2010	93	
(Abstract:"it architecture") AND (Abstract:contribution OR Abstract:benefit OR Abstract:value OR Abstract:goal OR Abstract:impact OR Abstract:capabilities OR Abstract:effectiveness)	IEEE Computer Society Digital Library	08/10/2010	21	
(Abstract:"information technology architecture") AND (Abstract:contribution OR Abstract:benefit OR Abstract:value OR Abstract:goal OR Abstract:impact OR Abstract:capabilities OR Abstract:effectiveness)	IEEE Computer Society Digital Library	08/10/2010	3	
(Abstract:"business architecture") AND (Abstract:contribution OR Abstract:benefit OR Abstract:value OR Abstract:goal OR Abstract:impact OR Abstract:capabilities OR Abstract:effectiveness)	IEEE Computer Society Digital Library	08/10/2010	10	
(Abstract:"organizational architecture") AND (Abstract:contribution OR Abstract:benefit OR Abstract:value OR Abstract:goal OR Abstract:impact OR Abstract:capabilities OR Abstract:effectiveness)	IEEE Computer Society Digital Library	08/10/2010	1	
Topic=("enterprise architecture") AND Topic=(contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness)	Science Citation Index (SCI)	08/10/2010	128	
Topic=("it architecture") AND Topic=(contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness)	Science Citation Index (SCI)	08/10/2010	-	No provision for "IT" word.
Topic=("information technology architecture") AND Topic=(contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness)	Science Citation Index (SCI)	08/10/2010	9	
Topic=("business architecture") AND Topic=(contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness)	Science Citation Index (SCI)	08/10/2010	29	
Topic=("organizational architecture") AND Topic=(contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness)	Science Citation Index (SCI)	08/10/2010	21	
AB "enterprise architecture" AND AB (contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness) + Narrowed by Academic Journal	EBSCO	08/10/2010	10	
AB "it architecture" AND AB (contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness) + Narrowed by Academic Journal	EBSCO	08/10/2010	2	
AB "information technology architecture" AND AB (contribution OR benefit OR	EBSCO	08/10/2010	1	

Search Term	Search Medium	Search Date	Results	Comments
value OR goal OR impact OR capabilities OR effectiveness) + Narrowed by Scholarly (Peer Reviewed) Journals				
AB "business architecture" AND AB (contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness) + Narrowed by Scholarly (Peer Reviewed) Journals	EBSCO	08/10/2010	1	
AB "organizational architecture" AND AB (contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness) + Narrowed by Scholarly (Peer Reviewed) Journals	EBSCO	08/10/2010	3	
TITLE-ABSTR-KEY("enterprise architecture") and TITLE-ABSTR-KEY(contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness)	Elsevier/Science Direct	08/10/2010	11	
TITLE-ABSTR-KEY("it architecture") and TITLE-ABSTR-KEY(contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness)	Elsevier/Science Direct	08/10/2010	5	
TITLE-ABSTR-KEY("information technology architecture") and TITLE-ABSTR-KEY(contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness)	Elsevier/Science Direct	08/10/2010	1	
TITLE-ABSTR-KEY("business architecture") and TITLE-ABSTR-KEY(contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness)	Elsevier/Science Direct	08/10/2010	6	
TITLE-ABSTR-KEY("organizational architecture") and TITLE-ABSTR-KEY(contribution OR benefit OR value OR goal OR impact OR capabilities OR effectiveness)	Elsevier/Science Direct	08/10/2010	10	
"enterprise architecture" AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness) / Abstract	Emerald	08/10/2010	10	
"it architecture" AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness) / Abstract	Emerald	08/10/2010	-	No provision for "IT" word.
"information technology architecture" AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness) / Abstract	Emerald	08/10/2010	3	
"business architecture" AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness) / Abstract	Emerald	08/10/2010	9	
"organizational architecture" AND (benefit OR value OR contribution OR impact OR goal OR capabilities OR effectiveness) / Abstract	Emerald	08/10/2010	15	

B.6.4 SLR Accepted & Rejected Contributions

Table 58 Eligible (Accepted) Contributions. [Contribution ID] is the unique identification field used throughout this research to refer to Contributions. [Reference ID] is the unique identification field used to refer to the Contributions' Reference, in the list of References, for this document. Thus, this table serves as an associative index between an Accepted Contribution and its Reference details.

Contribution ID	Reference ID
6	[10]
19	[17]
27	[26]
2811	[84]
2817	[85]
2999	[86]
3039	[87]
3095	[25]
3131	[88]
3160	[40]
3161	[41]
3177	[46]
3185	[50]
3191	[54]

Table 59 Excluded (Rejected) Contributions. [Contribution ID] is the unique identification field used throughout this research to refer to Contributions. [Reference ID] is the unique identification field used to refer to the Contributions' Reference, in the list of References, for this document. Thus, this table serves as an associative index between an Excluded Contribution and its Reference details.

Contribution ID	Reference ID
12	[3]
15	[49]
20	[14]
22	[36]
34	[12]
2800	[100]
2801	[101]
2802	[102]
2803	[103]
2804	[104]
2806	[105]
2807	[106]
2809	[107]
2814	[108]
2819	[109]
2825	[110]
2828	[111]
2829	[112]
2830	[113]
2831	[114]
2835	[115]
2838	[116]
2851	[117]
2855	[118]
2857	[119]
2858	[120]
2861	[121]
2863	[122]
2870	[123]
2873	[124]
2900	[125]
2902	[126]
2918	[127]
2925	[128]
2926	[129]
2931	[37]
2950	[130]
2953	[131]
2963	[132]
2976	[133]
2996	[134]
3000	[135]
3001	[136]
3002	[137]
3004	[138]
3005	[139]
3009	[140]
3014	[141]
3018	[142]
3024	[143]
3033	[144]
3037	[145]
3045	[146]
3051	[147]
3052	[148]
3077	[149]
3089	[150]
3091	[151]

Contribution ID	Reference ID
3093	[152]
3094	[153]
3097	[154]
3105	[155]
3106	[156]
3107	[157]
3110	[158]
3113	[159]
3118	[160]
3121	[161]
3147	[162]
3157	[38]
3158	[39]
3159	[163]
3162	[42]
3166	[43]
3175	[44]
3176	[45]
3179	[47]
3181	[48]
3187	[51]
3188	[52]
3190	[53]
3192	[55]
3193	[56]
3194	[57]
3195	[58]
3196	[59]
3197	[60]
3198	[61]
3199	[62]
3200	[63]
3201	[64]

Contribution ID	Reference ID
3202	[65]
3203	[66]

Table 60 Accepted Contributions (Qualitative Research): Full-Text Evaluation of Eligibility Criteria. All Contributions' Types (G_3) are eligible (S_1 = TRUE). First Column [ID] stands for "Contribution ID".

ID	G_2	G_3	S_2	S_3	S_4	S_5	S_6	QL_1	QL_2	QL_3	QL_4	QL_5	QL_6	QL_7	Comments	Date
2811	Conference Proceedings	Case study	†	‡	‡	‡	†	‡	-	-	‡	‡	-	×	The sampling strategy question is not relevant since the authors base their research on the findings of a specific case study. We have no information on the data collection methods, but the data presented appear to support the research. We have no indication that the findings of the study are actually transferable due to the limitation of the single-case study validation. No discussion on researcher biases is conducted. Nevertheless, the research undertaken is valuable because it is unique, since no other research on how Requirements Engineering is affected by EA has been conducted (according to the authors).	29/10/2009
2817	Journal Article	Case study	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	†	‡	The findings are transferable to the same context, that is, of multi-enterprise networks with high demands to privacy management solutions and trust. However, the point should be made that the case study organization was already acquainted with EA prior to the initiation of the research undertaking.	30/10/2009
3039	Conference Proceedings	Action research	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	×	×	There is no attempt being made in order to assert the transferability of the findings. Researcher bias is not recognized, but this is understandable since in Action Research by definition the researcher is involved and shapes the data being produced by the application of the research itself.	30/10/2009
3131	Journal Article	Case study	‡	‡	‡	‡	‡	‡	‡	‡	†	‡	†	‡	Although the authors do not make an explicit attempt to establish the transferability of the findings, the findings themselves are supported by the relevant literature and so their transferability is deemed as "potential".	30/10/2009
3185	Workshop	Action Research	‡	‡	‡	‡	†	‡	‡	‡	†	‡	×	×	Rigorous and relevant research scientifically and for the synthesis. Although the authors do not make any claim about the transferability of the findings of this research, some of the main findings themselves seem to be supported by other existing literature on EA. Nevertheless, there is only one case study supporting the author's claims.	04/11/2009
3191	Book Chapter	Case study	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡	†	×		04/11/2009

Legend: × = Disagree, † = Partially Agree, ‡ = Agree, – = Other; G_2 = Contribution Type, G_3 = Research Design Type.

Table 61 Accepted Contributions (Quantitative Research): Full-Text Evaluation of Eligibility Criteria. All Contributions' Types (G2) are eligible (S_1 = TRUE). First Column [ID] stands for "Contribution ID".

ID	G_2	G_3	S_2	S_3	S_4	S_5	S_6	QN_1	QN_2	QN_3	QN_4	QN_5	Comments	Date
6	Workshop	Survey	‡	‡	‡	‡	†	‡	†	†	†	‡	The only relative downside is the relatively small dataset (51) of the respondents of the survey. Additionally, it is not clear if the EA Application Scenarios surveyed by the authors can be taken as potential Outcomes of EA since the hypothesis being tested is different.	06/11/2009
19	Conference Proceedings	Survey	‡	‡	‡	‡	‡	‡	‡	‡	†	†		26/10/2009
27	Research Report	Survey	‡	‡	‡	‡	‡	‡	-	‡	‡	‡	We have no data to assess the questions answered with "other".	23/10/2009
2999	Conference Proceedings	Survey	‡	‡	†	‡	‡	‡	‡	‡	‡	‡		30/10/2009
3095	Journal Article	Survey	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡		28/10/2009
3160	Organizational Statistics	Survey	‡	‡	‡	‡	‡	‡	‡	‡	†	‡		26/10/2009
3161	Organizational Statistics	Survey	‡	‡	-	‡	†	‡	×	‡	×	‡	Although the research aims are not explicitly stated, this is easily understood by the content of the study. The sampling strategy is not reported. The data analysis is not in any way rigorous, since only the hard-numbers are presented.	26/10/2009
3177	Organizational Statistics	Survey	‡	†	‡	‡	†	‡	†	‡	‡	‡	The sampling strategy is given in fragments in the first pages. From the results relevant to this study (page 6), it is not clear if they are purely Contextual factors or Outcomes or EA or even both. The intent of the question is not very clear.	26/10/2009
Legend: × = Disagree, † = Partially Agree, ‡ = Agree, – = Other; G_2 = Contribution Type, G_3 = Research Design Type.														

Table 62 Rejected Contributions: Full-Text Evaluation against Screening Questions and Eligibility Criteria. If column G_1 = "QL", then columns [QL_1 – QL_7] must be filled in, otherwise if G_1 = "QN", then columns [QN_1 – QN_5] must be filled in. If column S_1 = "F" or at least one column from [S_2 – S_5] = "×", then the contribution has not been qualitatively reviewed at all (columns [S_2 – QN_5] *may* be empty), since it did not pass the screening questions (white background). Contributions that have been qualitatively reviewed are distinguished using a light grey background (per row). Inclusion/exclusion and relevant decision comments are included in Table 63. First Column [ID] stands for "Contribution ID".

ID	G_1	G_2	G_3	S_1	S_2	S_3	S_4	S_5	S_6	QL_1	QL_2	QL_3	QL_4	QL_5	QL_6	QL_7	QN_1	QN_2	QN_3	QN_4	QN_5	Date
12	QL	Journal Article	Conceptual	T	†	†	×	-	×													26/10/2009
15		Conference Proceedings		T	×				×													05/11/2009
20	QL	Book		T	‡	×	‡	-	×													26/10/2009
22	QL	Journal Article	Literature review	T	×				×													17/11/2009
34	QL	Conference Proceedings	Case study	T	×	‡	‡	‡	×	‡	‡	†	†	‡	-	†						26/10/2009
2800		Book		T	×	†			×													30/10/2009
2801		Workshop		T	×				×													30/10/2009
2802		Other		F					×													28/10/2009
2803	QL	Conference Proceedings	Literature review	T	×	‡	‡	†	×		×											02/11/2009
2804		Conference Proceedings		T	×				×													28/10/2009
2806		Book		T	×				×													28/10/2009
2807		Book		T	×				×													03/11/2009
2809	QL	Workshop		T	×				×													28/10/2009
2814	QL	Conference Proceedings		T	×				×													29/10/2009
2819		Book		T	×				×													28/10/2009
2825		Book		T	×				×													03/11/2009
2828	QL	Conference Proceedings	Case study	T	×				×													06/11/2009
2829		Poster		F	×				×													28/10/2009
2830		Conference Proceedings		F	×				×													30/10/2009
2831	QL	Workshop	Case study	T	×	‡	‡	‡	×	‡	‡	‡	†	‡	†	×						28/10/2009
2835		Book		T	×				×													02/11/2009
2838	QL	Workshop	Conceptual	T	‡	‡	‡	‡	×	†	-	-	-	-	-	-						30/10/2009
2851	QL	Conference Proceedings	Case study	T	×				×													29/10/2009
2855	QL	Conference Proceedings		T	×				×													30/10/2009
2857		Proceedings Introduction		F	×				×													28/10/2009
2858		Conference Proceedings		T	×				×													03/11/2009
2861		Journal Article		T	×				×													04/11/2009

ID	G_1	G_2	G_3	S_1	S_2	S_3	S_4	S_5	S_6	QL_1	QL_2	QL_3	QL_4	QL_5	QL_6	QL_7	QN_1	QN_2	QN_3	QN_4	QN_5	Date
2863		Journal Article		T	×				×													30/10/2009
2870	QL	Conference Proceedings	Interviews	T	‡	‡	‡	‡	×	‡	×	×	‡	‡	×	‡						31/10/2009
2873		Book		T	×				×													28/10/2009
2900		Magazine (Peer Reviewed)		F	×				×													28/10/2009
2902		Book		T	×				×													30/10/2009
2918	QL	Journal Article		T	×				×													28/10/2009
2925		Book		T	×				×													28/10/2009
2926		Journal Article		T	×				×													30/10/2009
2931	QL	Conference Proceedings		T	×	‡	‡		×													26/10/2009
2950		Seminar Paper		F	×				×													28/10/2009
2953		Workshop		T	‡	‡	‡	†	×	†	-	-	×	×	×	-						31/10/2009
2963		Conference Proceedings		T	×	‡	†	-	×													28/10/2009
2976		Workshop		T	×				×													30/10/2009
2996	QL	Conference Proceedings	Case study	T	-				×													04/11/2009
3000	QL	Conference Proceedings	Case study	T	×				×													04/11/2009
3001	QL	Conference Proceedings		T	×				×													06/11/2009
3002	QL	Conference Proceedings		T	×				×													04/11/2009
3004	QL	Conference Proceedings		T	×	‡	‡	‡	×													04/11/2009
3005		Conference Proceedings		T	×				×													28/10/2009
3009		Conference Proceedings		T	‡	‡	†	-	×													04/11/2009
3014	QL	Conference Proceedings	Conceptual	T	‡	‡	†	‡	×	‡	-	-	-	-	-	-						04/11/2009
3018	QL	Conference Proceedings		T	×				×													04/11/2009
3024		Conference Proceedings		T	×	†	×	-	×													28/10/2009
3033	QL	Workshop	Case study	T	‡	‡	†	‡	×	‡	-	-	×	†	-	×						30/10/2009
3037		Conference Proceedings		T	‡	‡	‡	×	×													28/10/2009
3045	QL	Conference Proceedings		T	×				×													31/10/2009
3051		Conference Proceedings		T	×				×													04/11/2009
3052		Conference Proceedings	Conceptual	T	†	‡	‡	†	×	†	-	-	-	-	-	-						28/10/2009
3077	QL	Conference Proceedings		T	×			-	×													04/11/2009
3089		Conference Proceedings		T	‡	†	‡	×	×													28/10/2009
3091		Periodical (Edited)		F					×													28/10/2009

ID	G_1	G_2	G_3	S_1	S_2	S_3	S_4	S_5	S_6	QL_1	QL_2	QL_3	QL_4	QL_5	QL_6	QL_7	QN_1	QN_2	QN_3	QN_4	QN_5	Date
3093		Conference Proceedings		T	‡	‡	‡	×	×													28/10/2009
3094	QL	Journal Article		T	×				×													04/11/2009
3097		Journal Article	Conceptual study	T	‡	†	‡	-	×													17/11/2009
3105	QL	Conference Proceedings		T	×				×													28/10/2009
3106		Journal Article		T	×				×													02/11/2009
3107		Journal Article		T	×				×													28/10/2009
3110		Journal Article	Conceptual	T	‡	‡	‡	‡	×													30/10/2009
3113	QL	Journal Article	Action research	T	×				×													03/11/2009
3118	QL	Journal Article		T	×				×													03/11/2009
3121	QL	Journal Article	Case study	T	†	‡	‡	‡	×	-	‡	†	†	‡	×	×						17/11/2009
3147	QL	Journal Article	Case study	T	×				×													02/11/2009
3157	QL	Conference Proceedings	Literature Review	T	‡	†	‡	‡	×													26/10/2009
3158	QL	Conference Proceedings	Literature Review	T	†	‡	‡	‡	×	‡	†	‡	‡	‡	-	‡						26/10/2009
3159	QN	Organizational Statistics	Survey	T	‡	‡	‡	‡	×								‡	‡	†	†	‡	30/10/2009
3162	QL	Journal Article		T	†	†	‡	-	×	-	-	×	×	×	×	×						22/10/2009
3166	QN	Organizational Statistics	Survey	T	‡	‡	‡	‡	×								‡	×	†	‡	‡	26/10/2009
3175		Journal Article		T	‡	×	×	-	×													26/10/2009
3176	QL	Conference Proceedings	Case study	T	†	‡	‡	‡	×	‡	‡	†	×	‡	×	†						26/10/2009
3179	QL	Conference Proceedings	Case study	T	×				×													26/10/2009
3181	QL	Conference Proceedings	Case study	T	×	‡	‡	‡	×													26/10/2009
3187	QL	Conference Proceedings	Case study	T	×				×													04/11/2009
3188	QL	Conference Proceedings	Conceptual	T	×				×													04/11/2009
3190	QL	Conference Proceedings		T	×				×													04/11/2009
3192		Research Report		T	×				×													05/11/2009
3193		Workshop		T	×				×													05/11/2009
3194		Journal Article		T	×				×													05/11/2009
3195		Conference Proceedings		T	×				×													05/11/2009
3196	QL	Workshop		T	×				×													05/11/2009
3197		Research Report		T	×				×													05/11/2009
3198	QL	Conference Proceedings	Case study	T	‡	†	†	†	×	‡	×	×	×	†	×	×						05/11/2009
3199	QL	Workshop	Conceptual	T	†	†	‡	-	×													05/11/2009

ID	G_1	G_2	G_3	S_1	S_2	S_3	S_4	S_5	S_6	QL_1	QL_2	QL_3	QL_4	QL_5	QL_6	QL_7	QN_1	QN_2	QN_3	QN_4	QN_5	Date
3200		Journal Article		T	×				×													05/11/2009
3201	QL	Conference Proceedings	Case study	T	×				×													05/11/2009
3202	QL	Book Chapter	Case study	T	†	†	†	‡	×	‡	-	-	×	×	×	×						06/11/2009
3203	QL	Conference Proceedings		T	×				×													04/11/2009

Table 63 Contributions Inclusion/Exclusion Comments. Contributions that have been qualitatively reviewed (were relevant to the synthesis) are distinguished using a light grey background (per row).

Contribution ID	Inclusion/Exclusion Comment
20	Original contribution with potential implications for practice, but unclear contributions for science. The only useful contributions to this synthesis are the Contextual factors for EA (like SOX, Basel II, etc.) and the Outcomes for EA, both of which appear without any means of validation or reference to other relevant research.
34	Although the book itself is not relevant to the synthesis, a chapter from within it is, so it has been manually included in the list of contributions for quality assessment.
2800	The book is an important contribution to the field of EA by itself, but does not contribute to the aims of this review per se, since it references relevant literature on EA benefits, but doesn't research further on them. Instead it has been used in order to identify potential contributions for this study (back-referencing).
2803	The contribution contains EA triggers/goals from the literature that are relevant to the research. The problem is that the sources that have been used, in their majority do not come from validated research, but from mere claims or plain references in all kinds of articles/sources; something which is not acceptable/relevant for this research. Nevertheless, the sources that this paper references have been included for qualitative assessment.
2825	Although the book itself is not relevant to the synthesis, a chapter from within it is, so it has been manually included in the list of contributions for quality assessment.
2828	The paper investigates the contribution of SOA and not EA.
2835	The book includes a collection of chapters/contributions that are relevant to the domain of EA and more specifically GEA, but the contributions mostly have to do with "lessons-learned" or purely conceptual cases, with the exception of one contribution that has been added in the manual list of references.
2838	This is a highly relevant study both for researchers and practitioners. The authors successfully design the technique for Failure Impact Analysis, but do not validate it in practice. They only provide a fictitious example in order to demonstrate the technique. The qualitative research criteria are thus not applicable.
2870	The sample size of the study does not suffice in any way in order to draw any conclusions or make any generalizations.
2902	Introduces some benefits of "Enterprise IT Architecture" completely unmotivated.
2953	Highly relevant study on the relationship of EA with BRM and as a result with corporate governance. It suffers though from many quality issues. The thesis that the author is citing and that contains the actual research project is not available on the internet. We have no indication from the paper on how, from whom, with which method, etc the goals of EA and BRM have been received. There is no elaboration on the findings either. The diagram is not in any way

Contribution ID	Inclusion/Exclusion Comment
	explicative. Even the theoretical foundations of the study suffer from inconsistency because for example, the mechanisms through which EA has an impact on corporate governance are not motivated through either personal research or the relevant literature. Some references that appear are unfortunate since they do not concern research that directly validated EA effects on corporate governance, but rather generic conceptual articles.
2996	It is part of another study [135] (Contribution ID:3000) of the same authors that has already been taken into account for qualitative assessment.
3004	Although this research is relevant to the EA domain, it is not relevant to the synthesis, since it is a purely conceptual paper with the addition of a small illustrative Case study.
3009	The paper reports on the decision-making process that led to the decision to adopt a SOA-based EA for a specific need of the Canadian DoD. The important thing is why they selected EA among other alternatives to solve the issue - the authors fail to provide us with any relevant information. There is no information either in order to conclude on the appropriateness of the methodologies used. The research aims are not so clear and there might be confusion occurring with the actual project aims that are described in the paper.
3014	While the authors present rather haphazardly an extended model for EA development, they present no information on its validity, established practical relevance, etc. The research seems potentially promising, but seems in a very early stage so as to make any claims on the true usefulness.
3033	There is no indication provided about the sampling strategy, data collection strategy and the data analysis is not in any way rigorous. The findings have been presented in a rather unstructured and unmotivated way and there is no indication on how the conclusions are supported by collected data. There is no indication on how and if the findings are transferable. No research bias has been recognized. The research theme however is very relevant and unique in that sense.
3037	This paper tries to establish the need for EA as the platform for successful MDA. Unfortunately, no research has been conducted to enforce the notion.
3052	The proposed method has scientific value, but is not validated in any way and its relevance for practice not established except from a simple example. The research design suffers exactly for this reason. The value comes from the conclusion that EA can be used in order to develop change impact analysis scenarios.
3089	There is no apparent methodology specified or some specific research design. Although the claim made by the paper is relevant to the synthesis, there is no data whatsoever to support it.
3093	Although this is an original contribution, it suffers from methodological issues. There is no research methodology presented whatsoever to back-up the claims of the researchers.
3097	This is a purely conceptual paper (i.e. no empirical validation) that can be seen at most as suggestive. Although it is relevant to the synthesis it cannot be accepted due to the complete lack of validation.
3110	This is a highly original paper that proposes a tailor-made EA framework to mitigate security risks and reduce potential losses for enterprises that undertake business convergence. It is a conceptual paper and there is no indication provided of any validation performed in order to assess the effectiveness of the proposed solution.
3118	Although the paper is irrelevant to the synthesis, some references of possible value have been identified and added to the list of potential contributions for further evaluation.
3121	The relevancy of this contribution on the synthesis is not clear since it talks about a different "business architecture", overarching the EA. The case study research design although appropriate, is insufficient because it is producing very limited research results from a single organization in order to try and

Contribution ID	Inclusion/Exclusion Comment
	answer a research question that concerns general alignment of companies. When the authors revisit their research questions in the concluding section they establish them in a different way, regarding only the case study organization. For these reasons we exclude the contribution from the synthesis.
3157	Highly relevant contribution that sheds light on the necessity and current state of evaluating the benefits of GEA. Unfortunately, the EA benefits used are referenced from [39] (Contribution ID:3158) which has been evaluated separately. The rest of the issues concern reviews of EA benefits categorization schemas and not benefits themselves.
3158	This contribution is highly relevant but the literature study it conducted followed completely different evaluation and inclusion criteria. Including the study completely would mean that we would have added from the "back door" studies that do not conform to this literature research's evaluation. As a consequence, we have replicated the study step by step, but using our study's evaluation and inclusion criteria. The contribution as such is not going to be included.
3159	Excluded because there is an updated version included [40] (Contribution ID:3160).
3162	We have no data to judge on the "other" questions.
3166	The sampling strategy is not thoroughly documented. The data collection seems to be addressing the research issue. The problem regarding the inclusion of the survey in the synthesis revolves around the issue that the relevant data for this synthesis (pages 11-12) are given without any indication on the sampling method as they do not appear with any hard numbers as the rest of the survey results. In other words, we do not know if these relevant data are the result of open-questions and consequently how valid they are.
3176	No indication that findings are transferable. What is more, there are indications that the findings are not transferable due to the fact that the only case study conducted reveals highly contextual information pertaining to the Danish public health sector. Researcher bias has been minimized partially through data triangulation. This research concerns identifying potential drivers for EA implementation and not validated benefits from an EA implementation.
3198	Relevant scientifically and to this research, but suffers qualitatively. The case study that is presented is not used to validate the claim for the role EA is playing towards large-scale systems interoperability, but it serves rather as an example. If the intention was to validate the idea, then there is no data presented to support it.
3199	Although relatively relevant to the synthesis, this is a purely conceptual contribution and the benefits that the authors are claiming from the use of the artifact are based on imagination and not on fact/empirical validation.

B.6.5 CIMO Elements & CIMO Elements Relationships

Table 64 Contribution (C) Elements. Last column [CIMO_UNIQUE ID] corresponds to the [CIMO_UNIQUE ID] column of Table 69.

CIMO ID	Contribution ID	Element Name	Description	CIMO_UNIQUE ID
14	6	IT Business Alignment		25
15	6	Business Continuity Planning		26
16	6	Security Management		27
17	6	Technology Risk Management		28
18	6	Project Portfolio Planning		15
19	6	Project Initialization		29
20	6	Business Process Optimization		30
21	6	Quality Management		31
22	6	Compliance Management		32
23	6	Post Merger Integration		33
24	6	Adoption of COTS Shelf Software		34
25	6	Sourcing Decisions		14
26	6	IT Service Management		35
27	6	Management of IT Operations Costs		36
28	6	IT Consolidation		37
56	19	Organizational Governance, Assist		48
74	2817	Integrated Security Management Solutions in a Business Network of Partners with Heterogeneous ICT		59
84	2999	Private Enterprises		85
92	3039	Manage e-Government Inter-organizational Technochange		91
98	3095	Large and Geographically Dispersed Organizations with Subunits with Considerable Autonomy in IT Resources Management		96
107	3131	Government Organizations		20
162	3177	Mergers and Acquisitions, Helps		13
163	3177	In/Out Sourcing, Support		14
164	3177	Decision-making, Support		131

165	3177	Managing Complexity		132
167	3177	Systems Development, Support		134
168	3177	IT Portfolio Management, Support		135
169	3177	Business & IT Budget Prioritization, Support		165
171	3185	For an Organizational & ICT design problem	Design an organization that preserves the planned business and ICT goals	137
177	3191	Public Agency		20
244	3160	Organizational Change, Restructuring, M&A, Support		160

Table 65 Intervention (I) Elements. Last column [CIMO_UNIQUE ID] corresponds to the [CIMO_UNIQUE ID] column of Table 71.

CIMO ID	Contribution ID	Element Name	Description	CIMO_UNIQUE ID
13	27	EA		19
38	6	EA		19
63	19	EA		19
66	2811	EA		19
75	2817	EA		19
85	2999	EA		19
93	3039	EA		19
108	3131	EA		19
115	3160	EA		19
130	3161	EA		19
161	3177	EA		19
172	3185	EA		19
178	3191	EA		19
227	3160	EA		19
228	19	EA		19
239	3095	EA		19

Table 66 Mechanism (M) Elements. Last column [CIMO_UNIQUE ID] corresponds to the [CIMO_UNIQUE ID] column of Table 70.

CIMO ID	Contribution ID	Element Name	Description	CIMO_UNIQUE ID
99	3095	EA Standards		97
111	3131	IS/IT Governance Framework		99
213	6	EA Models	EA Models constitute the foundation of a variety of applications and analysis methods	71

Table 67 Outcome (O) Elements. Last column [CIMO_UNIQUE ID] corresponds to the [CIMO_UNIQUE ID] column of Table 72.

CIMO ID	Contribution ID	Element Name	Description	CIMO_UNIQUE ID
6	27	IT Operations Unit Costs, Reduce		156
7	27	Applications Maintenance Costs, Reduce		120
8	27	Development Time, Reduce		12
9	27	Business Risk from IT Systems Failures, Reduce		21
10	27	Accessibility of Data for Regulatory Compliance, Improve	Accessibility of accurate data to respond to government requirements	22
11	27	Ease & Speed of IT Backup & Recovery Services, Increase		23
12	27	IT Security Breaches, Reduce		24
45	19	IT complexity, Reduced		38
46	19	IT Resources, More effective use		39
47	19	IT ROI, Improve		40
48	19	IT Utilization, Improve		41
49	19	IS Development, Faster		12
50	19	IS interoperability, Improve		42
51	19	Change Responsiveness, Improve		43
52	19	IS Security, Improve		44
53	19	Organizational Performance Measures, Standardize		45
54	19	Intra-organizational Collaboration, Improve		46

CIMO ID	Contribution ID	Element Name	Description	CIMO_UNIQUE ID
55	19	Intra-organizational Trust, Improve		47
57	19	Intra-organizational Communication, Improve		3
58	19	Organizational Stovepipes, Reduce		49
59	19	Inter-organizational Communication, Improve		50
60	19	Project Resources Waste, Minimize		51
61	19	Business/IT Alignment		4
62	19	Goal Attainment, Improve		52
64	27	Discipline and Standardization in Technology Management and Use, Enforce		53
65	27	Discipline and Standardization in Business Processes		5
67	2811	Requirements Elicitation Process, Faster		54
68	2811	Requirements Specifications Accuracy, Increase		55
69	2811	Requirements Re-use In Requirements Elicitation, Facilitate		56
76	2817	Inter-organizational Information Exchange Transparency & Security, Increase		60
77	2817	Inter-organizational Business Process Support Transparency & Security, Increase		61
80	2817	Communication of Systems and Infrastructures Changes Transparency, Increase		121
81	2817	Systems Development Takes Into Account Existing Enterprise Systems, Ensure		84
82	2817	EA-based Systems Development Requirements Elicitation		2
86	2999	Foundation for Execution, Establish		86
87	2999	Performance-based CAGR, Increase		87
88	2999	Business Performance (ROS), Increase		88
89	2999	Agility		8
90	2999	Efficiency	Means Operations Efficiency	89
91	2999	Ability to Deal with Changes	Relating to Operations Processes	90

CIMO ID	Contribution ID	Element Name	Description	CIMO_UNIQUE ID
94	3039	Solution Concepts Communication During Project Management, Improve		92
95	3039	Stakeholder Views During Project Management, Identify and Manage		93
96	3039	Ambiguous Project Goals During Project Management, Identify and Manage		94
97	3039	Stakeholder Collaborative Form During Project Management, Identify and Manage		95
103	3095	IT Infrastructure Components Heterogeneity Across BUs, Minimize		6
104	3095	IT Infrastructure Services Replication Across BUs, Minimize		98
105	3095	Applications Integration Across the Enterprise, Achieve		10
106	3095	Enterprise Data Integration Across the Enterprise, Achieve		11
109	3131	Business - IS/IT Alignment, Enables		4
112	3131	Business Process (Processing) Convergence		100
116	3160	Business - IT Alignment, Better		4
118	3160	Business & Processes Flexibility, Enable		101
119	3160	Technology & Applications Portfolio, Simplify		6
120	3160	Business Transformation, Enable		102
121	3160	IT Costs, Reduce		7
123	3160	Information Exchange Between BUs, Improve		3
124	3160	IT Innovation, Enable		104
125	3160	Customer Satisfaction, Improve		105
127	3160	IT Investments Value, Optimize		107
128	3160	IT Assets QoS, Improve		108
131	3161	Supplier Integration		110
132	3161	Agility		8
133	3161	Cost Reduction		111
134	3161	Technology Consolidation		9
135	3161	Applications Consolidation		112

CIMO ID	Contribution ID	Element Name	Description	CIMO_UNIQUE ID
136	3161	Data Consolidation		16
137	3161	Process Consolidation		113
138	3161	Deliverables Completeness		114
139	3161	Deliverables Consistency		115
140	3161	IT Decision-making, Better		116
141	3161	Strategic Planning, Better		117
142	3161	Business - IT Alignment		4
143	3161	Business - Business Alignment		118
174	3185	Conceptual Consolidation of a Project's To-Be Situation Between Stakeholders, Enable		164
175	3185	Project Scoping, Better		1
179	3191	Business - IT Alignment (Business Processes - IS Alignment)	The article describes the functional aspects of the Business - IT Alignment	4
181	3191	IS & IT Governance Arrangements Communication, Improve		141
184	27	Non-Value-Adding Variations in Tech Use, Eliminate		6
185	27	Technical Competencies Variations, Minimize		143
187	27	Technology Decision-Making Time, Reduce		144
188	27	Technical Problems Solving Time, Reduce		145
189	27	IT Infrastructure, Clean-up		146
190	27	Shared Data, Clean-up		147
191	27	IT Environment Manageability, Improve		148
194	27	Data Sharing, Increase		149
195	27	Process Standards, Integrate		150
196	27	Senior Management Satisfaction with IT		151
197	27	BU Leader Satisfaction with IT		152
198	27	Operational Excellence		153
199	27	Customer Intimacy		154
200	27	Product Leadership		155
201	27	Strategic Agility		8

CIMO ID	Contribution ID	Element Name	Description	CIMO_UNIQUE ID
203	2811	Requirements Specifications Structure, Increase		63
204	2811	Requirements Traceability, Improve		64
210	19	Inter-organizational Information Sharing, Improve		69
214	27	Enterprise Applications, Clean-up		72
215	27	Risk Management, Improve		73
216	27	IT Costs, Reduce		7
217	27	IT Responsiveness, Increase		74
219	2817	IT Management & Planning, Comprehensive & Coordinated		75
220	2817	Enterprise-wide Decisions Diffusion Communication		3
221	2817	Enterprise-wide Changes Communication		3
222	3131	Data Stores Consolidation		76
223	3131	Technical Systems Reuse, Enable		17
224	3131	Business Processes Reuse, Enable		18
225	3131	Tasks & Activities Reuse, Enable		77
230	3185	Project Investment Decisions Communication, Enable		78
241	2817	Security Management & Planning, Comprehensive & Coordinated		157
242	3191	Corporate Information & Data, Consolidate & Improve Sharing		158
243	3191	Business & IT Artifacts, Measured Reuse & Efficient Replication		159
245	3160	Business Processes, Standardize & Improve		161
246	3160	IT Projects Delivery Time & Risk, Reduce		162
247	3160	Business & Process Change, Enable		163

Table 68 CIMO Elements Relationships. Each Relationship holds a unique ID in column [REL ID] and is encoded as a directed arc pointing from a CIMO Element with the "CIMO ID" in column [CIMO ID From], to a CIMO Element with the "CIMO ID" in column [CIMO ID To]. The last column [REL_UNIQUE ID] corresponds to the [REL_UNIQUE ID] column of Table 73.

REL ID	CIMO ID From	CIMO ID To	REL_UNIQUE ID
77	74	75	125
97	84	85	133
104	92	93	134
105	98	239	135
109	99	103	136
113	107	108	101
122	111	109	140
123	112	109	141
139	130	131	84
140	130	132	34
141	130	133	85
142	130	134	35
143	130	135	86
144	130	136	37
145	130	137	87
146	130	138	88
147	130	139	89
148	130	140	90
149	130	141	91
150	130	142	30
151	130	143	92
175	171	172	151
182	177	178	101
188	181	179	152
222	14	38	106
223	15	38	107
224	16	38	108
225	17	38	109
226	18	38	24
227	19	38	110
228	20	38	111
229	21	38	112
230	22	38	113
231	23	38	114
232	24	38	115
233	25	38	23
234	26	38	116
235	27	38	117
236	28	38	118
249	99	104	139
250	99	105	137
251	99	106	138
273	38	213	61
274	13	64	54
275	13	65	31
276	64	184	120
277	64	185	122
278	184	6	20
279	184	7	17
280	185	6	154
281	185	7	153
282	6	216	165
283	7	216	142
284	184	187	18
285	184	188	19
286	187	8	155
287	188	8	156
288	8	217	21
289	64	189	123
290	64	190	124
291	64	214	121
292	189	191	157
293	190	191	158
294	214	191	126
295	191	9	161
296	191	10	162
297	191	11	163
298	191	12	164
299	9	215	102
300	10	215	103
301	11	215	104
302	12	215	105

REL ID	CIMO ID From	CIMO ID To	REL_UNIQUE ID
303	190	194	159
304	190	195	160
305	65	194	10
306	65	195	11
307	65	196	12
308	65	197	13
309	65	198	14
310	65	199	15
311	65	200	16
312	65	201	9
315	75	80	93
316	75	81	65
317	75	82	28
318	75	220	29
319	75	221	29
320	80	76	143
321	80	77	144
322	80	219	145
323	81	76	129
324	81	77	130
325	81	219	131
326	82	76	1
327	82	77	2
328	82	219	3
329	220	76	5
330	220	77	6

REL ID	CIMO ID From	CIMO ID To	REL_UNIQUE ID
331	220	219	7
332	221	76	5
333	221	77	6
334	221	219	7
335	85	86	66
336	85	87	67
337	85	88	68
338	85	89	34
339	85	90	69
340	85	91	70
341	93	94	71
342	93	95	72
343	93	96	73
344	93	97	74
345	108	111	76
346	108	112	77
347	108	222	62
348	108	223	38
349	108	224	39
350	108	225	63
351	222	109	127
352	223	109	25
353	224	109	26
354	225	109	128
380	63	45	40
381	63	46	41

REL ID	CIMO ID From	CIMO ID To	REL_UNIQUE ID
382	63	47	42
383	63	48	43
384	63	49	36
385	63	50	44
386	63	51	45
387	63	52	46
388	63	53	47
389	63	54	48
390	63	55	49
391	63	57	29
392	63	58	50
393	63	59	51
394	63	60	52
395	63	61	30
396	63	62	53
397	56	228	119
398	162	161	22
399	163	161	23
400	164	161	147
401	165	161	148
402	167	161	149
403	168	161	150
404	169	161	169
407	172	174	100
408	172	175	27
410	172	230	64

REL ID	CIMO ID From	CIMO ID To	REL_UNIQUE ID
413	178	181	94
423	239	99	75
432	63	210	60
433	80	241	146
434	81	241	132
435	82	241	4
436	220	241	8
437	221	241	8
438	178	242	95
439	178	243	96
440	242	179	166
441	243	179	167
442	66	67	55
443	66	68	56
444	66	69	57
445	66	203	58
446	66	204	59
447	244	227	168
448	115	116	30
449	115	118	78
450	115	119	32
451	115	120	79
452	115	121	33
453	115	123	29
454	115	124	80
455	115	125	81

REL ID	CIMO ID From	CIMO ID To	REL_UNIQUE ID
456	115	127	82
457	115	128	83
458	115	245	97
459	115	246	98
460	115	247	99

B.6.6 Unique CIMO Elements & Unique CIMO Elements Relationships

Table 69 Unique Context (C) Elements.

CIMO_UNIQUE ID	Element Name	Description
13	Mergers & Acquisitions, Support	
14	Sourcing Decisions, Support	
15	Business & IT Project Portfolio Planning, Support	
20	Government Organization	
25	IT Business Alignment	
26	Business Continuity Planning	
27	Security Management	
28	Technology Risk Management	
29	Project Initialization	
30	Business Process Optimization	
31	Quality Management	
32	Compliance Management	
33	Post Merger Integration	
34	Adoption of COTS Shelf Software	
35	IT Service Management	
36	Management of IT Operations Costs	
37	IT Consolidation	
48	Organizational Governance, Assist	
59	Integrated Security Management Solutions in a Business Network of Partners with Heterogeneous ICT	
85	Japanese Private Enterprises	
91	Manage e-Government Inter-organizational Technochange	
96	Large and Geographically Dispersed Organizations with Subunits with Considerable Autonomy in IT Resources Management	
131	Decision-making, Support	
132	Managing Complexity	

134	Systems Development, Support
135	IT Portfolio Management, Support
137	For an Organizational & ICT design problem
160	Organizational Change, Restructuring, M&A, Support
165	Business & IT Budget Prioritization, Support

Table 70 Unique Intervention (I) Elements.

CIMO_UNIQUE ID	Element Name	Description
19	EA	

Table 71 Unique Mechanism (I) Elements.

CIMO_UNIQUE ID	Element Name	Description
71	EA Models	
97	EA Standards	
99	IS/IT Governance Framework	

Table 72 Unique Outcome (O) Elements.

CIMO_UNIQUE ID	Element Name	Description
1	Project Scoping, Better	
2	EA-based Requirements Elicitation	
3	Intra-Organizational Communication, Improve	
4	Business & IT Alignment, Improve	
5	Business Process, Standardize & Enforce Discipline	
6	IT Heterogeneity, Minimize	
7	IT Costs, Reduce	
8	Agility, Improve	
9	Technology Consolidation, Improve	
10	Applications Integration, Improve	
11	Data Integration, Improve	
12	IS Development Time, Reduce	
16	Data Consolidation, Improve	

CIMO_UNIQUE ID	Element Name	Description
17	Technical Systems Reuse, Increase	
18	Business Processes Reuse, Enable	
21	Business Risk from IT Systems Failures, Reduce	
22	Accessibility of Data for Regulatory Compliance, Improve	
23	Ease & Speed of IT Backup & Recovery Services, Increase	
24	IT Security Breaches, Reduce	
38	IT Complexity, Reduce	
39	IT Resources, More effective use	
40	IT ROI, Improve	
41	IT Utilization, Improve	
42	IS interoperability, Improve	
43	IT Change Responsiveness, Improve	
44	IS Security, Improve	
45	Organizational Performance Measures, Standardize	
46	Intra-organizational Collaboration, Improve	
47	Intra-organizational Trust, Improve	
49	Organizational Stovepipes, Reduce	
50	Inter-organizational Communication, Improve	
51	Project Resources Waste, Minimize	
52	Goal Attainment, Improve	
53	Discipline & Standardization in IT Management & Use, Enforce	
54	Requirements Elicitation Process, Faster	
55	Requirements Specifications Accuracy, Increase	
56	Requirements Re-use In Requirements Elicitation, Facilitate	
60	Inter-org. Information Exchange Transparency & Security, Increase	
61	Inter-org. Business Process Support Transparency & Security, Increase	
63	Requirements Specifications Structure, Increase	
64	Requirements Traceability, Improve	
69	Inter-organizational Information Sharing, Improve	
72	Enterprise Applications, Clean-up	
73	Risk Management, Improve	
74	IT Responsiveness, Increase	
75	IT Management & Planning, Comprehensive & Coordinated	

CIMO_UNIQUE ID	Element Name	Description
76	Data Stores Consolidation	
77	Tasks & Activities Reuse, Enable	
78	Project Investment Decisions Communication, Enable	
84	IS Development Considers Existing Enterprise IS, Ensure	
86	Foundation for Execution, Establish	Establish the necessary level of core and routine business process IT-automation
87	Performance-based CAGR, Increase	
88	Business Performance (ROS), Increase	
89	Efficiency	
90	Ability to Deal with Changes	
92	Solution Concepts Communication During Project Management, Improve	
93	Stakeholder Views During Project Management, Identify and Manage	
94	Ambiguous Project Goals During Project Management, Identify and Manage	
95	Stakeholder Collaborative Form During Project Management, Identify and Manage	
98	IT Infrastructure Services Replication Across BUs, Minimize	
100	Business Process (Processing) Convergence	Using common information processing procedures
101	Business & Processes Flexibility, Enable	
102	Business Transformation, Enable	A key executive management initiative that attempts to align People, Process and Technology initiatives of an organization more closely with its business strategy and vision
104	IT Innovation, Enable	
105	Customer Satisfaction, Improve	
107	IT Investments Value, Optimize	
108	IT Assets QoS, Improve	
110	Supplier Integration	
111	Cost Reduction	
112	Applications Consolidation	
113	Process Consolidation	
114	Deliverables Completeness	
115	Deliverables Consistency	
116	IT Decision-making, Better	
117	Strategic Planning, Better	

CIMO_UNIQUE ID	Element Name	Description
118	Business - Business Alignment	
120	Applications Maintenance Costs, Reduce	
121	Communication of IS & IT Changes Transparency, Increase	
141	IS & IT Governance Arrangements Communication, Improve	
143	Employee Technical Competencies Variations, Minimize	
144	Technology Decision-Making Time, Reduce	
145	Technical Problems Solving Time, Reduce	
146	IT Infrastructure, Clean-up	
147	Shared Data, Clean-up	
148	IT Environment Manageability, Improve	
149	Data Sharing, Increase	
150	Process Standards, Integrate	
151	Senior Management Satisfaction with IT	
152	BU Leader Satisfaction with IT	
153	Operational Excellence	
154	Customer Intimacy	
155	Product Leadership	
156	IT Operations Unit Costs, Reduce	
157	Security Management & Planning, Comprehensive & Coordinated	
158	Corporate Information & Data, Consolidate & Improve Sharing	
159	Business & IT Artifacts, Measured Reuse & Efficient Replication	
161	Business Processes, Standardize & Improve	
162	IT Projects Delivery Time & Risk, Reduce	
163	Business & Process Change, Enable	
164	Conceptual Consolidation of a Project's To-Be Situation Between Stakeholders, Enable	

Table 73 Unique CIMO Elements Relationships. Each Relationship holds a unique [REL_UNIQUE ID] and is encoded as a directed arc pointing from a Unique CIMO Element with the "CIMO_UNIQUE ID" in column [CIMO_UNIQUE ID From], to a Unique CIMO Element with the "CIMO_UNIQUE ID" in column [CIMO_UNIQUE ID To].

REL_UNIQUE ID	CIMO_UNIQUE ID From	CIMO_UNIQUE ID To
1	2	60
2	2	61
3	2	75
4	2	157
5	3	60
6	3	61
7	3	75
8	3	157
9	5	8
10	5	149
11	5	150
12	5	151
13	5	152
14	5	153
15	5	154
16	5	155
17	6	120
18	6	144
19	6	145
20	6	156
21	12	74
22	13	19
23	14	19
24	15	19
25	17	4
26	18	4
27	19	1
28	19	2
29	19	3
30	19	4
31	19	5
32	19	6
33	19	7
34	19	8
35	19	9
36	19	12
37	19	16
38	19	17
39	19	18
40	19	38
41	19	39
42	19	40
43	19	41
44	19	42
45	19	43
46	19	44
47	19	45
48	19	46
49	19	47
50	19	49
51	19	50
52	19	51
53	19	52
54	19	53
55	19	54
56	19	55
57	19	56
58	19	63
59	19	64
60	19	69
61	19	71
62	19	76
63	19	77
64	19	78
65	19	84
66	19	86
67	19	87
68	19	88
69	19	89
70	19	90
71	19	92
72	19	93
73	19	94

REL_UNIQUE ID	CIMO_UNIQUE ID From	CIMO_UNIQUE ID To
74	19	95
75	19	97
76	19	99
77	19	100
78	19	101
79	19	102
80	19	104
81	19	105
82	19	107
83	19	108
84	19	110
85	19	111
86	19	112
87	19	113
88	19	114
89	19	115
90	19	116
91	19	117
92	19	118
93	19	121
94	19	141
95	19	158
96	19	159
97	19	161
98	19	162
99	19	163

REL_UNIQUE ID	CIMO_UNIQUE ID From	CIMO_UNIQUE ID To
100	19	164
101	20	19
102	21	73
103	22	73
104	23	73
105	24	73
106	25	19
107	26	19
108	27	19
109	28	19
110	29	19
111	30	19
112	31	19
113	32	19
114	33	19
115	34	19
116	35	19
117	36	19
118	37	19
119	48	19
120	53	6
121	53	72
122	53	143
123	53	146
124	53	147
125	59	19

REL_UNIQUE ID	CIMO_UNIQUE ID From	CIMO_UNIQUE ID To
126	72	148
127	76	4
128	77	4
129	84	60
130	84	61
131	84	75
132	84	157
133	85	19
134	91	19
135	96	19
136	97	6
137	97	10
138	97	11
139	97	98
140	99	4
141	100	4
142	120	7
143	121	60
144	121	61
145	121	75
146	121	157
147	131	19
148	132	19
149	134	19
150	135	19
151	137	19

REL_UNIQUE ID	CIMO_UNIQUE ID From	CIMO_UNIQUE ID To
152	141	4
153	143	120
154	143	156
155	144	12
156	145	12
157	146	148
158	147	148
159	147	149
160	147	150
161	148	21
162	148	22
163	148	23
164	148	24
165	156	7
166	158	4
167	159	4
168	160	19
169	165	19

Appendix C EABF

C.1 EA Benefits List & EA Benefits Relationships List

Table 74 EA Benefits List (EABL) – EA Benefits grouped by EABM Perspectives and Categories

Category	Sub-Category	ID	EA Outcome Name
Customer Perspective			
Customer Outcomes			
		154	Customer Intimacy
		155	Product Leadership
Financial Perspective			
Financial Outcomes			
		7	IT Costs, Reduce
		17	Technical Systems Reuse, Increase
		18	Business Processes Reuse, Enable
		39	IT Resources, More effective use
		40	IT ROI, Improve
		41	IT Utilization, Improve
		51	Project Resources Waste, Minimize
		56	Requirements Re-use In Requirements Elicitation, Facilitate
		77	Tasks & Activities Reuse, Enable
		87	Performance-based CAGR, Increase
		88	Business Performance (ROS), Increase
		107	IT Investments Value, Optimize
		111	Cost Reduction
		120	Applications Maintenance Costs, Reduce
		156	IT Operations Unit Costs, Reduce
		159	Business & IT Artifacts, Measured Reuse & Efficient Replication
Internal Perspective			
Customer Management Processes			
	Customer Retention		
		105	Customer Satisfaction, Improve
Innovation Processes			
	Design & Develop		
		1	Project Scoping, Better
		2	EA-based Requirements Elicitation
		12	IS Development Time, Reduce
		54	Requirements Elicitation Process, Faster
		55	Requirements Specifications Accuracy, Increase
		63	Requirements Specifications Structure, Increase
		64	Requirements Traceability, Improve
		84	IS Development Considers Existing Enterprise IS, Ensure
		93	Stakeholder Views During Project Management, Identify and Manage
		94	Ambiguous Project Goals During Project Management, Identify and Manage
		95	Stakeholder Collaborative Form During Project Management, Identify and Manage

Category	Sub-Category	ID	EA Outcome Name
		104	IT Innovation, Enable
		114	Deliverables Completeness
		115	Deliverables Consistency
		162	IT Projects Delivery Time & Risk, Reduce
Operations Management Processes			
	Develop Supplier Relationships		
		110	Supplier Integration
	Produce Products & Services		
		5	Business Process, Standardize & Enforce Discipline
		8	Agility, Improve
		45	Organizational Performance Measures, Standardize
		89	Efficiency
		90	Ability to Deal with Changes
		101	Business & Processes Flexibility, Enable
		113	Process Consolidation
		150	Process Standards, Integrate
		153	Operational Excellence
		161	Business Processes, Standardize & Improve
		163	Business & Process Change, Enable
	Risk Management		
		21	Business Risk from IT Systems Failures, Reduce
		73	Risk Management, Improve
Learning & Growth Perspective			
Human Capital			
		52	Goal Attainment, Improve
		116	IT Decision-making, Better
		117	Strategic Planning, Better
		143	Employee Technical Competencies Variations, Minimize
Information Capital			
		6	IT Heterogeneity, Minimize
		9	Technology Consolidation, Improve
		10	Applications Integration, Improve
		11	Data Integration, Improve
		16	Data Consolidation, Improve
		22	Accessibility of Data for Regulatory Compliance, Improve
		23	Ease & Speed of IT Backup & Recovery Services, Increase
		24	IT Security Breaches, Reduce
		38	IT Complexity, Reduce
		42	IS interoperability, Improve
		43	IT Change Responsiveness, Improve
		44	IS Security, Improve
		53	Discipline & Standardization in IT Management & Use, Enforce
		60	Inter-org. Information Exchange Transparency & Security, Increase
		61	Inter-org. Business Process Support Transparency & Security, Increase
		72	Enterprise Applications, Clean-up
		74	IT Responsiveness, Increase
		75	IT Management & Planning, Comprehensive & Coordinated
		76	Data Stores Consolidation

Category	Sub-Category	ID	EA Outcome Name
		86	Foundation for Execution, Establish
		98	IT Infrastructure Services Replication Across BUs, Minimize
		100	Business Process (Processing) Convergence
		108	IT Assets QoS, Improve
		112	Applications Consolidation
		144	Technology Decision-Making Time, Reduce
		145	Technical Problems Solving Time, Reduce
		146	IT Infrastructure, Clean-up
		147	Shared Data, Clean-up
		148	IT Environment Manageability, Improve
		157	Security Management & Planning, Comprehensive & Coordinated
		158	Corporate Information & Data, Consolidate & Improve Sharing
Organization Capital			
		3	Intra-Organizational Communication, Improve
		4	Business & IT Alignment, Improve
		46	Intra-organizational Collaboration, Improve
		47	Intra-organizational Trust, Improve
		49	Organizational Stovepipes, Reduce
		50	Inter-organizational Communication, Improve
		69	Inter-organizational Information Sharing, Improve
		78	Project Investment Decisions Communication, Enable
		92	Solution Concepts Communication During Project Management, Improve
		102	Business Transformation, Enable
		118	Business - Business Alignment
		121	Communication of IS & IT Changes Transparency, Increase
		141	IS & IT Governance Arrangements Communication, Improve
		149	Data Sharing, Increase
		151	Senior Management Satisfaction with IT
		152	BU Leader Satisfaction with IT
		164	Conceptual Consolidation of a Project's To-Be Situation Between Stakeholders, Enable

Table 75 EA Benefits Relationships List (EABRL) – Each Relationship holds a unique "ID" and is encoded as a directed arc pointing from EA Benefit with "ID From", to an EA Benefit with "ID To".

ID	ID From	ID To
326	2	60
327	2	61
328	2	75
435	2	157
329	3	60
330	3	61
331	3	75
332	3	60
333	3	61
334	3	75
436	3	157
437	3	157
305	5	149
306	5	150
307	5	151
308	5	152
309	5	153
310	5	154
311	5	155
312	5	8
278	6	156
279	6	120
284	6	144
285	6	145
288	12	74
352	17	4
353	18	4
299	21	73
300	22	73
301	23	73
302	24	73
276	53	6
277	53	143
289	53	146
290	53	147
291	53	72
294	72	148
351	76	4
354	77	4
323	84	60
324	84	61
325	84	75
434	84	157
123	100	4
283	120	7
320	121	60
321	121	61
322	121	75
433	121	157
188	141	4
280	143	156
281	143	120
286	144	12
287	145	12
292	146	148
293	147	148
303	147	149
304	147	150
295	148	21
296	148	22
297	148	23
298	148	24
282	156	7
440	158	4
441	159	4

C.2 EABM Templates

Figure 37 EABM construction template for the high-level Internal Perspective Categories.

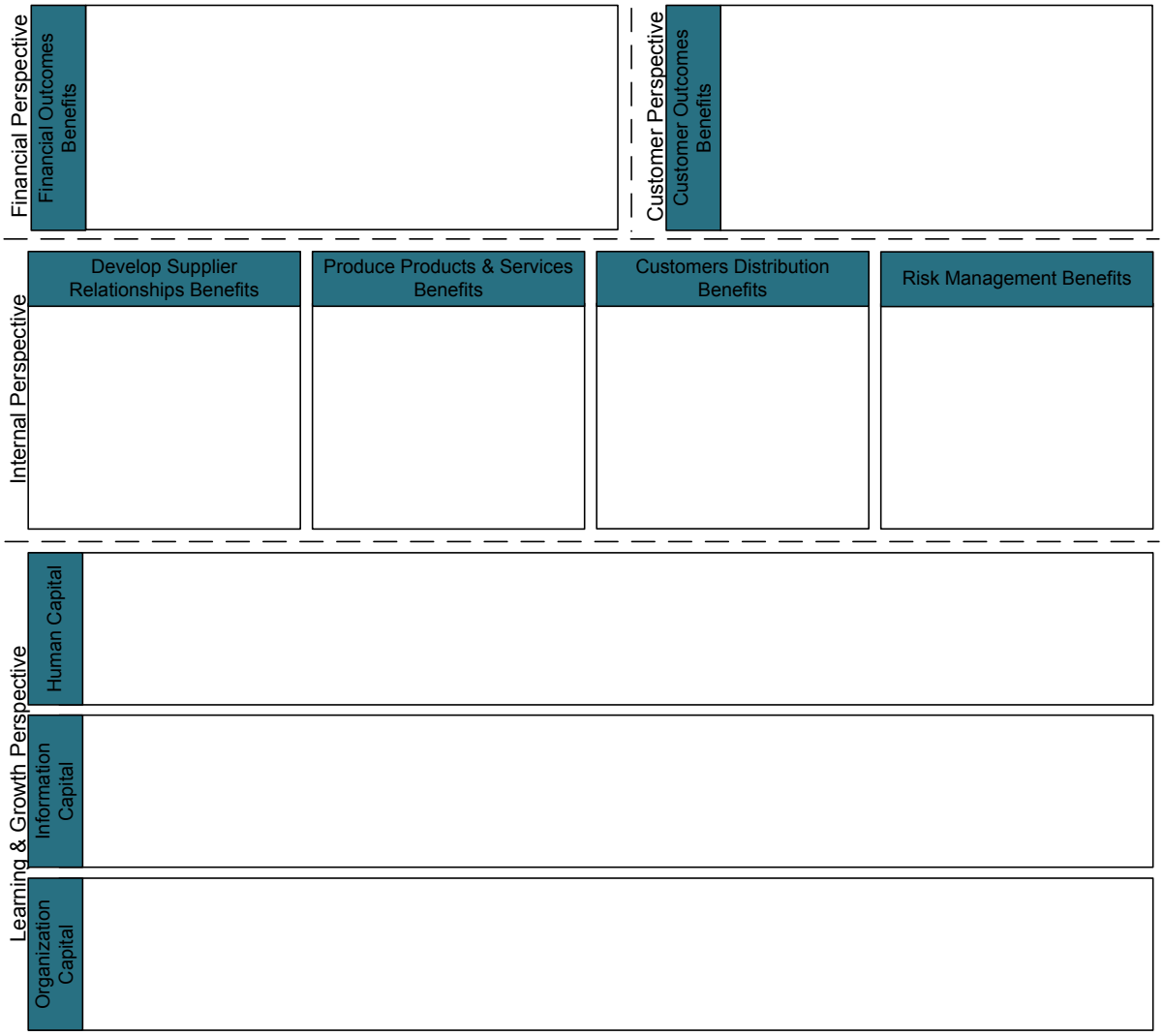


Figure 38 EABM construction template for the second-level Internal Perspective's Category "Operations Management Processes Benefits".

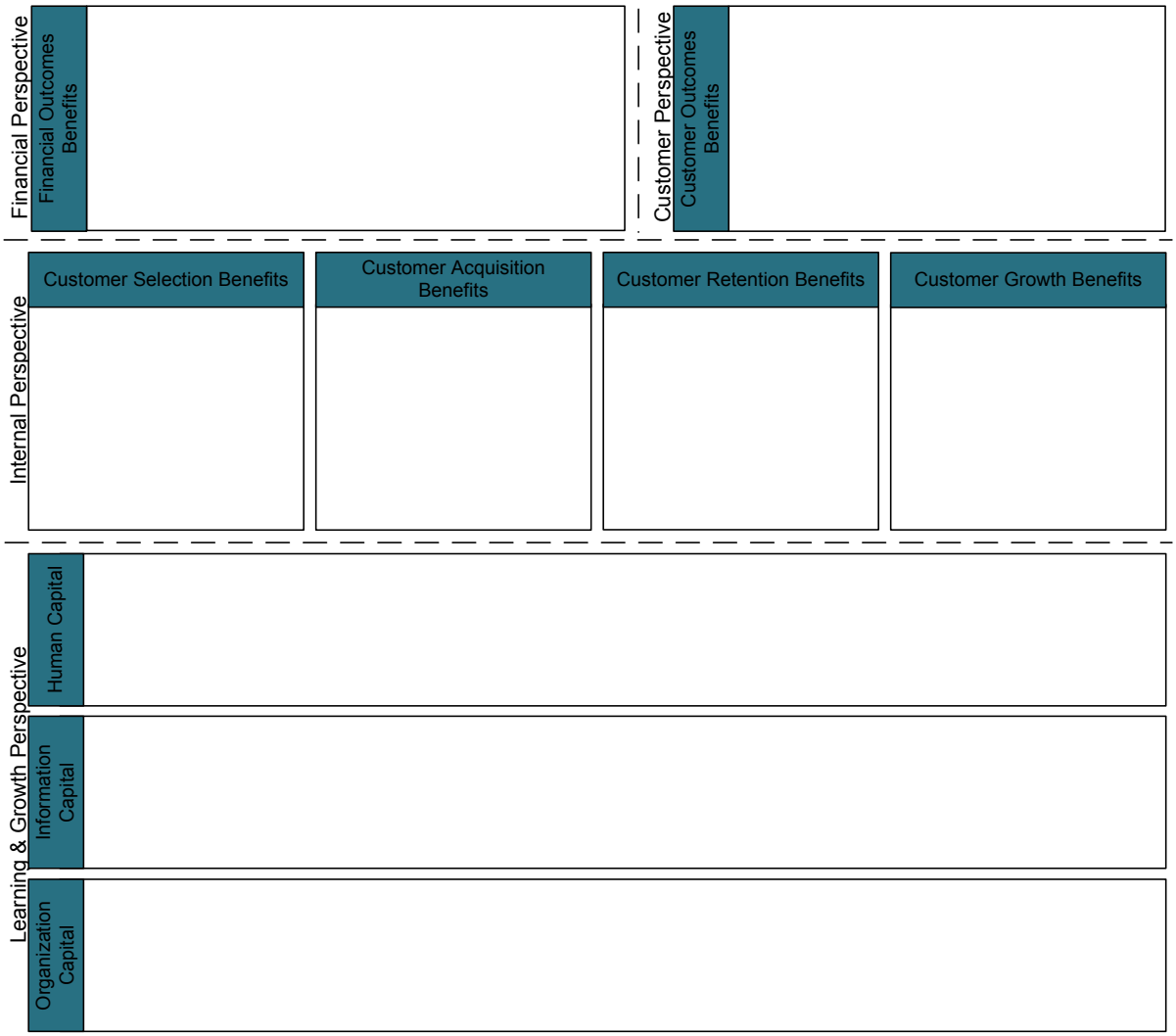


Figure 39 EABM construction template for the second-level Internal Perspective's Category "Customer Management Processes Benefits".

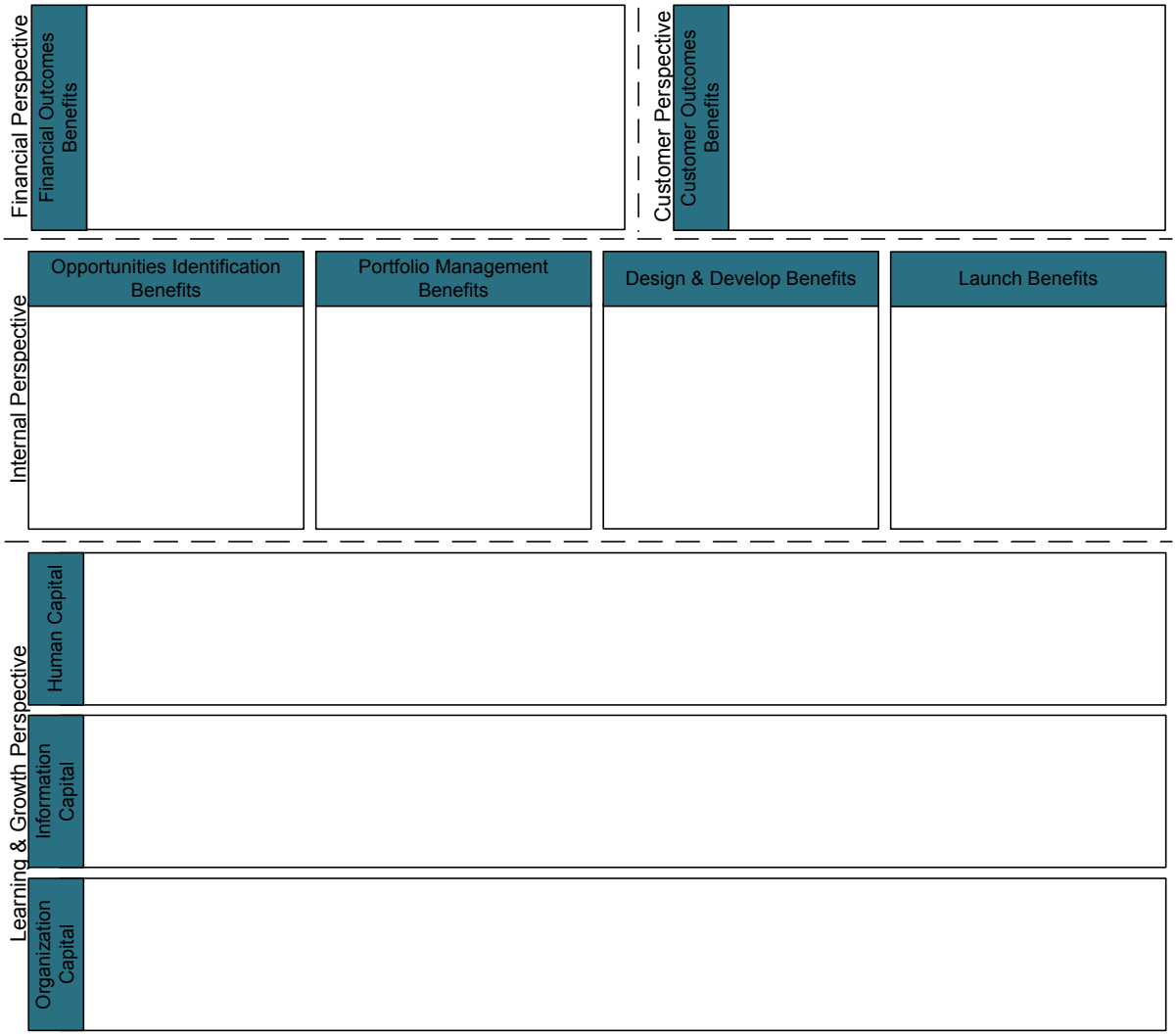


Figure 40 EABM construction template for the second-level Internal Perspective's Category "Innovation Processes Benefits".

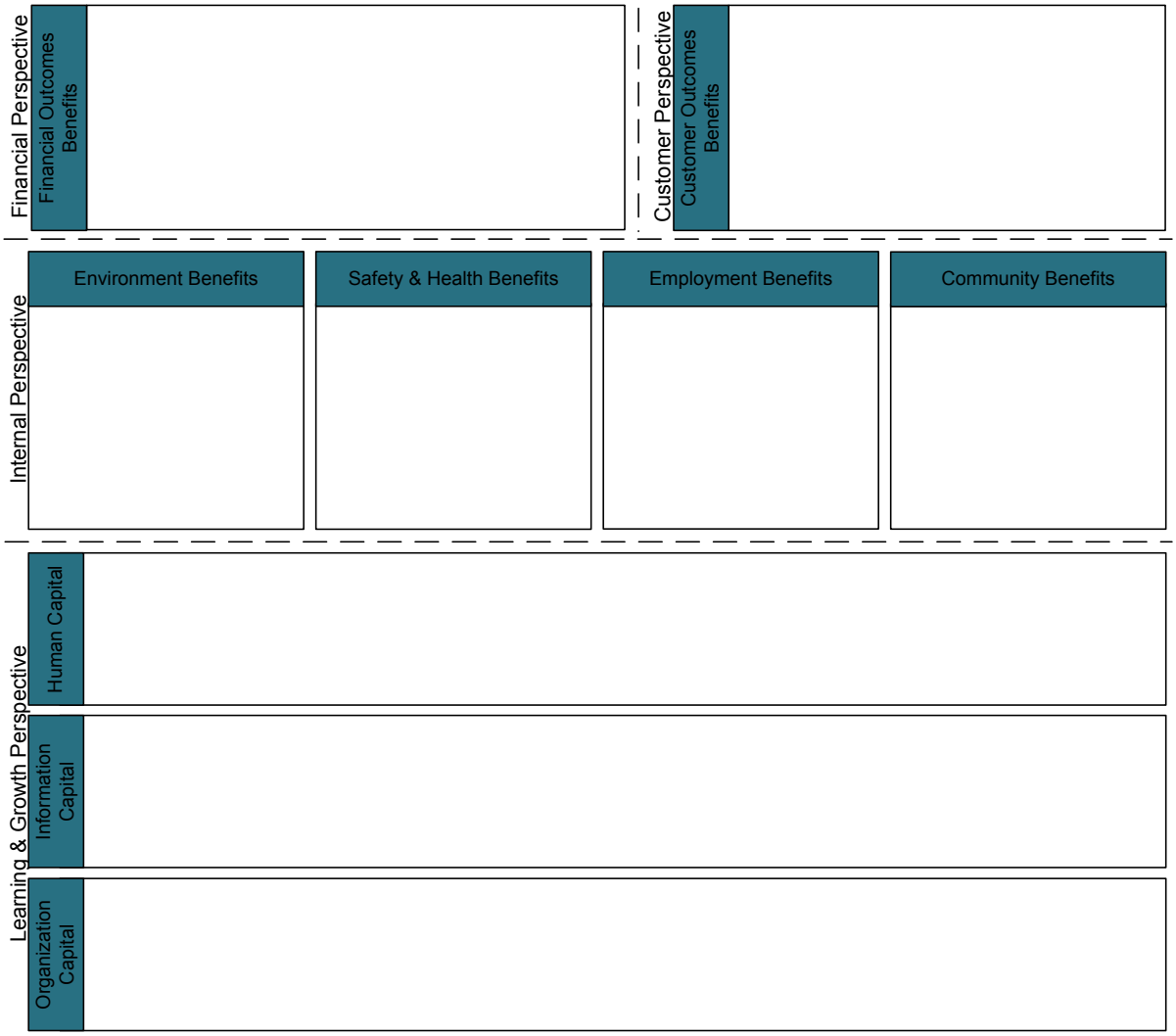


Figure 41 EABM construction template for the second-level Internal Perspective's Category "Regulatory & Safety Processes Benefits".

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